

C1.1: Form of Offer & Acceptance

Offer

The *Employer*, identified in the Acceptance signature block, has solicited offers to enter into a contract for the procurement of:

The Design, Supply, Installation and testing of Distributed Acoustic Sensing (DAS) to detect potential intrusions on the underground Pipelines using a Fibre Optic Detection Solution

The tenderer, identified in the Offer signature block, has examined the documents listed in the Tender Data and addenda thereto as listed in the Returnable Schedules, and by submitting this Offer has accepted the Conditions of Tender

By the representative of the tenderer, deemed to be duly authorised, signing this part of this Form of Offer and Acceptance the tenderer offers to perform all of the obligations and liabilities of the *Contractor* under the contract including compliance with all its terms and conditions according to their true intent and meaning for an amount to be determined in accordance with the *conditions of contract* identified in the Contract Data.

Phase 1

The offered total of the Prices exclusive of VAT is	R
Value Added Tax @ 15% is	R
The offered total of the Prices inclusive of VAT is	R
(in words)	

Optional Phase 2

The offered total of the Prices exclusive of VAT is	R
Value Added Tax @ 15% is	R
The offered total of the Prices inclusive of VAT is	R
(in words)	

This Offer may be accepted by the Employer by signing the Acceptance part of this Form of Offer and Acceptance and returning one copy of this document including the Schedule of Deviations (if any) to the tenderer before the end of the period of validity stated in the Tender Data, or other period as agreed, whereupon the tenderer becomes the party named as the *Contractor* in the *conditions of contract* identified in the Contract Data.

Signature(s)

Name(s)

Capacity

**For the
Contractor:**

(Insert name and address of organisation)

Name &
signature of
witness

Date

Tenderer's CIDB registration number:

Acceptance

By signing this part of this Form of Offer and Acceptance, the *Employer* identified below accepts the tenderer's Offer. In consideration thereof, the *Employer* shall pay the *Contractor* the amount due in accordance with the *conditions of contract* identified in the Contract Data. Acceptance of the tenderer's Offer shall form an agreement between the *Employer* and the tenderer upon the terms and conditions contained in this agreement and in the contract that is the subject of this agreement.

The terms of the contract, are contained in:

Part C1	Agreements and Contract Data, (which includes this Form of Offer and Acceptance)
Part C2	Pricing Data
Part C3	Works Information

and drawings and documents (or parts thereof), which may be incorporated by reference into the above listed Parts.

Deviations from and amendments to the documents listed in the Tender Data and any addenda thereto listed in the Returnable Schedules as well as any changes to the terms of the Offer agreed by the tenderer and the Employer during this process of offer and acceptance, are contained in the Schedule of Deviations attached to and forming part of this Form of Offer and Acceptance. No amendments to or deviations from said documents are valid unless contained in this Schedule.

The tenderer shall within two weeks of receiving a completed copy of this agreement, including the Schedule of Deviations (if any), contact the Employer's agent (whose details are given in the Contract Data) to arrange the delivery of any securities, bonds, guarantees, proof of insurance and any other documentation to be provided in terms of the *conditions of contract* identified in the Contract Data at, or just after, the date this agreement comes into effect. Failure to fulfil any of these obligations in accordance with those terms shall constitute a repudiation of this agreement.

Notwithstanding anything contained herein, this agreement comes into effect on the date when the tenderer receives one fully completed original copy of this document, including the Schedule of Deviations (if any).

Unless the tenderer (now *Contractor*) within five working days of the date of such receipt notifies the Employer in writing of any reason why he cannot accept the contents of this agreement, this agreement shall constitute a binding contract between the Parties.

Signature(s)

Name(s)

Capacity

**for the
Employer**

Transnet SOC Ltd

*(Insert name and address of organisation)*Name &
signature of
witness

Date

Schedule of Deviations

Note:

1. To be completed by the Employer prior to award of contract. This part of the Offer & Acceptance would not be required if the contract has been developed by negotiation between the Parties and is not the result of a process of competitive tendering.
2. The extent of deviations from the tender documents issued by the Employer prior to the tender closing date is limited to those permitted in terms of the Conditions of Tender.
3. A tenderer's covering letter must not be included in the final contract document. Should any matter in such letter, which constitutes a deviation as aforesaid be the subject of agreement reached during the process of Offer and Acceptance, the outcome of such agreement shall be recorded here and the final draft of the contract documents shall be revised to incorporate the effect of it.

No.	Subject	Details
1		
2		
3		
4		

By the duly authorised representatives signing this Schedule of Deviations below, the Employer and the tenderer agree to and accept this Schedule of Deviations as the only deviations from and amendments to the documents listed in the Tender Data and any addenda thereto listed in the Tender Schedules, as well as any confirmation, clarification or changes to the terms of the Offer agreed by the tenderer and the Employer during this process of Offer and Acceptance.

It is expressly agreed that no other matter whether in writing, oral communication or implied during the period between the issue of the tender documents and the receipt by the tenderer of a completed signed copy of this Form shall have any meaning or effect in the contract between the parties arising from this Agreement.

	For the Contractor:	For the Employer
Signature	_____	_____
Name	_____	_____
Capacity	_____	_____
On behalf of	(Insert name and address of organisation)	Transnet SOC Ltd
Name & signature of witness	_____	_____
Date	_____	_____

C1.2 Contract Data

Part one - Data provided by the *Employer*

Clause	Statement	Data
1	General	
	The <i>conditions of contract</i> are the core clauses and the clauses for main Option	
		Engineering and Construction Contract (ECC)
		Option A: Priced contract with activity schedule
	dispute resolution Option	W1: Dispute resolution procedure
	and secondary Options	X1: Price adjustment for inflation
		X2: Changes in the law
		X7: Delay damages
		X13: Performance bond
		X16: Retention
		X18: Limitation of liability
		Z: Additional conditions of contract
		Z1: Intellectual property
		Z2: Assignment and Waiver
		Z3: Right Reserved by Transnet to Conduct State Security Agency (SSA) Vetting
		Z4: Additional Clause Relating to Collusion
		Z5: Protection of Personal Information Act
		Z6: Additional clause relating to Performance Bonds and/or Guarantees
		Z7: Obligations in respect of Joint Venture Agreements
		Z8: Additional Obligations in Respect of Termination
		Z9: Phase 2 (Roll-out) - Optional

10.1	The <i>Employer</i> is:	Transnet SOC Ltd (Reg no. 1990/000900/30)
	Address	Registered address: 138 Eloff Street Braamfontein Johannesburg 2000
	Having elected its Contractual Address for the purposes of this contract as:	Transnet Pipelines 202 Anton Lembede Street Durban, South Africa 4001
10.1	The <i>Project Manager</i> is: (Name)	TBC
	Address	Transnet Pipelines 202 Anton Lembede Street Durban, South Africa 4001
	Tel No.	TBC
	e-mail	TBC
10.1	The <i>Supervisor</i> is: (Name)	TBC
	Address	Transnet Pipelines 202 Anton Lembede Street Durban, South Africa 4001
	Tel No.	TBC
	e-mail	TBC
11.2(13)	The <i>works</i> are	The Design, Supply, Installation and testing of Distributed Acoustic Sensing (DAS) to detect potential intrusions on the underground Pipelines using a Fibre Optic Detection Solution
11.2(14)	The following matters will be included in the Risk Register	1. Community Unrest 2. Local Business Forums interruptions 3. Unknown underground services 4. Site Occupation 5. Unregistered Crossing Services
11.2(15)	The <i>boundaries of the site</i> are	As prescribed in Part C3
11.2(16)	The Site Information is	As prescribed in Part C3
11.2(19)	The Works Information is in	Part C3
12.2	The <i>law of the contract</i> is the law of	The Republic of South Africa subject to the jurisdiction of the Courts of South Africa.

13.1	The <i>language of this contract</i> is	English	
13.3	The <i>period for reply</i> is	2 weeks	
2	The Contractor's main responsibilities	No additional data is required for this section of the <i>conditions of contract</i> .	
3	Time		
11.2(3)	The <i>completion date</i> for the whole of the <i>works</i> is	30 June 2028	
11.2(9)	The <i>key dates</i> and the <i>conditions</i> to be met are:	Condition to be met	key date
		Phase 1: (Pilot)	
		Health and Safety Requirements	Within four weeks of Contract Start Date
		Project Execution Plan	TBC
		Site Survey	TBC
		System Design	TBC
		System Design Acceptance by Employer	TBC
		Site Preparation	TBC
		System Deployment	TBC
		System Testing, Correction, and Re-testing	TBC
		System/Solution Acceptance	TBC
		System Monitoring	TBC
		Phase 1 (Pilot) Close - out	TBC
		Phase 2: (Roll-out) - Optional	
As described in detail Part 3 Works Information			
	Key dates will be based on the bidder's programme		
30.1	The <i>access dates</i> are	Part of the Site	Date
		1 Whole of the Site	2 days after safety file approval

31.1	The <i>Contractor</i> is to submit a first programme for acceptance within	2 weeks of the Contract Date.
31.2	The <i>starting date</i> is	04 November 2024
32.2	The Contractor submit a revised programme	Every 4 weeks
4	Testing and Defects	
42.2	The <i>defects date</i> is	52 weeks after Completion of the whole of the works.
43.2	The <i>defect correction period</i> is	2 weeks
5	Payment	
50.1	The <i>assessment interval</i> is monthly on the	25th (twenty-fifth) day of each successive month, and the final invoice to be submitted by the 20th (twentieth) day of each successive month
51.1	The <i>currency of this contract</i> is the	South African Rand.
51.2	The period within which payments are made is	30 days from date of receipt of valid Tax Invoice and month-end Statement.
51.4	The <i>interest rate</i> is	Prime lending rate of the Rand Merchant Bank South Africa as determined from time to time.
6	Compensation events	
60.1(13)	The <i>weather measurements</i> to be recorded for each calendar month are,	the cumulative rainfall (mm)
		the number of days with rainfall more than 10 mm
	The place where weather is to be recorded (on the Site) is:	The site under execution
	The <i>weather data</i> are the records of past <i>weather measurements</i> for each calendar month which were recorded at:	The closest weather station to the site under execution
	and which are available from:	South African Weather Services 012 367 6000 or info4@weathersa.co.za.
7	Title	No additional data is required for this section of the conditions of contract.
8	Risks and insurance	

84.2	The minimum limit of indemnity for insurance in respect of loss of or damage to property (except the <i>works</i> , Plant, Materials and Equipment) and liability for bodily injury to or death of a person (not an employee of the <i>Contractor</i>) caused by activity in connection with this contract for any one event is		Whatever the <i>Contractor</i> requires in addition to the amount of insurance taken out by the <i>Employer</i> for the same risk.														
	The minimum limit of indemnity for insurance in respect of death of or bodily injury to employees of the <i>Contractor</i> arising out of and in the course of their employment in connection with this contract for any one event is		The <i>Contractor</i> must comply at a minimum with the provisions of the Compensation for Occupational Injuries and Diseases Act No. 130 of 1993 as amended.														
84.2	The insurance against loss of or damage to the works, Plant and Materials as stated in the insurance policy for contract works and public liability selected from: Blanket Principal Controlled Insurance (BPCI), Principal Controlled Insurance (PCI), Principal Controlled Contractors Liability Insurance, Principal Controlled Insurance One-off; and Project Specific Insurance		<table><tr><td>Select one</td><td></td></tr><tr><td>BPCI</td><td>x</td></tr><tr><td>PCI</td><td></td></tr><tr><td></td><td></td></tr><tr><td>PCI Liab only</td><td></td></tr><tr><td>PCI One Off</td><td></td></tr><tr><td>PSI</td><td></td></tr></table>	Select one		BPCI	x	PCI				PCI Liab only		PCI One Off		PSI	
Select one																	
BPCI	x																
PCI																	
PCI Liab only																	
PCI One Off																	
PSI																	
84.1	The <i>Employer</i> provides these insurances from the Insurance Table																
	1	Insurance against:	Loss of or damage to the <i>works</i> , Plant and Materials is as stated in the selected Insurance policy for Contract Works/ Public Liability.														
		Cover / indemnity:	to the extent as stated in the selected insurance policy for Contract Works / Public Liability														
		The deductibles are:	as stated in the selected insurance policy for Contract Works / Public Liability (Principal Controlled Insurance)														
	2	Insurance against:	Loss of or damage to property (except the <i>works</i> , plant, materials & equipment) and liability for bodily injury to or death of a person (not an employee of the <i>Contractor</i>) arising out of or in connection with the performance of the Contract as stated in the selected insurance policy for Contract Works / Public Liability														
		Cover / indemnity	Is to the extent as stated in the selected insurance policy for Contract Works / Public Liability														
		The deductibles are	as stated in the selected insurance policy for Contract Works / Public Liability														
84.1	3	Insurance against:	Loss of or damage to Equipment (Temporary Works only) as stated in the selected insurance policy for contract Works and Public Liability														

	Cover / indemnity	Is to the extent as stated in the selected insurance policy for Contract Works / Public Liability
	The deductibles are:	As stated in the selected insurance policy for Contract Works / Public Liability
	4 Insurance against:	Contract Works SASRIA insurance subject to the terms, exceptions and conditions of the SASRIA coupon
	Cover / indemnity	Cover / indemnity is to the extent provided by the SASRIA coupon
	The deductibles are	The deductibles are in respect of each, and every theft claim 0,1% of the contract value subject to a minimum of R2 500 and a maximum of R25 000.
84.1	The <i>Contractor</i> provides these additional insurances.	
	- Where the contract requires that the design of any part of the <i>works</i> shall be provided by the <i>Contractor</i>, the <i>Contractor</i> shall satisfy the Employer that professional indemnity insurance cover in connection therewith has been affected - Where the contract involves manufacture, and/or fabrication of Plant & Materials, components or other goods to be incorporated into the <i>works</i> at premises other than the site, the <i>Contractor</i> shall satisfy the <i>Employer</i> that such plant & materials, components or other goods for incorporation in the <i>works</i> are adequately insured during manufacture and/or fabrication and transportation to the site. - Should the <i>Employer</i> have an insurable interest in such items during manufacture of fabrication, such interest shall not be noted by endorsement to the <i>Contractor's</i> policies of insurance as well as those of any subcontractor - Motor Vehicle Liability Insurance comprising (as a minimum) "Balance of Third Party" Risks including Passenger and Unauthorised Passenger Liability indemnity with a minimum indemnity limit of R5,000,000.00 - The insurance coverage referred to in 1, 2, 3, and 4 above shall be obtained from an insurer(s) in terms of an insurance policy approved by the <i>Employer</i>. The <i>Contractor</i> shall arrange with the insurer to submit to the <i>Project Manager</i> the original and the duplicate original of the policy or policies of insurance and the receipts for payment of current premiums, together with a certificate from the	

		insurer or insurance broker concerned, confirming that the policy or policies provide the full coverage as required. The original policy will be returned to the <i>Contractor</i>		
9	Termination	There is no additional Contract Data required for this section of the conditions of contract.		
10	Data for main Option clause			
A	Priced contract with Activity Schedule	No additional data is required for this Option.		
11	Data for Option W1			
W1.1	The <i>Adjudicator</i> is	Both parties will agree as and when a dispute arises. If the parties cannot reach an agreement on the <i>Adjudicator</i> , the chairman of the Association of Arbitrators will appoint an <i>Adjudicator</i> .		
W1.2(3)	The <i>Adjudicator nominating body</i> is:	The Chairman of the Association of Arbitrators (Southern Africa)		
	If no <i>Adjudicator nominating body</i> is entered, it is:	the Association of Arbitrators (Southern Africa)		
W1.4(2)	The <i>tribunal</i> is:	Arbitration		
W1.4(5)	The <i>arbitration procedure</i> is	The Rules for the Conduct of Arbitrations of the Association of Arbitrators (Southern Africa)		
	The place where arbitration is to be held is	Durban, KwaZulu Natal		
	The person or organisation who will choose an arbitrator if the Parties cannot agree a choice or if the arbitration procedure does not state who selects an arbitrator, is	The Chairman of the Association of Arbitrators (Southern Africa)		
X1	Price adjustment for inflation			
X1.1(a)	The <i>base date</i> for indices is	On inception of Optional Phase 2		
X1.1(c)	The proportions used to calculate the Price Adjustment Factor are:	Pro-portion	linked to index for	Index prepared by

0.30	Labour (People)	The Consumer Price Index (CPI) for "All Items" in Table 1 (Consumer price indices for the total country) of the Statistical Release P0141 "Consumer Price Index - Additional Tables" published by Statistics South Africa.
0.15	Plant (Equipment)	The "Plant and Equipment" index in Table 4 (Mining and construction plant and equipment price index) of the Statistical Release P0151.1 "Construction Materials Price Indices" published by Statistics South Africa. (Link - http://www.statssa.gov.za/?page_id=1854&PPN=P0151.1)

0.15	Material (Civil)	The "Civil Engineering Material - Total" index in Table 6 (Civil engineering material price indices) of the Statistical Release P0151.1 "Construction Materials Price Indices" published by Statistics South Africa. (Link – http://www.statssa.gov.za/?page_id=1854&PPN=P0151.1) ; and
0.36	Material (Electrical)	The "Electrical Engineering" index in Table 5 (Mechanical and Electrical Engineering Input Price Indices) of the Statistical Release P0151.1 "Construction Materials Price Indices" published by Statistics South Africa.

		0.03	Material (Mechanical)	The "Mechanical Engineering" index in Table 5 (Mechanical and Electrical Engineering Input Price Indices) of the Statistical Release P0151.1 "Construction Materials Price Indices" published by Statistics South Africa.
		0.01	Fuel	The "Diesel" index in Table 1 (PPI for final manufactured goods) of the Statistical Release P0142.1 "Producer Price Index" published by Statistics South Africa. (Link - http://www.statssa.gov.za/?page_id=1854&PPN=P0142.1)
		0.15	Non-adjustable	
X2	Changes in the law	No additional data is required for this Option		
X7	Delay Damages			
X7.1	Delay damages for Completion of the whole of the <i>works</i> are	R 5000 per day excl. VAT The parties agree that this constitutes a genuine pre-estimate of the damages.		
X13	Performance Bond			
X13.1	The amount of the Performance Bond is	5% of the total of the Price at the contract date (excluding V.A.T.) By an issuer reasonably acceptable to Transnet SOC Ltd		

X16	Retention	
X16.1	The <i>retention free amount</i> is	Nil
	The <i>retention percentage</i> is	10% on all payments certified
X18	Limitation of liability	
X18.1	The <i>Contractor's</i> liability to the <i>Employer</i> for indirect or consequential loss is limited to:	Nil
X18.2	For any one event, the Contractor's liability to the Employer for loss of or damage to the Employer's property is limited to:	The deductible of the relevant insurance policy
X18.3	The Contractor's liability for Defects due to his design which are not listed on the Defects Certificate is limited to:	The cost of correcting the Defect
X18.4	The <i>Contractor's</i> liability to the <i>Employer</i> for Defects that are not found until after the <i>defects date</i> is limited to:	The Total of the Prices
X18.5	The <i>end of liability date</i> is	5 (Five) years after Completion of the whole of the services
Z	Additional conditions of contract	
	The <i>additional conditions of contract</i> are:	
Z 1	INTELLECTUAL PROPERTY	
Z 1.1	Intellectual property rights (including patents, copyright, trademarks etc.) rest with the party owning them.	
Z 1.2	The Employer indemnifies the Contractor against any claim or action (including costs) caused by or arising from the failure as the Employer to obtain such consent and the contractor indemnifies the Employer against any claim or action (including costs) caused by or arising from the failure of the Contractor to obtain such consent.	
Z 2	ASSIGNMENT AND WAIVER	
Z 2.1	No rights, duties or liabilities under this contract may be ceded, assigned, transferred, conveyed or otherwise disposed of by either Party (<i>Employer or Contractor</i>) without the prior written consent of the other Party (<i>Employer or Contractor</i>), which consent shall not be unreasonably withheld.	
Z 2.2	No grant by the <i>Contractor</i> or the <i>Employer</i> to the other of any concession, waiver, condonation or allowance is, in respect of any specific event or circumstance other than of which the grant was made, to constitute a waiver of the rights of the grantor in terms of the Contract or an <i>estoppel</i> of the grantor's right to enforce the provisions of the Contract.	

Z 3**RIGHT RESERVED BY TRANSNET TO CONDUCT VETTING THROUGH STATE SECURITY AGENCY (SSA):**

Transnet reserves the right to conduct vetting through State Security Agency (SSA) for security clearances of any Contractor who has access to National Key Points for the following without limitations:

1. Confidential – this clearance is based on any information which may be used by malicious, opposing or hostile elements to harm the objectives and functions of an organ of state.
2. Secret – clearance is based on any information which may be used by malicious, opposing or hostile elements to disrupt the objectives and functions of an organ of state.
3. Top Secret – this clearance is based on information which may be used by malicious, opposing or hostile elements to neutralise the objectives and functions of an organ of state.

Z 4**ADDITIONAL CLAUSE RELATING TO COLLUSION IN THE CONSTRUCTION INDUSTRY**

The Contract award is made without prejudice to any rights Transnet may have to take appropriate action later with regard to any declared bid rigging including blacklisting

Z 5**PROTECTION OF PERSONAL INFORMATION ACT:**

The *Employer* and the *Contractor* are required to process information obtained for the duration of the Agreement in a manner that is aligned to the Protection of Personal Information Act

Z 6**ADDITIONAL CLAUSE RELATING TO PERFORMANCE BONDS AND/OR GUARANTEES**

The Performance Guarantee under X13 above shall be an irrevocable, on-demand performance guarantee, to be issued in the same form of the Pro Forma document provided for this purpose under C1.3 (Forms of Securities), in favour of the *Employer* by a financial institution reasonably acceptable to the *Employer*

Failure to comply with this obligation by the *Contractor* will entitle the *Employer* to terminate the *Contractor's* obligation to Provide the remainder of the Works without any further entitlement to the *Contractor* for any payment or consideration with regards to the provision of the remainder of the work contracted for.

Z 7**OBLIGATIONS IN RESPECT OF JOINT VENTURE AGREEMENTS:**

In the instance that the *Contractor* is a joint venture, the *Contractor* shall provide the *Employer* with a certified copy of its signed joint venture agreement, and in the instance that the joint venture is an 'Incorporated Joint Venture,' the Memorandum of Incorporation, within 4 (four) weeks of the Contract starting date

The Joint Venture agreement shall contain but not be limited to the following:

- A brief description of the Contract and the Deliverables.
- The name, physical address, communications addresses and domicilium citandi et executandi of each of the constituents and of the Joint Venture.
- The constituents' interests.
- A schedule of the insurance policies, sureties, indemnities and guarantees which must be taken out by the Joint Venture and by the individual constituents.
- Details of an internal dispute resolution procedure.

Written confirmation by all of the constituents:

- i. of their joint and several liability to the *Employer* to Provide the *works*.
- ii. proof of separate bank account/s in the name of the joint venture.
- iii. identification of the lead in the joint venture confirming the authority of the lead to bind the joint venture through the *Contractor's* representative.
- iv. Identification of the roles and responsibilities of the constituents to provide the *works*.

Financial requirements for the Joint Venture:

- i. the working capital requirements for the Joint Venture and the extent to which and manner whereby this will be provided and/or guaranteed by the constituents from time to time.

the names of the auditors and others, if any, who will provide auditing and accounting services to the Joint Venture

Z 8**ADDITIONAL OBLIGATIONS IN RESPECT OF TERMINATION****Z8.1**

The following will be included under core clause 91.1:

In the second main bullet, after the word 'partnership' add 'joint venture whether incorporate or otherwise (including any constituent of the joint venture)' and

Under the second main bullet, insert the following additional bullets after the last sub-bullet:

- commenced business rescue proceedings (R22)
- repudiated this Contract (R23)

Z8.2**Termination Table**

The following will be included under core clause 90.2 Termination Table as follows:

Amend "A reason other than R1 – R21" to "A reason other than R1 – R23"

Z8.3

Amend "R1 – R15 or R18" to "R1 – R15, R18, R22 or R23."

Z 9**Phase 2 (Roll-out) - Optional****Z9.1**

The instruction to undertake phase 2 shall be given by the *Employer* subject to the proven success of phase 1 and should the business deem necessary to undertake the remainder of the works (phase 2).

C1.2 Contract Data

Part two - Data provided by the Contractor

Clause	Statement	Data
10.1	The Contractor is:	.....
	Address	.....
	Tel No.	.....
	Fax No.	.....
11.2(8)	The direct fee percentage is	.....
	The subcontracted fee percentage is	.....
11.2(18)	The working areas are the Site and	.....
24.1	The Contractor's key persons are:	
	1 Name:	.....
	Job:	.....
	Responsibilities:	.....
	Qualifications:	.....
	2 Name:	.....
	Job:	.....
	Responsibilities:	.....
	Qualifications:	.....
	3 Name:	.....
	Job:	.....
	Responsibilities:	.....
	Qualifications:	.....
	4 Name:	.....
	Job:	.....
	Responsibilities:	.....
	Qualifications:	.....

A	Priced contract with price list			
11.2(21)	Priced contract with price list	Part C2 Pricing Data		
11.2(31)	The tendered total of the Prices is	(in figures)		
		(in words), excluding VAT		
	Data for Schedules of Cost Components	<i>Note "SCC" means Schedule of Cost Components starting on page 56 of ECC, and "SSCC" means Shorter Schedule of Cost Components starting on page 59 of ECC.</i>		
A	Priced contract with price list	Data for the Shorter Schedule of Cost Components		
41 in SSCC	The percentage for people overheads is:	.....		
21 in SSCC	The published list of Equipment is the last edition of the list published by	.....		
	The percentage for adjustment for Equipment in the published list is	.....		
22 in SSCC	The rates of other Equipment are:	Equipment	Size capacity or	Rate
61 in SSCC	The hourly rates for Defined Cost of design outside the Working Areas are	Category of employee	Hourly rate	
62 in SSCC	The percentage for design overheads is	.....		



PART 2: PRICING DATA

Document reference	Title	No of pages
C2.1	Pricing instructions: Option A	2
C2.2	Activity Schedule	2

C2.1 Pricing Instructions: Option A

1. The *conditions of contract*

1.1. How the contract prices work and assesses it for progress payments

Clause 11 in NEC3 Engineering and Construction Contract, June 2005, (with amendments June 2006 and April 2013) (ECC) Option A states:

Identified and defined terms

- 11.2 (20) The Activity Schedule is the *activity schedule* unless later changed in accordance with this contract.
- (22) Defined Cost is the cost of the components in the Shorter Schedule of Cost Components whether work is subcontracted or not excluding the cost of preparing quotations for compensation events.
- (27) The Price for Work Done to Date is the total of the Prices for
- each group of completed activities and
 - each completed activity which is not in a group
- A completed activity is one which is without Defects which would either delay or be covered by immediately following work.
- (30) The Prices are the lump sums for each of the activities on the Activity Schedule unless later changed in accordance with this contract.

1.2. Measurement and Payment

- 1.2.1 The Activity Schedule provides the basis of all valuations of the Price for Work Done to Date, payments in multiple currencies, price adjustments for inflation and general progress monitoring.
- 1.2.2 The amount due at each assessment date is based on **completed activities and/or milestones** as indicated on the Activity Schedule.
- 1.2.3 The Activity Schedule work breakdown structure provided by the *Contractor* is based on the Activity Schedule provided by the *Employer*. The activities listed by the *Employer* are the minimum activities acceptable and identify the specific activities which are required to achieve Completion. The activity schedule work breakdown structure is compiled to the satisfaction of the *Project Manager* with any additions and/or amendments deemed necessary.
- 1.2.4 The *Contractor's* detailed Activity Schedule summates back to the Activity Schedule provided by the *Employer* and is in sufficient detail to monitor completion of activities related to the Accepted Programme in order that payment of completed activities may be assessed.

-
- 1.2.5 The short descriptions in the Activity Schedule are for identification purposes only. All work described in the Works Information is deemed included in the activities.
- 1.2.6 The Activity Schedule is integrated with the Prices, Accepted Programme and where required the forecast rate of payment schedule.
- 1.2.7 Activities in multiple currencies are separately identified on both the Activity Schedule and the Accepted Programme for each currency.
- 1.2.8 The tendered total of the prices as stated in the Contract Data is obtained from the Activity Schedule summary. The tendered total of the prices includes for all direct and indirect costs, overheads, profits, risks, liabilities and obligations relative to the Contract.

C2.2 Activity Schedule

The Tenderer details his Activity Schedule below or makes reference to his Activity Schedule and attaches it to this schedule.

COST ESTIMATES :DISTRIBUTED ACOUSTIC SENSING (DAS) SUB-SYSTEM



PHASE 1 (PILOT) SECURITY PROJECT - ACTIVITY SCHEDULE

Item	Scope Reference	Activity	Quantities	Unit	Unit Price	Amount
1		Health and Safety Requirements	Total			
	4.1.1	Approved Health and Safety Requirements.	1	Sum		
2		Phase 1: (Pilot)				
3		Project Initiation	Total			
		Conduct Sites Visit for Phase 1 (Pilot):				
	4.1.2	Conduct sites visit end to end between Villiers - Jameson Park.	1	Sum		
		Conduct sites visit end to end between Jameson Park - Secunda.	1	Sum		
		Conduct sites visit end to end between Jameson Park - Kendal.	1	Sum		
		Conduct sites visit end to end between Kendal - Watloo.	1	Sum		
		Conduct sites visit end to end between Kendal - Secunda.	1	Sum		
		Conduct sites visit end to end between Kendal - Witbank.	1	Sum		
4		System Design	Total			
		Develop a Detail Design for Phase 1 (Pilot):				
	4.1.3	Develop a detail design end to end between Villiers - Jameson Park.	1	Sum		
		Develop a detail design end to end between Jameson Park - Secunda.	1	Sum		
		Develop a detail design end to end between Jameson Park - Kendal.	1	Sum		
		Develop a detail design end to end between Kendal - Watloo.	1	Sum		
		Develop a detail design end to end between Kendal - Secunda.	1	Sum		
		Develop a detail design end to end between Kendal - Witbank.	1	Sum		
5		Site Preparation	Total			
		Sites Preparation for Phase 1 (Pilot):				
	4.1.4	Sites Preparation end to end between Villiers - Jameson Park.	1	Sum		
		Sites Preparation end to end between Jameson Park - Secunda.	1	Sum		
		Sites Preparation end to end between Jameson Park - Kendal.	1	Sum		
		Sites Preparation end to end between Kendal - Watloo.	1	Sum		
		Sites Preparation end to end between Kendal - Secunda.	1	Sum		
		Sites Preparation end to end between Kendal - Witbank.	1	Sum		
6		System Deployment	Total			
		Supply a number of DAS sub-system units for Phase 1 (Pilot):				
	4.1.5	Supply a DAS sub-system units between Villiers - Jameson Park.	1	Sum		
		Supply a DAS sub-system units between Jameson Park - Secunda.	1	Sum		
		Supply a DAS sub-system units between Jameson Park - Kendal.	1	Sum		
		Supply a DAS sub-system units between Kendal - Watloo.	1	Sum		
		Supply a DAS sub-system units between Kendal - Secunda.	1	Sum		
		Supply a DAS sub-system units between Kendal - Witbank.	1	Sum		
7		System Testing, Correction, and Re-testing	Total			
		System Testing and Correction for Phase 1 (Pilot):				
	4.1.6	Test System DAS sub-system units between Villiers - Jameson Park.	1	Sum		
		Test System DAS sub-system units between Jameson Park - Secunda.	1	Sum		
		Test System DAS sub-system units between Jameson Park - Kendal.	1	Sum		
		Test System DAS sub-system units between Kendal - Watloo.	1	Sum		
		Test System DAS sub-system units between Kendal - Secunda.	1	Sum		
		Test System DAS sub-system units between Kendal - Witbank.	1	Sum		
8		System/Solution Acceptance	Total			
	4.1.7	System/Solution Acceptance of DAS sub-system units between Villiers - Jameson Park.	1	Sum		
		System/Solution Acceptance of DAS sub-system units between Jameson Park - Secunda.	1	Sum		
		System/Solution Acceptance of DAS sub-system units between Jameson Park - Kendal.	1	Sum		
		System/Solution Acceptance of DAS sub-system units between Kendal - Watloo.	1	Sum		
		System/Solution Acceptance of DAS sub-system units between Kendal - Secunda.	1	Sum		
		System/Solution Acceptance of DAS sub-system units between Kendal - Witbank.	1	Sum		
9		System Monitoring	Total			
		System Monitoring for 24/7 - Phase 1 (Pilot):				
	4.1.8 & 6.1.4.7	Operates and monitor the systems for a period of 2 months.	1	Sum		
		Provide training to a minimum of 10 Employer's personnel for 2 months.	1	Sum		
		Provide preventative and reactive maintenance for a period of 2 years.	1	Sum		
10		Phase 1 (Pilot) Close - out	Total			
		A comprehensive document detailing a close-out in compliance with PrCPM responsibilities.				
		Close - out documents inline with Project Life Cycle (PLP) and presentation to Gate Review Team.	1	Sum		
Total Item (1+2+3+4+5+6+7+8+9+10)						
VAT at 15%						
Total Sum Carried Forward to Form of Offer						

COST ESTIMATES - DISTRIBUTED ACOUSTIC SENSING (DAS) SUB-SYSTEM						
PHASE 2: ROLL OUT - OPTIONAL						
Item	Scope Reference	Activity	Quantities	Unit	Unit Price	Amount
11		Health and Safety Requirements	Total	Quantity		
11.1	4.2.2	Approved Health and Safety Requirements.	1	Sum		
13		Phase 2 (Project Initiation)	Total			
		Conduct Sites Visit for Phase 2 (Roll - out):				
13.1	4.2.3	Conduct Sites Survey end to end between Island View - Twini.	1	Sum		
13.2		Conduct Sites Survey end to end between Twini - Hilltop.	1	Sum		
13.3		Conduct Sites Survey end to end between Hilltop - Nambithi.	1	Sum		
13.4		Conduct Sites Survey end to end between Nambithi - Warden.	1	Sum		
13.5		Conduct Sites Survey end to end between Warden - Villiers.	1	Sum		
14		System Design	Total			
		Develop a Detail Design for Phase (Roll - out):				
14.1	4.2.4	Develop a detail design end to end between Island View - Twini.	1	Sum		
14.2		Develop a detail design end to end between Twini - Hilltop.	1	Sum		
14.3		Develop a detail design end to end between Hilltop - Nambithi.	1	Sum		
14.4		Develop a detail design end to end between Nambithi - Warden.	1	Sum		
14.5		Develop a detail design end to end between Warden - Villiers.	1	Sum		
15		Site Preparation	Total			
		Sites Preparation for Phase 2 (Roll - out):				
15.1	4.2.5	Sites Preparation for DAS sub-system units between Island View - Twini.	1	Sum		
15.2		Sites Preparation for DAS sub-system units between Twini - Hilltop.	1	Sum		
15.3		Sites Preparation for DAS sub-system units between Hilltop - Nambithi.	1	Sum		
15.4		Sites Preparation for DAS sub-system units between Nambithi - Warden.	1	Sum		
15.5		Sites Preparation for DAS sub-system units between Warden - Villiers.	1	Sum		
16		System Deployment	Total			
		Supply a number of DAS sub-system units for Phase 2 (Roll - out):				
16.1	4.2.6	Supply a DAS sub-system units between Island View - Twini.	1	Sum		
16.2		Supply a DAS sub-system units between Twini - Hilltop.	1	Sum		
16.3		Supply a DAS sub-system units between Hilltop - Nambithi.	1	Sum		
16.4		Supply a DAS sub-system units between Nambithi - Warden.	1	Sum		
16.5		Supply a DAS sub-system units between Warden - Villiers.	1	Sum		
17		System Testing, Correction, and Re-testing	Total			
		System Testing and Correction for Phase 2 (Roll - out):				
17.1	4.2.7	Test System DAS sub-system units between Island View - Twini.	1	Sum		
17.2		Test System DAS sub-system units between Twini - Hilltop.	1	Sum		
17.3		Test System DAS sub-system units between Hilltop - Nambithi.	1	Sum		
17.4		Test System DAS sub-system units between Nambithi - Warden.	1	Sum		
17.5		Test System DAS sub-system units between Warden - Villiers.	1	Sum		
18		System/Solution Acceptance			Total	
		Acceptance testing confirms the software's stability and checks flaws for Phase 2 (Roll - out):				
18.1	4.2.8	System/Solution Acceptance of DAS sub-system units between Island View - Twini.	1	Sum		
18.2		System/Solution Acceptance of DAS sub-system units between Twini - Hilltop.	1	Sum		
18.3		System/Solution Acceptance of DAS sub-system units between Hilltop - Nambithi.	1	Sum		
18.4		System/Solution Acceptance of DAS sub-system units between Nambithi - Warden.	1	Sum		
18.5		System/Solution Acceptance of DAS sub-system units between Warden - Villiers.	1	Sum		
19		System Monitoring			Total	
		System Monitoring for 24/7 - Phase 2 :				
19.1	4.2.9	Operates and monitor the systems for a period of 2 months.	1	Sum		
19.2		Provide training to a minimum of 10 Employer's personnel for 2 months.	1	Sum		
19.2		Provide preventative and reactive maintenance for a period of 16 months.	1	Sum		
20		Phase 2 (Roll-out) Close - out			Total	
		A comprehensive document detailing a close-out in compliance with Act 48 of 2000:				
20.1		Close - Out Documents.	1	Sum		
Total Item (11+12+13+14+15+16+17+18+19+20)						
VAT at 15%						
Total Sum Carried Forward to Form of Offer						



TRANSNET PIPELINES (TPL)

DOCUMENT NO DAS-TPL

**REQUIREMENTS SPECIFICATION AND SCOPE OF WORK
DEFINITION FOR A DISTRIBUTED ACOUSTIC SENSING (DAS) SUB-SYSTEM
SECURITY PROJECT**

BY NATHI NDLOVU AND BRAAM GREEFF

10 JULY 2024



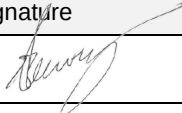
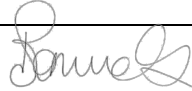
EXECUTIVE SUMMARY

Title:	Requirements specification and scope of work definition for a Distributed Acoustic Sensing (DAS) Sub-System .
Abstract:	This scope of work document provides the requirements for an installation, testing and maintenance of a Distributed Acoustic Sensing System (DAS) solution at Transnet Pipeline (TPL) network infrastructure.
Keywords:	Distributed Acoustic Sensing (DAS), Distributed Acoustic Sensing Integrated System (DASIS).
Objective:	The objective of the DAS phase 1 pilot implementation is to evaluate the detection feasibility of the DAS technology to detect and report security intrusion breaches along a part of the current Transnet Pipeline (TPL) network infrastructure.



Approval Page

Project Name	Integrated Security Solution		
Project No	DS-CCIS-TPL-003		
Title	Requirements specification and scope of work definition for a Distributed Acoustic Sensing (DAS) Sub-System Pilot Phase 1 security project.		
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Approved for	TPL	Signature	Date
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FIGURES

Figure 1: Context and relationship to other documents

Figure 2: Transnet Pipeline National Network

Figure 3: Overview of planned Project Phases

Figure 4: CONOPS for Phase 1 DAS Sub-system pilot test implementation

Figure 5: The Pilot (Phase 1) DAS Sub-system context configuration

Figure 6: DAS Sub-system for Pilot Phase 1 high-level interface definition diagram

TABLES

Table 1: Overview of pipeline network status.

Table 2: Allocated reliability requirements.

Table 3: Allocated DAS Sub-system MTTR requirements.

ABBREVIATIONS

BV	Block Valve
CI	Critical Infrastructure
DAS	Distributed Acoustic Sensing
DASIS	Distributed Acoustic Sensing Integrated System
E/IF	External Interface
EI	Essential Infrastructure
IU	Interrogator Unit
NKP	National Key Point
NOC	National Operations Centre
PILOT	The first feasibility (phase 1) to verify the feasibility of the DAS technology.
POC	Proof of Concept
PSIM	Physical Security Information Management
SCO	Senior Controller
SHE	Safety Health Environment
TPL	Transnet Pipelines

DEFINITIONS

Term	Definition formulation
“Conduited”	The term is used to refer to the Transnet TPL current fibre optic installation configuration. The Transnet TPL 48-core fibre optic cable has been installed within a conduit channel.
DAS Sub-system	The DAS sub-system term refers to the Phase 1 acoustic sensor as deployed only to a limited section of the pipeline to test for feasibility. No integration with the Transnet TPL PSIM security management system is required. This configuration shall be used during the Phase 1 of the project.
DASIS	The DAS Integrated System (DASIS) refers to the complete installed DAS sub-system, but also integrated with the Transnet TPL security management systems.
MTBF	MTBF can be calculated as the arithmetic mean (average) time between failures of a system.
MTTR	Mean time to repair (MTTR) is a basic measure of the maintainability of repairable items. It represents the average time required to repair a failed component or device.
PSIM	Physical Security Information Management System
Pilot Phase	The purpose of the pilot phase of the project shall be to validate the feasibility of the DAS technology.
First line support tasks	Routine non-complex maintenance and support tasks which could be performed by operational personnel on site. No special equipment or specialised skills are required.
Second line support tasks	Specialised maintenance and repair tasks that are performed by trained technicians on site.
Third line support tasks	Equipment is removed from the site and sent to specialised off-site workshops or laboratories.
URS	The User Requirements Specification describes the high-level needs for what users require from the system. User Requirements Specifications are written early in the validation process, typically before the system is created.

1 Scope

This document defines the system requirements and scope of work (SOW) for the customisation, supply, installation, testing, and maintenance support requirements for a pilot (phase 1) evaluation of a Distributed Acoustic Sensing (DAS) sub-system. The DAS sub-system shall be installed over a limited pilot test section of the TPL pipeline network infrastructure. The purpose of the DAS sub-system capability shall be to detect potential pipeline security intrusions and violations on the current TPL network infrastructure. The pilot phase DAS sub-system capability shall have the functionality to report incidents to an Operations Centre (OC) and send an alarm notification to 3rd party security response organisations as required by the TPL.

1.1 Document context and relationships

This document is informed by the higher-level document, the User Requirements Specification for the DAS Sub-system Pilot (Phase 1), as depicted in Figure 1 below:

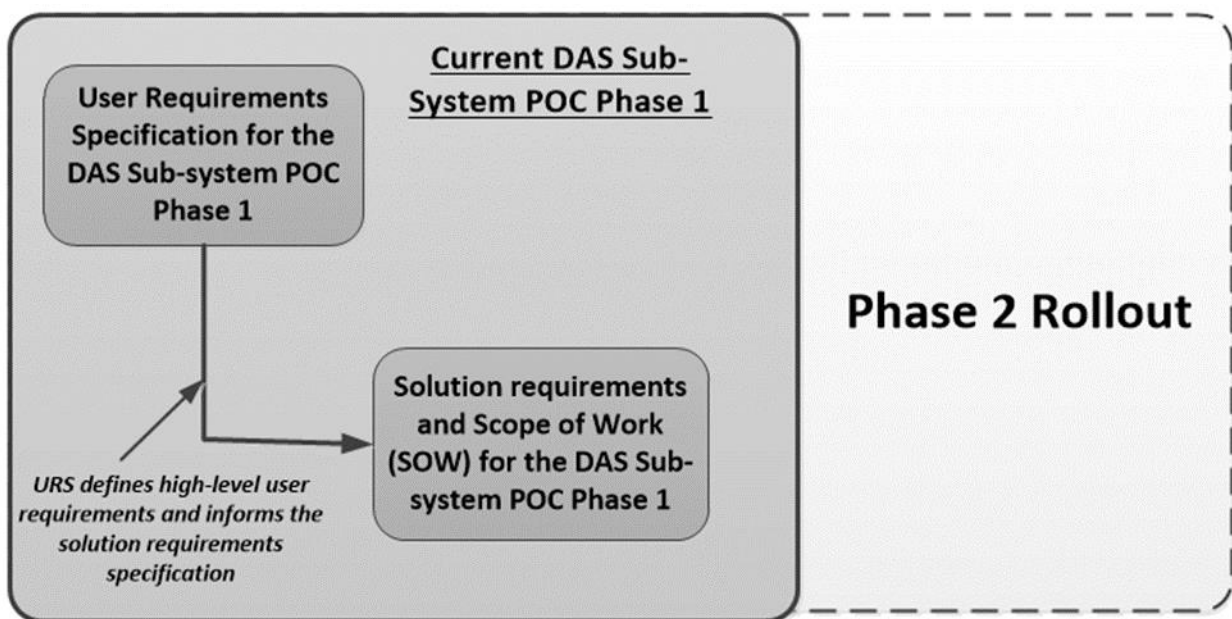


Figure 1: Context and relationship to other documents

Upon successfully completing the Pilot (Phase 1), the project will be rolled out to Phase 2.

2 Background to the Project

Transnet Pipelines (TPL) is the largest multi-product operator in Southern Africa, transporting hydrocarbons and methane-rich gas through a network (Figure 2) of 3 800 km of petroleum and gas pipeline infrastructure of which 3 116 km is currently operational. The pipeline network traverses five different provinces in South Africa (KwaZulu-Natal, Free State, Gauteng, Northwest, and Mpumalanga) ensuring the security of petroleum supply to the inland market and methane-rich gas to Kwa-Zulu Natal. In some areas the underground pipelines cross services such as water pipelines, powerline, roads, and cables.

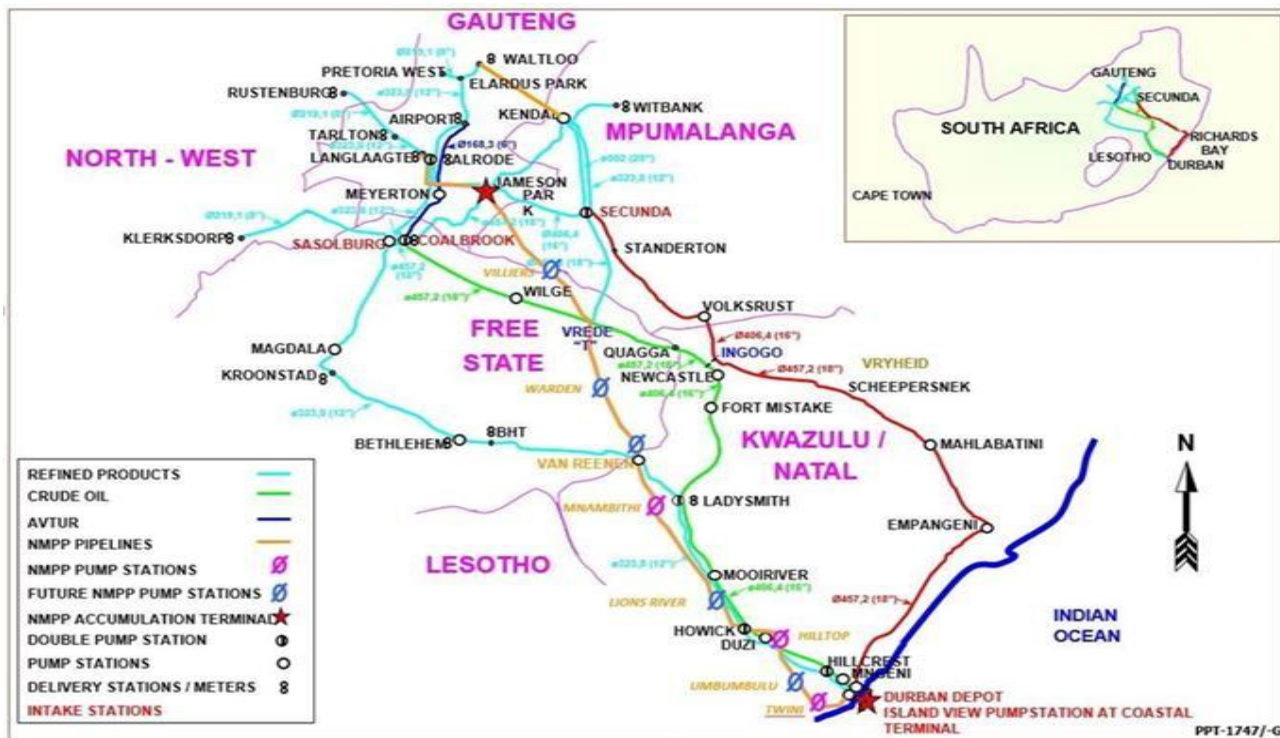


Figure 2: Transnet Pipeline National Network

The pipeline infrastructure comprises underground installations, along with above-ground supporting equipment such as test points, rectifiers, concrete markers, and block valves. The block valve chambers are located on the pipeline's servitude area and are approximately 15 km apart, depending on the terrain's topography. These chambers facilitate the isolation of pipeline sections during testing for leaks, maintenance activities, and reactive maintenance, in the event of a leak. Additionally, a conduit-installed fibre-optic communication cable has been installed underground with the pipeline over certain sections of the existing infrastructure. Spare fibres are available for DAS sensing applications.

The protection, safeguarding, and resilience of Critical Infrastructure (CI) and Essential Infrastructure (EI) pipelines are imperative, as mandated by the CI Protection Act 8 of 2019.

The following challenges currently exist in the pipelines that need to be considered within the scope of work when designing, implementing, or supporting the environment:

- The pipelines are in remote areas without electrical or communication infrastructure present. (Refer to Figure 2).
- The access route to these pipelines is typically bad such that in most cases, it is accessible by 4-wheel drive vehicles only.
- Some of the pipelines are accessible through the farmer's land, which requires the landowner's permission for access. Transnet Pipelines (TPL) to facilitate access requirements.
- The communication network coverage in some areas is poor, other areas have no network coverage at all.

3 Purpose

3.1 Purpose

The purpose of the request for quotation (RFQ) is to acquire a Contractor to design, supply, install, commission, and maintain a Distributed Acoustic Sensing (DAS) solution. This solution will be utilized to detect security violations along the pipeline infrastructure (refer to Table 1 for an overview of the pipeline network).

3.2 Project Overview

- a. The project shall be executed in a phased approach, consisting of two progressive phases, namely:

Phase 1: Pilot phase

The pipeline pilot sites will include Sections 6, 7,8,9,10, and 11. Section 6 has spare "conduited" fibre lines, while Sections 7,8,9,10, and 11 require a new installation.

Should Phase 1 fail to meet the required performance standards, the project will be terminated.

Phase 2: Roll-out phase

Phase 2 will focus on rolling out the initial solution to sections 1,2,3,4, and 5 as listed in "Table 1" upon the successful conclusion of Phase 1 Pilot (Figure 3).

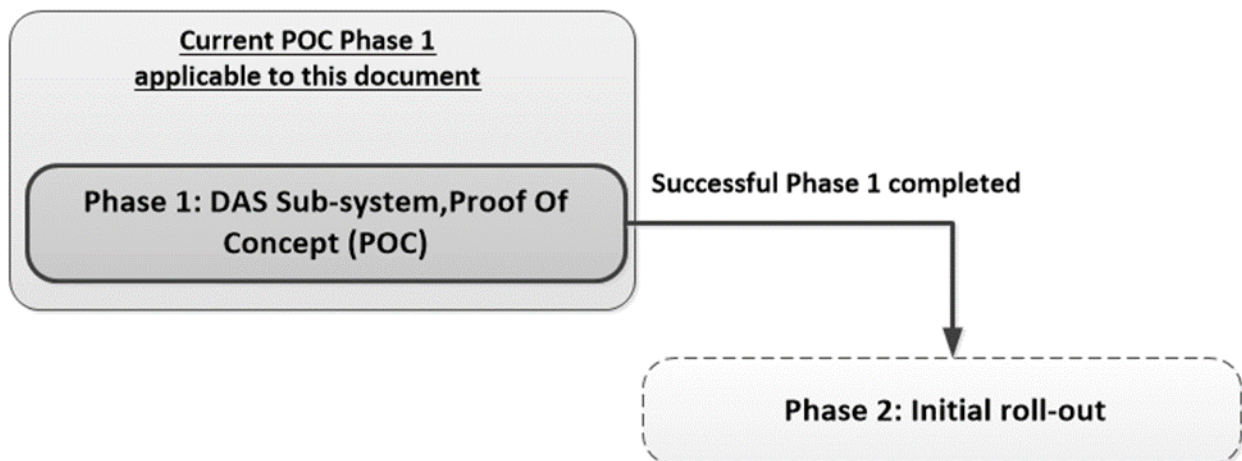


Figure 3: Overview of planned project phases

4 Scope of Work

4.1 Phase 1: Pilot System Solution

4.1.1 Health & Safety Requirements

The Contractor must prepare all Health & Safety documents for acceptance by the Employer. These documents must comply with the following requirements:

- 4.1.1.1 The Occupational Health and Safety Act, 85 of 1993, and relevant regulations.
- 4.1.1.2 The provisions of the Act and for implementing any Safety, Health, and Environmental rules required by the Employer. Additionally, the Contractor must ensure that all employees or persons working on their behalf have undergone safety, health, and environmental induction specific to the site hazards before entering any Employer site.
- 4.1.1.3 The Contractor must always adhere to Safety, Health, and Environmental requirements as per relevant legislation and the Transnet Contractor Management Procedure (TIMS-GRP-PROC-014) for the scope of services.
- 4.1.1.4 It is also the Contractor's responsibility to ensure that all on-site employees have valid medical certificates issued by an occupational health practitioner.
- 4.1.1.5 Furthermore, before establishing or entering any Transnet site, the Contractor must submit a Safety, Health, and Environmental Compliance file for review and approval by the Employer, aligning with the scope of services provided by the Contractor.
- 4.1.1.6 **Deliverables:**
Health and Safety compliance file approved.

4.1.2 Phase 1 (Project Initiation):

The Contractor shall conduct a site visit for phase 1, which will entail the following:

- 4.1.2.1 A site kick-off meeting, the agenda for the kick-off meeting will include the following items:
 - a) Confirm the roles, responsibilities, and availability of the project team members.
 - b) Review timelines based on the resources and team members' availability.
 - c) Ensure that all necessary equipment is available.
 - d) Ensure team members have access to all necessary documents.
 - e) Define system configuration management.
 - f) Identification of all affected Stakeholders (Farmers, Local Authorities, and others).
- 4.1.2.2 The Contractor is to be responsible for preparing a project management plan that covers, a minimum of nine knowledge areas: integration, scope, schedule, costs, quality, resources, risks, communication, procurement, stakeholders, health, and safety.
Additionally, the Contractor must comply with the following:
 - a) The provision of the South African Council for the Project and Construction Management Professions (SACPCMP) Act, 2000 (Act No. 48 of 2000) and relevant regulations as amended.
 - b) A Professional Construction Project Manager (Pr. CPM) shall be the point of communication in this process.
 - c) A Professional Construction Project Manager (Pr. CPM) must be accredited by the SACPCMP.

-
- d) The Contractor performs the duties of the Employer and is in every respect responsible for compliance with the provisions of the SACPCMP Act.
- 4.1.2.3 **The Contractor shall** prepare, coordinate and monitor the project schedule. The schedule shall entail the following minimum requirements:
- a) The sequencing of all construction and/ or installation, in accordance with the access granted by the Employer in order to meet the agreed programme.
 - b) The contractor shall supply a level 3 detail schedule clearly outlining the scope and milestones.
 - c) The schedule must be resource loaded with a level of effort and weighting structure clearly outlined.
 - d) The schedule must clearly indicate the critical path whether it be on the longest path or activities with zero float.
- 4.1.2.4 **The Contractor shall** ensure Health and Safety compliance during the project phase 1 implementation:
- a) The Contractor shall at all times comply with Safety, Health, and Environmental requirements prescribed by the relevant legislation as well as the Transnet Contractor Management Procedure (TIMS-GRP-PROC-014) as they may apply to the scope of services.
 - e) The Contractor shall comply with the provisions of the Occupational Health and Safety Act, 85 of 1993, and relevant regulations as amended.
 - f) The Contractor performs the duties of the Employer and is in every respect responsible for compliance with the provisions of the Act.
 - g) The Contractor will be responsible for the Safety, Health, and Environmental rules that the Employer may require to be implemented.
 - h) The Contractor is to comply with the Construction Environmental Plan issued by the Employer.
 - i) The Contractor shall ensure that no employees or persons working on his/her behalf are allowed to enter any Employer site unless that employee or person has undergone safety, health, and environmental induction on the hazards prevalent to the site at the time of entry.
 - j) The Contractor shall ensure that all employees working on-site have valid medical certificates of fitness specific to the scope of work to be performed and issued by an occupational health practitioner. Before establishing or entering any Transnet site, the Contractor shall submit a Safety, Health, and Environmental Compliance file for review and approval by the Employer. The submission requirements will be aligned to the scope of services of the Contractor."
- 4.1.2.5 The Contractor shall test the quality and suitability of the current Fibre Optic Cable installed in Section 6 (refer to Table 1) and provide a detailed report to the Employer for acceptance.
- 4.1.2.6 The Contractor is responsible for installing the new Fiber Optic Cable in Sections 7, 8, 9, 10, and 11. The installation will take place within the existing TPL pipeline servitude, which crosses, farmers lands, wetlands, municipalities, and river crossings in some areas. Additionally, the Contractor must:
- a) Notify the affected Stakeholders (Farmers, Local Authorities, and others) about the proposal to ensure that services are identified.
 - b) Adhere to the Employer underground Services Conditions and relevant regulations, installation, trenching, backfill, and all other applicable standards.

-
- 4.1.2.7 To visit the pump stations to ensure that the Contractor is familiar with the condition of the existing equipment room, which will house the DAS Interrogator control units. The equipment room building offer the following:
- a) A space for the DAS equipment, where the DAS Interrogator control units will be installed, will be identified by the Employer.
 - b) Room floor area is approximately 14.4 m2 with a suspended floor and roof concrete slab.
- 4.1.2.8 To attend regular site, technical, and progress meetings.
- 4.1.2.9 To facilitate *Employer's* approval of pilot documentation.
- 4.1.2.10 **Deliverables:**
- a) Project brief.
 - b) Prepare meeting minutes.
 - c) Distribute meeting minutes.
 - d) Check the status of action items.
 - e) Follow-up sections for resolving action items.
 - f) Update/Revise the project plan if needed and distribute.
 - g) Project execution plan accepted by the Employer.
 - h) Health and safety requirements accepted by the Employer.
 - i) Project baseline schedule accepted by the Employer.
 - j) Submit a pump station site visit report detailing the state of Fibre Optic lines, possible position of integrated units, and availability of power.
 - k) Submit a consolidated detailed report to the Employer for acceptance.
 - l) Approval by the Employer to proceed to the system design stage.

4.1.3 System Design

The *Contractor* shall utilize the information obtained from the initiation phase :

- 4.1.3.1 To develop a detailed design in Sections 6,7,8,9,10, and 11.
- a) The Contractor shall comply with the provisions of the Built Environment Act, 43 of 2000, and relevant regulations as amended.
 - b) The Contractor performs the duties of the Employer and is in every respect responsible for compliance with the provisions of the act.

-
- 4.1.3.2 The design shall be able to meet the requirements stipulated in 6.1. Capacity and Performance Requirements).
 - 4.1.3.3 Manage the integration of system design to form the basis for the initial viability assessment of the pilot solution.
 - 4.1.3.4 Establish responsibilities and monitor the information flow between the design team and the *Employer*.
 - 4.1.3.5 Identify, mitigate, and manage design risks.
 - 4.1.3.6 Design a complete DAS solution and submit it to the Employer for acceptance. The DAS Sub-system shall have the capability to detect and report security intrusions to the pipeline.
 - 4.1.3.7 Attend all project design meetings.
 - 4.1.3.8 **Deliverables:**
 - a) Identify risks and provide mitigation plan.
 - b) Table detail design to the *Employer* for acceptance.

4.1.4 Site Preparation

The *Contractor* shall:

- 4.1.4.1 Liaise, cooperate, and provide necessary construction project health and safety information to the *Employer*.
- 4.1.4.2 Install new Fibre Optic Cable Sections 7,8,9,10 and 11.
- 4.1.4.3 Complies with all statutory requirements regarding the excavation and works within trenches and excavations. This shall include the provision of shoring and lateral support design and installation where the trench dimensions and soil conditions require it.
- 4.1.4.4 Excavations and associated water control shall be the responsibility of the Contractor and the Contractor shall at all times keep excavations free of standing water.
- 4.1.4.5 Conduct the works in such a manner as to prevent the damage of any existing facilities whether known or unknown, buried or above ground.
- 4.1.4.6 Splice/repair existing fibre optic cable Sections 6.
- 4.1.4.7 Prepare existing equipment rooms for DAS equipment deployment.
- 4.1.4.8 Supply and install 18 000 BTU split unit Air Conditioner. (24 months warranty is required).
- 4.1.4.9 Monitor the implementation of construction health and safety plans, including periodic site audits for early works.
- 4.1.4.10 Ensure identification of hazards and risks relevant to the system deployment through regular coordinated site inspections.
- 4.1.4.11 **Deliverables:**
 - a) Produce fibre installation test report.
 - b) Once the site preparation is complete, notify the *Employer* for sign-off.

4.1.5 System Deployment

The *Contractor* shall:

- 4.1.5.1 Supply a required number of DAS Sub-system units.
- 4.1.5.2 Install DAS Sub-system units including racks in identified equipment rooms, to confirm installation feasibility.
- 4.1.5.3 Install a DAS-integrated system to receive alarms through the DAS software display interface at Jameson Park.
- 4.1.5.4 Provide a viewing station to the 3rd party vendor for alarm notification and security response purposes.
- 4.1.5.5 Monitor the implementation of construction health and safety plans, including periodic site audits for early works.
- 4.1.5.6 Ensure identification of hazards and risks relevant to the system deployment through regular coordinated site inspections.
- 4.1.5.7 **Develop technical reports in relation scope of work and communicate through monthly reports to the Employer.**
- 4.1.5.8 Manage the review and approval of all necessary shop details and product propriety information.
- 4.1.5.9 Test and commission DAS Sub-system components for the different pilot sections.
- 4.1.5.10 Develop the standards and operating procedures.
- 4.1.5.11 **Deliverables:**
 - a) As-built documentation to be submitted.
 - b) Provide Test Strategy.
 - c) Standards and operating procedures.
 - d) Provide necessary training for the *Employer* to test the system.
 - e) Provide any COC.
 - f) Handover solution to the *Employer* for user acceptance testing.

4.1.6 System Testing, Correction, and Re-testing

The *Contractor* shall:

- 4.1.6.1 Conduct system solution testing together with the *Employer's*.
- 4.1.6.2 Reconfigure the system to the *Employer's* requirements.
- 4.1.6.3 Document all test stages performed.
- 4.1.6.4 Finalize *Employer's* acceptable system performance standards.
- 4.1.6.5 Update detailed design specifications to comply with the *Employer's* system performance standards.

4.1.7 System/Solution Acceptance

The *Contractor* shall:

- 4.1.7.1 Update all relevant design documentation by the *Employer's* system performance standards and any other *Employer's* requirements.
- 4.1.7.2 Facilitate the *Employer's* approval to proceed to the system monitoring stage.
- 4.1.7.3 Present the Project Execution Plan to the Gate Review Team in line with Project Life Cycle Process (PLP).
- 4.1.7.4 **Deliverables:**
 - a) Submit all documentation and designs for the *Employer's* acceptance.
 - b) Gate Review approval.

4.1.8 System Monitoring

The *Contractor* shall:

- 4.1.11.1 Operates the system for a period of 2 months after phase 1 commissioning, while training 10 *Employers* personnel.
- 4.1.11.2 Provide training to a minimum of 10 *Employer's* personnel for a period of 2 months.
- 4.1.11.3 Provide preventative and reactive maintenance plan for a period of 2 years from system commissioning.

4.2 Phase 2: Roll-out

- 4.2.1.1 After successful implementation of Phase 1, successful testing, and the Employer has accepted the solution by the specified criteria, the Contractor shall roll out the solution to Phase 2.
- 4.2.1.2 If the outcome of phase 1 is not satisfactory, this project shall be terminated.
- 4.2.1.3 Phase 2 shall focus on the implementation of the solution in sections 1,2,3,4 and 5 as per Table 1.

4.2.2 Health & Safety Requirements

The Contractor must prepare all Health & Safety documents for acceptance by the Employer. These documents must comply with the following requirements:

- 4.2.2.1 The Occupational Health and Safety Act, 85 of 1993, and relevant regulations.
- 4.2.2.2 The provisions of the Act and for implementing any Safety, Health, and Environmental rules required by the Employer. Additionally, the Contractor must ensure that all employees or persons working on their behalf have undergone safety, health, and environmental induction specific to the site hazards before entering any Employer site.
- 4.2.2.3 The Contractor must always adhere to Safety, Health, and Environmental requirements as per relevant legislation and the Transnet Contractor Management Procedure (TIMS-GRP-PROC-014) for the scope of services.
- 4.2.2.4 It is also the Contractor's responsibility to ensure that all on-site employees have valid medical certificates issued by an occupational health practitioner.
- 4.2.2.5 Furthermore, before establishing or entering any Transnet site, the Contractor must submit a Safety, Health, and Environmental Compliance file for review and approval by the Employer, aligning with the scope of services provided by the Contractor.
- 4.2.2.6 **Deliverables:**
Health and Safety compliance file approved.

4.2.3 Phase 2 (Project Initiation):

The contractor shall conduct a site visit for phase 2, which will entail the following:

- 4.2.3.1 A site kick-off meeting, the agenda for the kick-off meeting will include the following items:
 - a) Confirm the roles, responsibilities, and availability of the project team members.
 - b) Review timelines based on the resources and team members' availability.
 - c) Ensure that all necessary equipment is available.
 - d) Ensure team members have access to all necessary documents.
 - e) Define system configuration management.
 - f) Identification of all affected Stakeholders (Farmers, Local Authorities, and others).
- 4.2.3.2 The Contractor is to be responsible for preparing a project management plan that covers, a minimum of nine knowledge areas: integration, scope, schedule, costs, quality, resources, risks, communication, procurement, stakeholders, health, and safety.

Additionally, the Contractor must comply with the following:

- a) The provision of the South African Council for the Project and Construction Management Professions (SACPCMP) Act, 2000 (Act No. 48 of 2000) and relevant regulations as amended.
- b) A Professional Construction Project Manager (Pr. CPM) shall be the point of communication in this process.
- c) A Professional Construction Project Manager (Pr. CPM) must be accredited by the SACPCMP.
- d) The Contractor performs the duties of the Employer and is in every respect responsible for compliance with the provisions of the SACPCMP Act.

4.2.3.3 The Contractor shall prepare, coordinate and monitor the project schedule. The schedule shall entail the following minimum requirements:

- a) The sequencing of all construction and/ or installation, in accordance with the access granted by the Employer in order to meet the agreed programme.
- b) The contractor shall supply a level 3 detail schedule clearly outlining the scope and milestones.
- c) The schedule must be resource loaded with a level of effort and weighting structure clearly outlined.
- d) The schedule must clearly indicate the critical path whether it be on the longest path or activities with zero float.

4.2.3.4 The Contractor shall ensure Health and Safety compliance during the project phase 2 Implementation:

- a) The Contractor shall at all times comply with Safety, Health, and Environmental requirements prescribed by the relevant legislation as well as the Transnet Contractor Management Procedure (TIMS-GRP-PROC-014) as they may apply to the scope of services.
- b) The Contractor shall comply with the provisions of the Occupational Health and Safety Act, 85 of 1993, and relevant regulations as amended.
- c) The Contractor performs the duties of the Employer and is in every respect responsible for compliance with the provisions of the Act.
- d) The Contractor will be responsible for the Safety, Health, and Environmental rules that the Employer may require to be implemented.
- e) The Contractor is to comply with the Construction Environmental Plan issued by the Employer.
- f) The Contractor shall ensure that no employees or persons working on his/her behalf are allowed to enter any Employer site unless that employee or person has undergone safety, health, and environmental induction on the hazards prevalent to the site at the time of entry.
- g) The Contractor shall ensure that all employees working on-site have valid medical certificates of fitness specific to the scope of work to be performed and issued by an occupational health practitioner. Before establishing or entering any Transnet site, the Contractor shall submit a Safety, Health, and Environmental Compliance file for review and approval by the Employer. The submission requirements will be aligned to the scope of services of the Contractor."

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- 4.2.3.5 The Contractor shall test the quality and suitability of the current Fibre Optic Cable installed in in Section 1,2,3,4 and 5 (refer to Table 1) and provide a detailed report to the Employer for acceptance.
- 4.2.3.6 To visit the pump stations to ensure that the Contractor is familiar with the condition of the existing equipment room, which will house the DAS Interrogator control units. The equipment room building offer the following:
- a) A space for the DAS equipment, where the DAS Interrogator control units will be installed, will be identified by the Employer.
 - b) Room floor area is approximately 14.4 m2 with a suspended floor and roof concrete slab.
- 4.2.3.7 To attend regular site, technical, and progress meetings.
- 4.2.3.8 To facilitate Employer's approval of pilot documentation.
- 4.2.3.9 **Deliverables:**
- a) Project brief.
 - b) Prepare meeting minutes.
 - c) Distribute meeting minutes.
 - d) Check the status of action items.
 - e) Follow-up sections for resolving action items.
 - f) Update/Revise the project plan if needed and distribute.
 - g) Project execution plan accepted by the Employer.
 - h) Health and safety requirements accepted by the Employer.
 - i) Project baseline schedule accepted by the Employer.
 - j) Submit a pump station site visit report detailing the state of Fibre Optic lines, possible position of integrated units, and availability of power.
 - k) Submit a consolidated detailed report to the Employer for acceptance.
 - l) Approval by the Employer to proceed to the system design stage.

4.2.4 System Design

The *Contractor* shall utilize information obtained from the initiation phase:

- 4.2.4.1 To develop a detailed design in Sections 1,2,3,4, and 5.
- a) The Contractor shall comply with the provisions of the Built Environment Act, 43 of 2000, and relevant regulations as amended.
 - b) The Contractor performs the duties of the Employer and is in every respect responsible for compliance with the provisions of the act.

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- 4.2.4.2 Manage the integration of system design.
 - 4.2.4.3 Establish responsibilities and monitor the information flow between the design team and the Employer.
 - 4.2.4.4 Identify, mitigate, and manage design risks.
 - 4.2.4.5 Design a complete DAS solution and submit it to the Employer for acceptance.
 - 4.2.4.6 Attend all project design meetings.
 - 4.2.4.7 **Deliverables:**
 - a) Identify risks and provide mitigation plan.
 - b) Table detail design to the Employer for acceptance.

4.2.5 Site Preparation

The *Contractor* shall:

- 4.2.5.1 Liaise, cooperate, and provide necessary health and safety information to the *Employer*.
- 4.2.5.2 Splice/repair existing fibre optic cable Sections 1,2,3,4, and 5.
- 4.2.5.3 Prepare existing equipment rooms for DAS equipment deployment.
- 4.2.5.4 Supply and install 18 000 BTU split unit Air Conditioner. (24 months warranty is required).
- 4.2.5.5 Monitor the implementation of construction health and safety plans, including periodic site audits for early works.
- 4.2.5.6 Ensure identification of hazards and risks relevant to the system deployment through regular coordinated site inspections.
- 4.2.5.7 **Deliverables:**
 - a) Produce fibre installation test report.
 - b) Once the site preparation is complete, notify the Employer for sign-off.

4.2.6 System Deployment

The *Contractor* shall:

- 4.2.6.1 Supply a required number of DAS Sub-system units.
- 4.2.6.2 Install DAS Sub-system units including racks in identified equipment rooms.
- 4.2.6.3 Install a DAS-integrated system to receive alarms through the DAS software display interface at Jameson Park.
- 4.2.6.4 Provide a viewing station to the 3rd party vendor for alarm notification and security response purposes.
- 4.2.6.5 Monitor the implementation of construction health and safety plans, including periodic site audits for early works.
- 4.2.6.6 Ensure identification of hazards and risks relevant to the system deployment through regular coordinated site inspections.
- 4.2.6.7 Develop technical reports in relation scope of work and communicate through monthly reports to the Employer.
- 4.2.6.8 Manage the review and approval of all necessary shop details and product propriety information.
- 4.2.6.9 Test and commission DAS Sub-system.
- 4.2.6.10 **Deliverables:**
 - a) As-built documentation to be submitted.
 - b) Provide Test Strategy.
 - c) Standards and operating procedures.
 - d) Provide necessary training for the Employer to test the system.
 - e) Provide any COC.
 - f) Handover solution to the Employer for user acceptance testing.

4.2.7 System Testing, Correction, and Re-testing

The *Contractor* shall:

- 4.2.7.1 Conduct system solution testing together with the *Employer's*.
- 4.2.7.2 Reconfigure the system to the Employer's requirements.
- 4.2.7.3 Document all test stages performed.
- 4.2.7.4 Finalize Employer's acceptable system performance standards.
- 4.2.7.5 Update detailed design specifications to comply with the Employer's system performance standards.

4.2.8 System/Solution Acceptance

The *Contractor* shall:

- 4.2.8.1 Update all relevant design documentation by the *Employer's* system performance standards and any other *Employer's* requirements.
- 4.2.8.2 Facilitate the Employer's approval to proceed to the system monitoring stage.
- 4.2.8.3 **Deliverables:**
 - a) Submit all documentation and designs for the *Employer's* acceptance.

4.2.9 System Monitoring

The *Contractor* shall:

- 4.2.12.1 Operates the system for a period of 2 months.
- 4.2.12.2 Provide preventative maintenance and reactive maintenance for a period of 16 months after phase 2 commissioning.

4.3 Concept of Security Operation: DAS Sub-system

4.3.1 The DAS Sub-system solution (Figure 4) shall have the following operational functional capabilities:

- 4.3.1.1 The Pilot DAS Sub-system system shall detect different types of potential intrusions of the underground pipelines using a fibre optic detection solution.
- 4.3.1.2 The detected potential intrusions shall be transmitted over the existing communication network to the Pilot (Phase 1) test and evaluation operations workstation for processing.
- 4.3.1.3 The operations workstation shall receive the alarm through a DAS software display interface.
- 4.3.1.4 The DAS Sub-system software shall classify alarms (e.g., a person walking on pipeline servitudes, hand and/or machine digging, etc) and notify the Employer's designated Controllers of incidents on the pipeline network.
- 4.3.1.5 Based on the alarm, the Controller shall manage the intrusion in line with standards and operating procedures.
- 4.3.1.6 The DAS Sub-system shall have an automatic escalation process should the operators not acknowledge or manage the alarms in a defined time frame.
- 4.3.1.7 The DAS Sub-system shall have the capability to generate incidents and statistical reports.

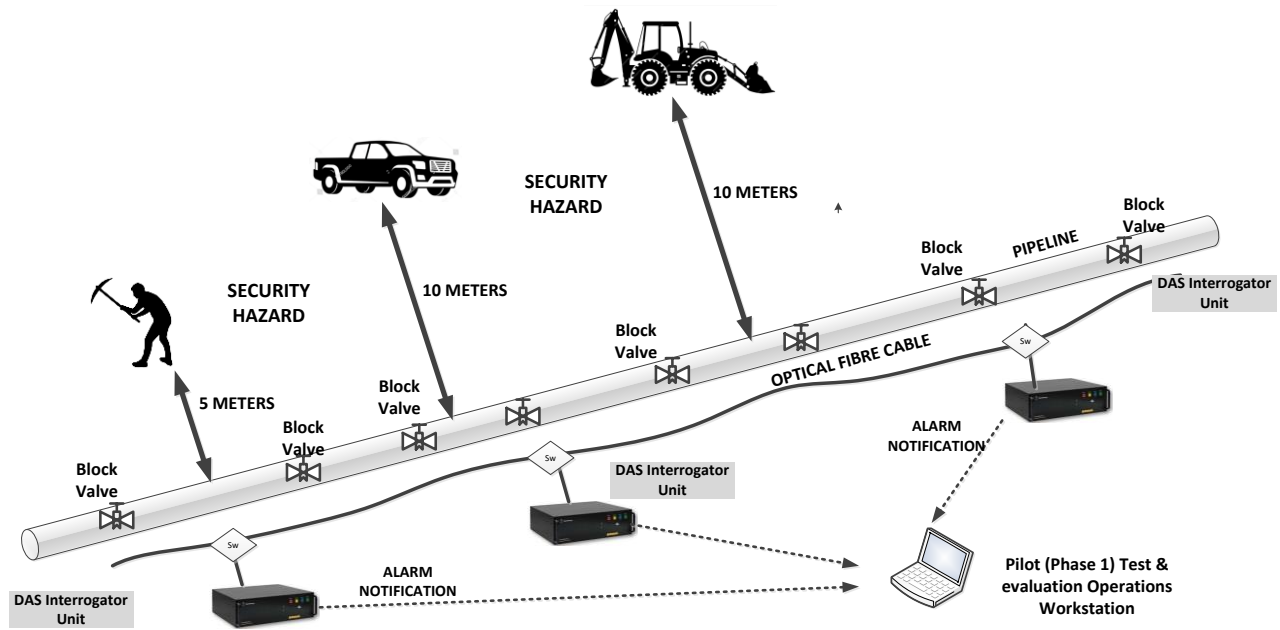


Figure 4: CONOPS for DAS Sub-system test implementation

The Table 1 below shows the different sections of the pipeline, includes distances per section, and indicates the pipelines that have existing fibre optic cables installed.

Section	From	Distance (km)	To	Fibre Installed (Yes or No)	Relevant to Phase 1 & 2
1	Island View	26	Twini	Yes	Phase 2
2	Twini	84	Hilltop	Yes	Phase 2
3	Hilltop	150	Nambithi	Yes	Phase 2
4	Nambithi	102	Warden	Yes	Phase 2
5	Warden	95	Villiers	Yes	Phase 2
6	Villiers	90	Jameson Park	Yes	Phase 1(Pilot)
7	Jameson Park	75	Secunda	No	Phase 1(Pilot)
8	Jameson Park	81	Kendal	No	Phase 1(Pilot)
9	Kendal	89	Watloo	No	Phase 1(Pilot)
10	Kendal	72	Secunda	No	Phase 1(Pilot)
11	Kendal	29	Witbank	No	Phase 1(Pilot)

Table 1: Overview of pipeline network status

5 Requirements

This requirements specification defines the functional and performance requirements for a Distributed Acoustic Sensing Sub-system (DASS). The Phase 1 project shall be the first pilot phase of a planned project to be implemented over a total of two phases.

5.1 Identification of DAS sub-system

The Phase 1 DASS shall function as a pipeline intrusion detection system over a limited Proof-Of-Concept section of the TPL pipeline infrastructure as depicted in Table 1. The DASS shall have the capability to detect pipeline security violations over a selected Phase 1 of the pipeline distance. The DAS Sub-system shall be of a modular design configuration with the ability to integrate, in future phases, the required number of DAS Interrogator Control Units (ICUs) to enable, in the future the envisaged phases. The DAS system shall have the capability to sense and report pipeline security violations to an operations control room.

The DAS installation shall be able to analyse captured acoustic data to detect and classification of third-party intrusion events in real-time.

5.2 Applicable and reference documents

The following documents are referenced in this document:

- b) SANS 2001-DP1:2011, Construction works, Part DP1: Earthworks for buried pipelines and prefabricated culverts.
- c) Occupational Health and Safety Act, 1993, Construction regulations, 2014, Guidelines, No 489, 02 June 2017.
- d) TPL underground Services Conditions and relevant regulations.

6 Requirements

6.1 Capability and Performance Requirements

The Pilot DAS Sub-system context is depicted in Figure 5. The Pilot DAS Sub-system implementation shall require as a minimum, five Functional Capability sets as defined in 6.1.1.

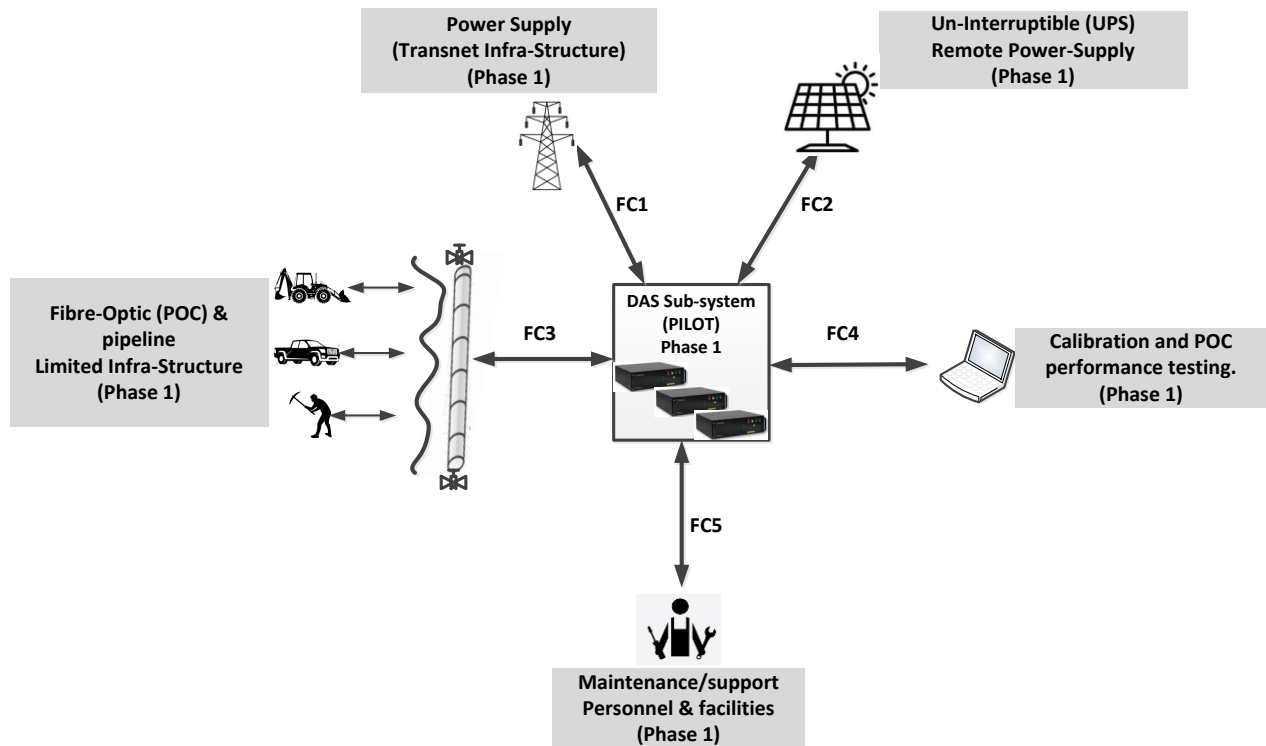


Figure 5: The Pilot DAS Sub-system context configuration

6.1.1 Capability Requirements

- 6.1.1.1 FC1: The installed Pilot DAS Sub-system shall have the capability to be powered off the utility grid.**
- The DAS Pilot Sub-system shall have the capability to be powered off the utility power supply grid, as available from existing Transnet TPL infrastructure, where applicable.
- 6.1.1.2 FC2: The installed Pilot DAS Sub-system shall have the capability to be powered using off-grid remote power supply systems.**
- The DAS Pilot Sub-system shall have the capability to be powered off by remote solar power supply installations. This power supply configuration shall have to be installed by the Contractor where required during the Pilot of the project.

6.1.1.3 **FC3: The installed Pilot DAS Sub-system shall have the capability to detect and report security intrusions to the pipeline.**

- c) The DAS Integrated System (DASIS) shall have the capability to detect pipeline security violations over a total distance of 3116 km.
- d) The DAS Integrated System (DASIS) shall be of a modular design configuration with the ability to integrate the required number of Interrogator Control Units (ICUs) to enable the DAS Integrated System to sense security violations over the total 3116 km pipeline system.
- e) The DASIS system shall be able to utilise the current duct-installed communications fibre infrastructure as a sensing medium. Additional fibre cables shall be installed where no current infrastructure is available.
- f) The DASIS installation shall be able to analyse captured acoustic data to detect and classification of third-party intrusion events in real-time, by using duct-installed or no-duct-installed fibre optic cables.
- g) The DASIS software application shall be able to integrate seamlessly with a DAS unit from respective sites. Operators shall be able to view the system remotely utilizing a web-based client only.
- h) The DASIS shall incorporate a dual redundant architecture configuration concept where possible with the objective to minimise single point of system failure events.
- i) The DASIS technology shall utilize the existing Employer conduit-installed fibre optic communication cable (duct-installed) network infrastructure, installed alongside the pipeline. [Note: Should the existing fibre optic infrastructure not meet the minimum requirement, the Contractor shall notify the Employer timeously. Sourcing of suitable fibre optic infrastructure remains the responsibility of the Contractor.
- j) In cases where a fibre optic cable network is not available, the Contractor shall be responsible for providing an appropriate fibre and associated equipment's.
- k) The Contractor shall adhere to the Employer installation, trenching, backfill, and all other applicable standards.
- l) The fibre optic cable shall have a nominal design lifetime of more than 20 years.
- m) The system shall be able to detect and report alarm events of intrusions and third-party activities or fault events on the buried pipelines, occurring in real time.
- n) The system shall provide the location of the event with the GPS coordinates and the intrusion alarms which need to be displayed on an intuitive map-based user interface.
- o) The system shall have a rate of detection better than 95%.

6.1.1.4 **FC4: The Pilot DAS Sub-system shall have the capability to be calibrated and optimised for a specific installed pipeline section.**

- p) The DAS Pilot Sub-system shall have the capability to store and report diagnostic and performance information to a maintenance technician's diagnostic computer for analysis purposes.
- q) The DAS Pilot Sub-system shall have a diagnostic calibration capability to enable authorised installation and maintenance technicians to calibrate the DAS Sub-system to perform at its optimum level for a specific installed section of the pipeline.

6.1.1.5 **FC5: The installed Pilot DAS Sub-system shall be maintainable over its specified operational life cycle.**

- r) The Employer maintenance team shall be able to perform first-line maintenance support tasks on the DAS Sub-system on completion of a supplier training course.
- s) The supplier shall be responsible for performing second and third-line maintenance and support tasks.

6.1.2 Reliability

6.1.2.1 Mean Time Between Failures (MTBF)

- a) The DAS Sub-system (together with its major components) shall have an allocated Mean Time Between Failures (MTBF) and Mean Time Between Critical Failures (MTBcF) of at least the values indicated in Table 2.
- b) The fibre optic cable shall have a nominal design lifetime of more than 20 years.

Item description	MTBF (Hours)	MTBcF (Hours)
DAS Sub-system System	120 000 (minimum)	26 280

Table 2: Allocated reliability requirements

6.1.2.2 Maintainability

Mean Time to Repair (MTTR)

The DASIS system shall have an allocated Mean Time to Repair (MTTR) time of at least the values indicated in Table 3.

Abbreviation	Sub-System Name	Allocated MTTR
DAS Sub-system	DAS Sub-system	8 hours
FOC	Fibre Optic Cable Installation	8 hours

Table 3: Allocated DAS Sub-system MTTR requirements.

***Notes:**

- As soon as the *Contractor* has identified the damaged fibre optic cable and made it visible, the *Contractor* is responsible for coming up with a plan of action to fix the fibre cable and test it within eight hours.
- Pending a permanent solution to be agreed upon between the contractor and employer, the employer will accept a temporary reinstatement to resume service.

6.1.3 Installation and commissioning standards

- 6.1.3.1 The DAS Sub-systems shall be installed and commissioned by the Manufacturer's & Employer's recommended procedures.
- 6.1.3.2 Before installation, the Contractor shall have completed a manufacturer's training program and be certified by the manufacturer. Alternatively, the Contractor shall be required to have the capability to provide technical support during installation and commissioning.

6.1.4 System Maintenance

- 6.1.4.1 The system shall not require periodic recalibration after site acceptance. However, the Contractor shall provide a maintenance, support plan, and system operating procedure to ensure optimum system performance and reliability.
- 6.1.4.2 The DAS unit shall have the capability to detect if the fibre optic cable is cut or damaged. It shall be possible to repair the fibre by fusion splicing with additional cable as necessary. Costs for repairs to the existing fibre optic cable remain the responsibility of the Contractor.
- 6.1.4.3 The product warrant shall be a minimum of 2 years from the date of system commissioning and an ongoing warranty extension program shall be available for the life of the product.
- 6.1.4.4 The Contractor shall provide technical support and shall warrant that replacement parts and assemblies shall be available for a minimum of ten years after installation. The Contractor shall include a preventative and reactive maintenance for a period of 2 years from system commissioning.
- 6.1.4.5 The Contractor shall provide maintenance and support on the following minimum set of components for the duration of the contract:
 - a) DAS Interrogator Unit,
 - b) Fibre Optic Cable,
 - c) Power Supply (Solar, batteries, UPS, etc.)
 - d) Server equipment at Jameson Park NOC.
- 6.1.4.6 In the case of a failure of the UPS system, the Contractor shall be able to repair or replace the batteries and associated UPS components on-site.
- 6.1.4.7 The Contractor shall train a minimum of 10 Employer's personnel on first-line maintenance tasks that would be required by the Employer to support the system.
- 6.1.4.8 The Contractor shall supply three sets of hard and soft copy native format of the required operators, administration, and maintenance manuals.

6.1.5 Product Certifications

- 6.1.5.1 The DAS Sub-system shall comply with Safety Integrity Level 2 (SIL2) requirements.
- 6.1.5.2 The DAS Sub-system shall comply with the American National Standards Institute (ANSI) - Laser safety classification – Class 1M.

6.1.6 Certifications

The DAS system hardware and software development and manufacturing shall comply with ISO 9001:2008 processes and the *Contractor* shall supply a valid certificate as proof of compliance during the supply chain process.

6.1.7 Built-in Test Equipment (BITE)

The DAS sub-system unit shall have the capability to provide Built-In-Test Equipment (BITE) (including Start-up BIT) to enable personnel to identify faulty DAS units or to calibrate the DASs for optimum performance during field maintenance.

6.1.8 Environmental Conditions

It shall be possible to operate and store the DAS equipment in all the different climatic regions in the RSA.

6.1.8.1 High-temperature storage

The DAS equipment shall be capable of withstanding high temperatures (i.e., when the item is stored in an extremely hot dry region in a shelter where there is little or no ventilation and where the effects of solar heating on the shelter causes a rise in the air temperature adjacent to the item) of up to + 85°C with a relative humidity of 3-7% during storage. The item shall not be damaged when subjected to this high temperature and shall meet all performance requirements after exposure.

6.1.8.2 Operational temperature

All DAS equipment shall be able to operate within a temperature range of -10 degrees Centigrade and +55 degrees Centigrade.

6.1.8.3 Ultraviolet (UV) protection

The DAS equipment shall be able to operate within South African UV exposure conditions for at least 15 years.

6.1.8.4 Transport shock

The DAS equipment shall not be damaged when exposed to shocks while being shipped or handled, including during normal loading, and unloading operations.

6.1.9 Installation requirements

6.1.9.1 The *Contractor* shall install the DAS sub-system in compliance with *Employer* installation, trenching, and backfill applicable standards, referenced in paragraph 4.2.

6.1.9.2 All new fibre cable installations shall comply with Transnet TPL cable installation guidelines and standards.

6.1.9.3 All new fibre optic cable installation joints shall be secured and marked (ID) for easy identification and repairs.

The *Contractor* shall be responsible for the following installation requirements:

- a) Compliance with the relevant *Employer* installation codes, standards, and regulations.
- b) Adherence to approved Employer environmental management plan (EMP) requirements of the Employer.

- c) Adherence to Code of Conduct for Contractors working in a pipeline servitude.
- d) Provision of temporary infrastructure as required, (Accommodation, toilets, lay down areas/equipment stores)
- e) Provision registration and qualified skilled labour as required by the appropriate Acts and Regulations.
- f) Scheduling and management of works with the minimum disruption/impact on site, terrain, and vegetation.
- g) Full-time supervision over execution of work which must be by SABS 0142.
- h) Transportation for working teams.

6.1.10 Installation process, materials, and parts

The *Contractor* shall be responsible for the installation of all required DAS equipment including the following:

- a) Commissioning of the DAS system.
- b) Testing and validation of the DAS system.

6.1.10.1 The materials listed below are prohibited to be used in any equipment:

- a) Asbestos; asbestos compounds; and asbestos-filled moulding compounds.
- b) Carcinogens, Chlorofluorocarbons (CFC).
- c) Magnesium or magnesium alloys.
- d) Mercury or its compounds and amalgams.
- e) Polychlorinated biphenyl (PCB) and polyvinyl chloride (PVC), except when used for component leads.
- f) Radioactive material.
- g) Pure cadmium Pure zinc or zinc alloys.
- h) No materials that produce a poisonous gas when burning shall be used.
- i) All bolts and nuts shall be metric sizes and standardized on certain fastener sizes and types where applicable.

6.1.11 Nameplates or Product Markings

- a) The DAS units shall as a minimum be marked with an identification code, serial number, modification status, and manufacturing date.
- b) Naming standards to be proposed to the *Employer* for approval.
- c) The nameplates should be applied in such a position and orientation that it is readable in the installed position.
- d) All connectors shall be marked and no duplication of connector types shall be allowed.
- e) Test/Integration harnesses supplied shall be marked, with mating connectors identified as such by their numbering scheme.

7 Interface Requirements

The Phase 1 Pilot DAS sub-system interface definition typical diagram for Phase 1 is depicted in Figure 6 below:

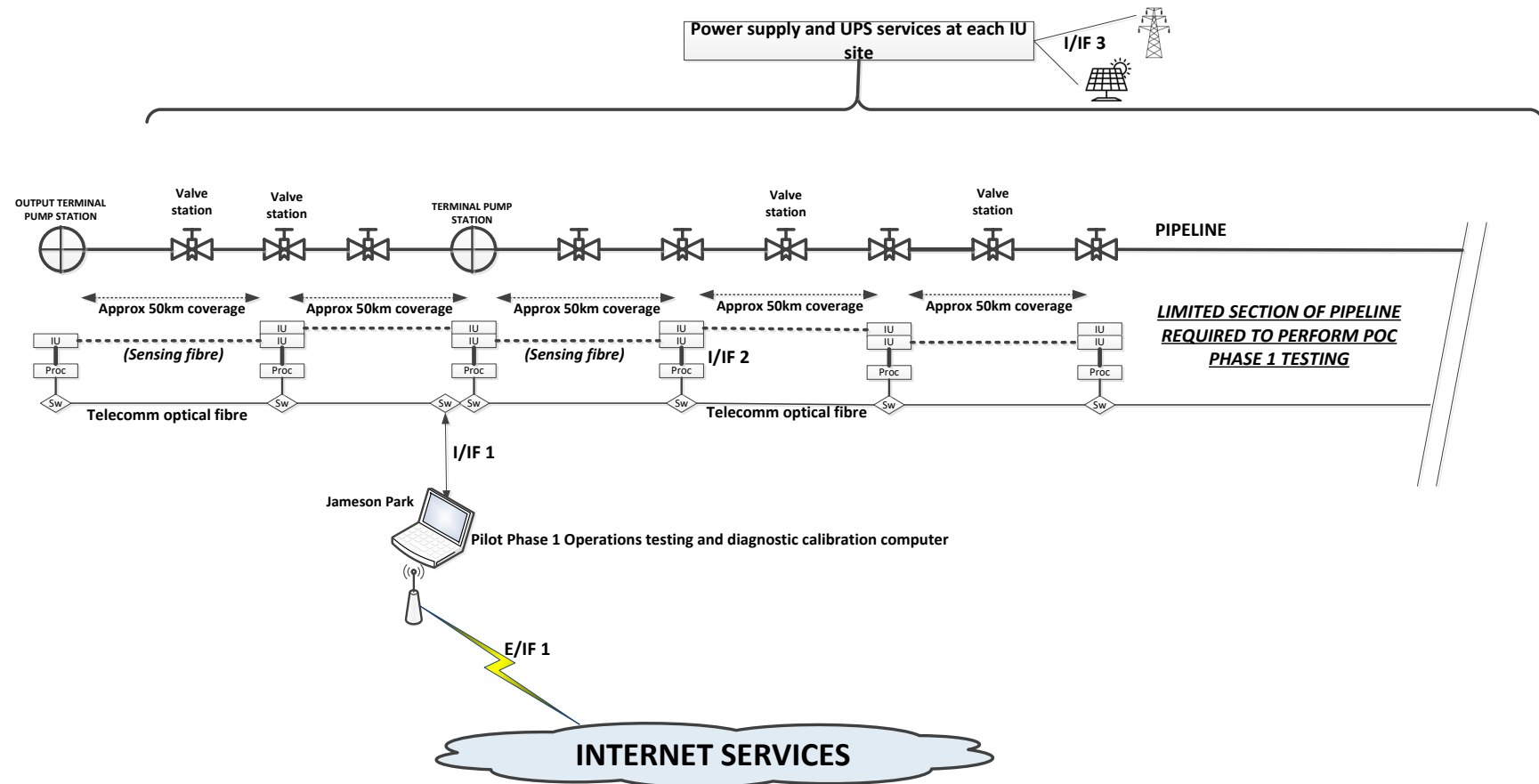


Figure 6: DAS Sub-system for Pilot (Phase 1) high-level interface definition diagram

7.1 External Interface Requirements

7.1.1 External Interface 1 (E/IF1): Internet interface: Provide remote diagnostic connectivity.

It shall be possible for a maintenance technician to connect remotely and securely via a wireless WiFi (E/IF2) or onsite physical diagnostic cable link to the IU to perform maintenance and calibration tasks. These maintenance interfaces shall only be used temporarily during maintenance operations.

7.2 Internal Interface Requirements

7.2.1 Internal Interfaces 1 (I/IF 1): Diagnostic, calibration, and maintenance of computer interface

The DAS Interrogator Units (IU) shall have a diagnostic interface to enable technical service personnel to calibrate the IUs to optimise their performance according to the fibre line requirements.

a) Internal Interfaces 2 (I/IF 2): Interrogator Unit's interface to fibre cable

The DAS IUs shall have the interface capability to connect with a "conduited" fibre cable system every 50 km, or as the physical terrain allows. The purpose of this interface shall be to transmit and receive optical signals communicated via the fibre network.

b) Internal Interfaces 3 (I/IF 3): Interrogator Unit's interface to Power Supply Facilities

The DAS IUs shall have the capability to receive 220V AC power supply inputs from the utility network, when available, as well as from solar-generated power/UPS services when 220V utility services are not available.

8 Major Component Characteristics

8.1 Interrogator Control Units (ICUs)

- 8.1.1** The Interrogator Control Unit (ICU) shall have the capability to be powered by utility 220V AC or Solar DC-powered sources.
- 8.1.2** The ICUs shall be able to operate from an Uninterruptable Power Supply (UPS) for at least 24 hours in full operational mode, as well in case of bad weather conditions.
- 8.1.3** The ICU shall have the capability to be calibrated and the embedded software configured using an external diagnostic computer, to adapt to specific fibre optic sensing constraints and optimisation conditions for optimum sensing performance.
- 8.1.4** The ICU shall be able to detect a discontinued fibre optic cable or sensing unit failure and shall be able to report the failures to the National Command Centre (NOC).
- 8.1.5** The system shall be able to locate and classify the following alarm types and detection distances accurately to +/- 10 metres on either side of the pipeline:
 - a) Person walking 5 metres from the fibre.
 - b) Vehicles 10 metres from the fibre.
 - c) Manual digging 5 metres from the fibre.
 - d) Mechanical digging 10 metres from the fibre.

-
- 8.1.6** The system shall have user zones to identify different areas of interest along the length of the pipeline, maximum zone length shall be the total cable length and the minimum range for a zone is 10 metres.
- 8.1.7** The system shall allow for zones to be isolated with the ability to pre-set sensitivity and approve permitted 3rd party activities to identify and discard specific environmental events (rain, background noise, etc.) that can produce nuisance alarms.
- 8.1.8** The system shall detect vibration within servitudes, up to 10 metres or greater, on either side of the pipeline.
- 8.1.9** The system accuracy shall not be affected by the cable length or number of sensing units in the total system.
- 8.1.10** The detection capability of the system shall not be affected by changes in the terrain, weather, or environment.
- 8.1.11** The system shall have capabilities to view, report, and acknowledge alarm events together with viewing optional CCTV camera feeds.
- 8.1.12** The system shall be truly distributed in nature and not zone-based and report any intrusion with the calculated cable meter position and GPS coordinates.
- 8.1.13** Each ICU controller shall have the capability to send intrusion alerts/alarm information to the NOC system for further analysis, investigation, and other actions within 5 seconds of detecting/receiving such information.
- 8.1.14** Each ICU controller shall have the capability to be able to provide GPS coordinates as well as linear distance from a fixed point of the breaching location/position.
- 8.1.15** The ICU controller shall have the capability to collate and send the following minimum parameters from the controller to the Operations Centre (OC) for processing:
- a)** Zone identification information.
 - b)** Intrusion/breaching alarm/alert.
 - c)** Time Date of intrusion.
 - d)** Location information (GPS (WGS84) coordinates position and linear distance from a fixed reference point).
 - e)** System status report every 10 minutes.
- 8.1.16** The ICU controller shall have remote access and control capability. It shall have the capability to:
- a)** Access the ICU controller remotely to test, program, and perform fault-finding.
 - b)** The ability to enable/disable ICU remotely.
 - c)** Perform diagnostic testing functions on the unit.

-
- 8.1.17** The ICU controller shall have the capability to send an error function message to the NOC to flag system failures/support system failures and attempted system interference actions that require immediate attention/intervention/response.
 - 8.1.18** The ICU Controller shall buffer the intruder information for an uninterrupted period of one week in the absence of the connection to the fibre optic cable recording server at the NOC.
 - 8.1.19** The ICU Controller shall have the capability to send the buffered records to the NOC within 10 seconds after the communications network is functional again and it has synchronised with the NOC.
 - 8.1.20** The ICU Controller shall have the capability to be configured remotely from the NOC over the communications network and through the web browser.
 - 8.1.21** The ICU controller shall incorporate a backup server for storage of raw data for detailed analysis if required.

8.2 Fibre Optic Sensing Cable

- 8.2.1** Where it would be required to install a new fibre-optic sensing cable, the cable shall be a multi-core type with a minimum of 48 single-mode fibres. The cable shall be available telecommunication grade optical fibre suitable for use in sensing acoustic vibrations along the infrastructure length of at least 3200km.
- 8.2.2** The optical loss of individual cable fibres shall be less than 0.25 dB/km @ 1550nm.
- 8.2.3** The installation of new terrestrial optic fibre cables shall be installed in such a way that the cable shall be - located underground within 0.5 metres parallel to the pipeline at a depth of between 1m to 1.5 metres.
- 8.2.4** The installation of undersea fibre optic cables shall be performed in such a way as to be secured directly to the pipeline surface, using appropriate ties and/or clamping devices suitable for allowing acoustic coupling between the pipeline and the fibre.
- 8.2.5** The fibre optic cable shall have a nominal design lifetime of more than 20 years.
- 8.2.6** The fibre optic shall ideally be installed at a uniform distance from the pipeline along its entire length.
- 8.2.7** The system shall be able to accurately locate the source of the events along the length of the fibre optic cable to an accuracy of +/- 10 meters at 50 Km.
- 8.2.8** All head-end controller devices, controllers, switches, etc. will be housed/installed in TPL's existing station equipment rooms.
- 8.2.9** A termination unit shall be installed at the far end of each detection channel and sealed within an outdoor-rated fibre optic splice enclosure.

8.3 Standby Operations Centre (SOC), Jameson Park (Heidelberg)

- 8.3.1** A backup/standby Operations Centre (OC) shall be established at Jameson Park pump station to act as a standby OC, under emergency conditions, should the NOC in Durban become unavailable. This OC shall be able to report on the monitoring and control of the fibre optic cable from this central location.
- 8.3.2** The backup/standby Operations Centre (OC) could be used as a temporary performance test base during the implementation and feasibility tests required during Phase 1.

Appendix A: Additional information

A1: Example of current conduit-installed “conducted” cable installation

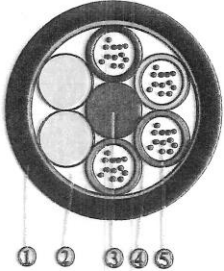
The photo in Figure A1 depicts the typical “conducted” 48-core fibre installation configuration.



Figure A1: Current “conducted” 48 Core single-mode fibre cable installation.

A2: Specification of currently installed 48-core single-mode fibre-optic cable.

DATA SHEET FIBRE OPTIC CABLE		CBI electric Aberdare etc telecom cables	
DATASHEET : DF5550/01			
BLOWN OPTIMISED FIBRE OPTIC CABLE (Non-Metallic, Dry Water-Blocked)			
CABLE DESCRIPTION			
1	High Density Polyethylene sheath (2.0mm RT)		
2	Dry Water-Blocked Cable Core		
3	Glass Reinforced Plastic (GRP) centre member		
4	PBT loose tube (Thixotropic gel filled)		
5	Optical Fibres		



FIBRE COUNT	ELEMENTS PER LAYER					
	1	2	3	4	5	6
48	Blue Tube (12 Fibres)	Orange Tube (12 Fibres)	Green Tube (12 Fibres)	Brown Tube (12 Fibres)	Yellow Filler	Yellow Filler
FIBRE COLOURS (in sequence):		Blue, Orange, Green, Brown, Grey, White, Red, Black, Yellow, Violet, Pink, Turquoise				

PRODUCT FEATURES
This cable design is optimized for only blow-in installation techniques A totally non-metallic construction ensures lightning immunity. An outstanding feature is the sustained reliability over a wide temperature range. The optical fibres are "stress" free inside loose tubes while the cable contracts and expands with temperature. Each length of cable shall be marked on the outer sheath every metre with the following: 1) Meter mark: sequentially numbered length (e.g. 1001, 1002 etc...) 2) Number of fibres and cable type 3) Abbreviation of project name 4) CBI Telecom (Factory name) 5) Manufacturing year 6) Unique cable number

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All information given in this datasheet is correct to the best of our knowledge, but the company reserves the right to make alterations and amendments to the detailed specification at its discretion.

DATA SHEET

FIBRE OPTIC CABLE



DATASHEET : DF5550/01

BLOWN OPTIMISED FIBRE OPTIC CABLE (Non-Metallic, Dry Water-Blocked)

TYPICAL PROPERTIES

Parameter	Property / Pass criteria	Test Method
	Fibre Count	
	48	
Number of elements	6	
Cable diameter (nominal)	12.4mm	
Cable weight (nominal)	112 kg/km	
Maximum installation load	1500 N	IEC 60794-1-2: E1
Minimum bend radius	185mm	IEC 60794-1-2: E11
Crush resistance (via 100 mm plates)	2000 N	IEC 60794-1-2: E3
Impact resistance (25mm anvil / 10 blows)	2 Nm Blows	IEC 60794-1-2: E4
Temperature performance	-20 to +60°C	IEC 60794-1-2: F1
Water penetration (3m cable, 1m head of water)	No leakage	IEC 60794-1-2: F5B
Drip test (300 mm sample of loose tube @ 80 °C)	No leakage	IEC 60794-1-2: F14

OPTICAL PROPERTIES (Alternative fibre types/properties are available on request)

FIBRE TYPE	Non Zero Dispersion Shifted (NZDSF) 9/125 µm	
Specification	ITU-T G. 655D	
Fibre core size	9.6 ± 0.4 µm (Mode field diameter @ 1550 nm)	
Cladding diameter	125 µm	
Primary coating diameter	245 µm	
Operating wavelength	1550 nm	1625 nm
Max. Attenuation	0.23 dB/km	0.26 dB/km
Max. Dispersion	2 ps/nm.km	6 ps/nm.km
PMD ₀	0.04 ps/km ^{1/2}	

YOUR LINK TO THE WORLD OF COMMUNICATION

CBI Electric: Aberdare ATC Telecom Cables (Pty) Ltd

Page 2 of 2

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Tel: +27 (0) 12 381 1400 – Fax: +27 (0) 12 250 3412 – sales@cbi-electric.com – www.cbi-electric.com

All information given in this leaflet is correct to the best of our knowledge, but the company reserves the right to make alterations and amendments to the detailed specification at its discretion.

A3: Service provider's responsibilities

The service provider's responsibilities shall include the following functions inter alia:

- a. Understand the specifications and requirements and if required and according to the process seek clarification from TPL on any aspects of this tender that are not clear.
- b. Design the solution in a manner to comply with all listed specifications and ensure that the system delivers the requirement output as contained in this document.
- c. The service provider is responsible for supplying, installing, configuring, and commissioning all equipment to render a complete working solution.
- d. It is the service provider's responsibility to test the existing TPL fibre and ensure that it meets the requirements to enable their system to function optimally and against the requirements.
- e. Service Provider is responsible for all trenching and backfilling according to TPL standards.
- f. SP responsible for providing suitable and secure transportation of equipment to sites.
- g. Comply with all TPL safety and security policies, procedures, and requirements.
- h. Comply with SAT testing procedures as per published criteria.
- i. Inform TPL of any system discrepancies that will place the project at risk.
- j. SP shall provide a detailed project execution/implementation plan.
- k. TPL recommended personnel must accompany all visits to any of TPL's sites.
- l. All work to be performed on TPL's infrastructure must be indicated before TPL's approval and must be supervised by TPL personnel.
- m. The SP will be liable for any damages to the current infrastructure caused during the installation, and maintenance exercises.
- n. A High-level project plan and macro design document of the solution is required in the proposal submission.
- o. Resources allocated to the project must be highly skilled with experience in completing similar projects.
- p. TPL reserves the right to amend the scope where required.
- q. All information about TPL is highly confidential as our infrastructure is classified as critical Infrastructure and a non-disclosure agreement will have to be signed.
- r. SP must bill TPL accordingly to the work done in each month (i.e., Area completed and integrated into the operational centre).

THE END