

ENVIRONMENTAL IMPACT



MANAGEMENT SERVICES

# ENVIRONMENTAL MANAGEMENT PROGRAMME

TETRA4 PRODUCTION RIGHT ENVIRONMENTAL  
IMPACT ASSESSMENT AND ENVIRONMENTAL  
MANAGEMENT PROGRAMME FOR THE GAS  
PRODUCTION NEAR VIRGINIA, FREE STATE  
PROVINCE

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*Leaders in Environmental Management*



**TETRA4 PRODUCTION RIGHT ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME FOR THE PROPOSED CLUSTER 1 GAS PRODUCTION NEAR VIRGINIA, FREE STATE PROVINCE**

**ENVIRONMENTAL MANAGEMENT PROGRAMME**

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## 2. INTRODUCTION

### 2.1. GENERAL PROJECT OVERVIEW

Tetra4 (the Applicant) appointed Environmental Impact Management Services (Pty) Ltd (EIMS) to undertake the necessary steps to prepare and submit an application for Environmental Authorisation (EA) to the Petroleum Agency of South Africa (PASA – the competent authority), in support of plans to extend natural gas production operations within an existing Production Right (PASA Reference: 12/4/1/07/2/2), in the Matjhabeng and Masilonyana Local Municipalities, near the town of Virginia in the Free State Province. A detailed description of the project is provided in Section 3 below.

In accordance with Chapter 4 of the EIA Regulations (2014) promulgated under the National Environmental Management Act (Act 107 of 1998 – NEMA, as amended) and Section 86 of the MPRDA Regulations for petroleum exploration and production (2015), an application for EA must be submitted to the PASA to amend the approved Environmental Management Programme (EMPR) as well as to include the combined helium and CNG plant and any activities not currently authorised, to the gas production development. The amendment to the approved EMPR also requires a Section 102 application under the Mineral and Petroleum Resources Development Act (Act 28 of 2002 – MPRDA). In this regard, several listed activities under various environmental legislation will be affected and as such a number of permits and/ or licenses, in addition to the EA, may be required. Furthermore, the issued Production Right makes provision to undertake site specific EMPR's within the Production Right area where the area is delineated as of medium to high environmental sensitivity, and Cluster 1 is, in effect, the first of these site specific EMPR's.

A full Environmental Impact Assessment (EIA) process is being followed for this EA application, comprising of Scoping and Environmental Impact Assessment (EIA) Phases, due to the nature of the NEMA Listed Activities triggered by the EA application (see Section 4 for details on the legislative requirements). The EIA process entails the submission of Scoping and EIA Reports to the PASA, towards decision-making regarding the EA application. This EIA Report (EIAR) and associated EMPR summarise the findings and recommendations of the EIA phase.

### 2.2. PURPOSE OF THIS DOCUMENT

In accordance with the Regulation 23 (1) (GNR982) of the National Environmental Management Act ((act 107 of 1998-NEMA) an application for an Environmental Authorisation (EA) must within 106 days of the acceptance of the scoping report submit to the competent authority-

- an environmental impact report inclusive of any specialist reports, and an EMPR, which must have been subjected to a public participation process of at least 30 days and which reflects the incorporation of comments received, including any comments of the competent authority.*

Further, Regulation 23 (4) (GNR 982) states that an 'EMPR must contain all information set out in Appendix 4 to these Regulations and, where the application is for an environmental authorisation is for prospecting, exploration, extraction and primary processing of a mineral or petroleum resource or activities directly related thereto, the EMPR must address the requirements as determined in the regulations, pertaining to the financial provision for the rehabilitation, closure and post closure of prospecting, mining or production operations, made

*in terms of the Act*. Section 2.3 provides a detailed breakdown of the content requirements stipulated in Appendix 4 of GNR 982.

The compilation of an EMPR for an activity which is likely to result in significant environmental impacts is typically compiled at the culmination of a thorough investigation into the receiving environment and the identification and assessment of likely environmental impacts (i.e. EIA). This EMPR was prepared through a comprehensive EIA and formed part of an application for EA.

**The primary objectives of the EMPR are as follows:**

- To promote sustainability and describe an action programme to mitigate negative impacts as far as possible;
- To be a practical document that sets out both the goals and actions required in mitigation. Though the term “mitigation” can be broad in definition, it means in this context to “allay, moderate, palliate, temper or intensify.” Mitigation of a negative impact means that its effect is reduced. Mitigation of a positive impact means that its effect is increased or optimised; and
- To indicate responsibilities for the implementation of these action items within the EMPR.

This EMPR shall be deemed to have contractual standing on the basis that its contents and specifically objectives are a detailed expansion of the environmental risks and consequent requirements of the EA. Where relevant Tetra 4 is responsible for delegating responsibility for compliance to designated parties (internal or external). Such delegation must be legally binding to the extent relevant.

The objectives and targets in this EMPR are further guided by the NEMA, and specifically by GNR982. Thus, the underlying principles of sustainable development are the ultimate objectives and targets of this report. The EMPR has included measures to ensure the development activity complies with the following principles, as instilled in the NEMA, amongst others:

- i. That the disturbance of ecosystems and loss of biological diversity are minimised and remedied;
- ii. That pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied;
- iii. That waste is avoided, minimised and reused or recycled where possible and otherwise disposed of in a responsible manner;
- iv. That a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and
- v. That negative impacts on the environment and on people’s environmental rights be anticipated, prevented and remedied.

It is important to note, as mentioned in Section 2.1, that a Production Right has been awarded to Tetra 4. This production right was issued after due consideration and assessment of the likely environmental impacts associated with the production application. However, as a result of there being limited site specific details for the planned production at full field development, a high level generic EMPR was prepared and approved under the Production Right. This EMPR did however take due cognisance of the gaps in knowledge and specifically the environmental impacts which may be associated with specific project activities in unique spatial contexts.

As such the EMPR approved under the production right included the following conditions, amongst others, relating to the need to supplement this EMPR as site and activity specific details became known:

- ✎ EMPR (December 2010) Section 9.3: *'It should be noted that the EMPR as provided in Table 27 is the baseline EMPR (based on the broad environmental assessment provided in this EMPR) and should be added to after the exact location of each production site has been established to make the EMP more site specific, where relevant.*
- ✎ EMPR (December 2010) Section 9.3, Table 27, Item 1.2: *'any drill sites or infrastructure routes that are located inside medium, high or very high sensitive sites on the sensitivity/constraint map require a site specific EMP. The EMP must address the sensitive aspects on site. Site specific EMP must include input from professional (Pri.Nat.Sci) ecologists, cultural heritage specialist. All recommendations of the site specific EMP will be considered an extension of the requirements of this EMPR'.*

This EMPR therefore serves to amend and replace the existing EMPR approved in 2010. As a point of departure all of the relevant conditions contained in the 2010 EMPR have been included herein. Further, the structure of the EMPR has been amended to account for the following:

- ✎ The updating of the 2010 EMPR to align with the current requirements for an EMPR (as contained in the NEMA Regulations); and
- ✎ To provide an EMPR structure that permits efficient supplementation of the site specific EMPR requirements as the production process progresses.

Future phases and/or clusters which require site specific assessments and management plans, will be viewed as extensions to this EMPR. A change register must be maintained to track these changes. All amendments and additions must comply with the relevant requirements of the MPRDA and the NEMA.

## 2.3. REPORT STRUCTURE

TABLE 1 below provides a summary of the NEMA requirements in terms of Appendix 4 of the EIA regulations (GNR 982), and an indication in which section the supporting information and documentation can be found.

**TABLE 1: REPORT STRUCTURE**

| Environmental Regulation          | Description   | Section in Report                         |
|-----------------------------------|---|---|
| <b>NEMA Regulation 982 (2014)</b> |   |   |
| <b>Appendix 4(1)(a):</b>          | Details of –  |   |
|                                   | <ul style="list-style-type: none"> <li>i) The EAP who prepared the report; and</li> <li>ii) The expertise of the EAP, including a curriculum vitae;</li> </ul>  | <p>Section 4.1.1</p> <p>Section 4.1.2</p> |
| <b>Appendix 4(1)(b):</b>          | A detailed description of the aspects of the activity that are covered by the EMPR as identified in the project;  | Section 3.3                               |
| <b>Appendix 4(1)(c):</b>          | A map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers; | Section 3.1                               |



|                          |   |  |
|--------------------------|---|--|
| <b>Appendix 4(1)(d):</b> | A description of the impact management objectives, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including –<br><br>i) Planning and design;<br><br>ii) Pre-construction activities;<br><br>iii) Construction activities;<br><br>iv) Rehabilitation of the environment after construction and where applicable post closure; and<br><br>v) Where relevant, operation activities;   | Section 7                                |
| <b>Appendix 4(1)(e):</b> | A description and identification of impact management outcomes required for the aspects contemplated in paragraph (d);  | Section 7.1                              |
| <b>Appendix 4(1)(f):</b> | A description of proposed impact management actions, identifying the matter in which the impact management objectives and outcomes contemplated in paragraph (d) and (e) will be achieved, and must, where applicable, include actions to –<br><br>i. Avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;<br><br>ii. Comply with any prescribed environmental management standards or practices;<br><br>iii. Comply with any applicable provisions for the Act regarding closure, where applicable; and<br><br>iv. Comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable; | Section 7.3                              |
| <b>Appendix 4(1)(g):</b> | The method of monitoring the implementation of the impact management actions contemplated in paragraph (f);   | Section 12                               |
| <b>Appendix 4(1)(h):</b> | The frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);  | Section 12                               |
| <b>Appendix 4(1)(j)</b>  | An indication of the persons who will be responsible for the implementation of the impact management actions;   | Section 6<br>Section 7.3<br><br>Appendix |
| <b>Appendix 4(1)(j):</b> | The time periods within which the impact management actions contemplated in paragraph (f) must be implemented;  | Section 7.3                              |
| <b>Appendix 4(1)(k):</b> | The mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);   | Section 7.3                              |
| <b>Appendix 4(1)(l):</b> | A program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;   | Section 12.1                             |
| <b>Appendix 4(1)(m)</b>  | An environmental awareness plan describing the manner in which –<br><br>i. The Applicant intends to inform his or her employees of any environmental risk which may result from their work; and   | Section 10                               |

- ii. Risk must be dealt with in order to avoid pollution or the degradation of the environment;

**Appendix 4(1)(n)** Any specific information that may be required by the competent authority. Section 15

### 3. DESCRIPTION OF THE PRODUCTION ACTIVITY

#### 3.1. LOCATION

The proposed Cluster 1 amendment of gas production operations is located is approximately 20 km south west of the town of Virginia, within the Matjhabeng and Masilonyana Local Municipalities, in the Free State Province. TABLE 2 below provides the extent of the production right and proposed Cluster 1 areas, as well as a summary of the properties which make up the Cluster 1 study area. The locality and extent of the Cluster 1 study area within the production right area is presented in FIGURE 1.

**TABLE 2: PROPERTY DESCRIPTION**

|   |  |                 |                       |
|---|--|-----------------|-----------------------|
| Approved Production Right Area (Ha)             | <b>Approximately 187 000</b>   |                 |                       |
| Proposed Cluster 1 Study Area (Ha)              | Approximately 14 316   |                 |                       |
| District Municipality                           | Lejweleputswa  |                 |                       |
| Local Municipality                              | Matjhabeng and Masilonyana   |                 |                       |
| Distance and direction from nearest town        | The proposed Cluster 1 is located is approximately 20 km south west of the town of Virginia, in the Free State Province. |                 |                       |
| 21 digit Surveyor General Code for each Portion | <b>Farm Name:</b>  | <b>Portion:</b> | <b>SG Codes:</b>      |
|   | 1. Brakspruit 121  | RE 0            | F03300000000012100000 |
|   | 2. Enkeldoorn 360  | 0               | F03300000000036000000 |
|   | 3. Boschluis Spruit 278  | RE 0            | F03300000000027800000 |
|   | 4. Boschluis Spruit 278  | 1               | F03300000000027800001 |
|   | 5. Boschluis Spruit 278  | 2               | F03300000000027800002 |
|   | 6. Retreat 118   | RE 0            | F03300000000011800000 |

|                     |      |                       |
|---------------------|------|-----------------------|
| 7. Nortier 361      | 1    | F03300000000036100001 |
| 8. Jordaan 1        | 1    | F03300000000000100001 |
| 9. Driekoppies 322  | 0    | F03300000000042200000 |
| 10. Frisgewaag 550  | Re 0 | F03300000000055000000 |
| 11. Frisgewaag 550  | 1    | F03300000000055000001 |
| 12. Frisgewaag 550  | 2    | F03300000000055000002 |
| 13. Kleinpan 320    | 0    | F03300000000032000000 |
| 14. Hendriena 563   | 0    | F03300000000056300000 |
| 15. Glen Ross 562   | Re 0 | F03300000000056200000 |
| 16. Glen Ross 562   | 1    | F03300000000056200001 |
| 17. Glen Ross 562   | 2    | F03300000000056200002 |
| 18. Glen Ross 562   | 3    | F03300000000056200003 |
| 19. Glen Ross 562   | 4    | F03300000000056200004 |
| 20. Glen Ross 562   | 5    | F03300000000056200005 |
| 21. Glen Ross 562   | 6    | F03300000000056200006 |
| 22. Glen Ross 562   | 7    | F03300000000056200007 |
| 23. Glen Ross 562   | 8    | F03300000000056200008 |
| 24. Glen Ross 562   | 9    | F03300000000056200009 |
| 25. Glen Ross 562   | 10   | F03300000000056200010 |
| 26. Palmietkuil 328 | RE 0 | F03300000000032800000 |
| 27. Palmietkuil 328 | RE 1 | F03300000000032800001 |
| 28. Palmietkuil 328 | 4    | F03300000000032800004 |
| 29. Palmietkuil 328 | 5    | F03300000000032800005 |

|                                |      |                       |
|--------------------------------|------|-----------------------|
| 30. Palmietkuil 328            | 6    | F03300000000032800006 |
| 31. Kalkoenkrans 225           | RE 1 | F03300000000022500001 |
| 32. Kalkoenkrans 225           | 2    | F03300000000022500002 |
| 33. Kalkoenkrans 225           | 4    | F03300000000022500004 |
| 34. Damplaats 341              | RE 0 | F03300000000034100000 |
| 35. Zonderzorg 342             | RE 0 | F03300000000034200000 |
| 36. Zonderzorg 342             | 1    | F03300000000034200001 |
| 37. Zoetendal 243              | 1    | F03300000000024300001 |
| 38. Doornrivier 330            | RE 1 | F03300000000033000001 |
| 39. Doornrivier 330            | 2    | F03300000000033000002 |
| 40. Excelsior 147              | RE 0 | F03300000000014700000 |
| 41. Excelsior 147              | 1    | F03300000000014700001 |
| 42. Terra Blanda 155           | 0    | F03300000000015500000 |
| 43. Blaauwdrift 188            | 3    | F03300000000018800003 |
| 44. De Wilger 544              | RE 0 | F03300000000054400000 |
| 45. Helpmekaar 47              | RE 0 | F03300000000004700000 |
| 46. Helpmekaar 47              | RE 1 | F03300000000004700001 |
| 47. Helpmekaar 47              | 3    | F03300000000004700003 |
| 48. Mond van Doornrivier<br>38 | RE 0 | F03300000000003800000 |
| 49. Mond van Doornrivier<br>38 | 2    | F03300000000003800002 |
| 50. Middelpaas 583             | 0    | F03300000000058300000 |
| 51. Grottkau 410               | RE 0 | F03300000000041000000 |

|                   |      |                       |
|-------------------|------|-----------------------|
| 52. Goedemoed 143 | RE 0 | F03300000000014300000 |
| 53. Goedemoed 143 | 2    | F03300000000014300002 |
| 54. Deeldam 106   | RE 0 | F03300000000010600000 |
| 55. Deeldam 106   | 4    | F03300000000010600004 |
| 56. Leeuwbult 52  | 0    | F03300000000005200000 |
| 57. Harmonie 579  | 0    | F03300000000057900000 |
| 58. Erfdeel 188   | 2    | F03500000000018800002 |
| 59. Tarka 656     | RE 0 | F03500000000065600000 |

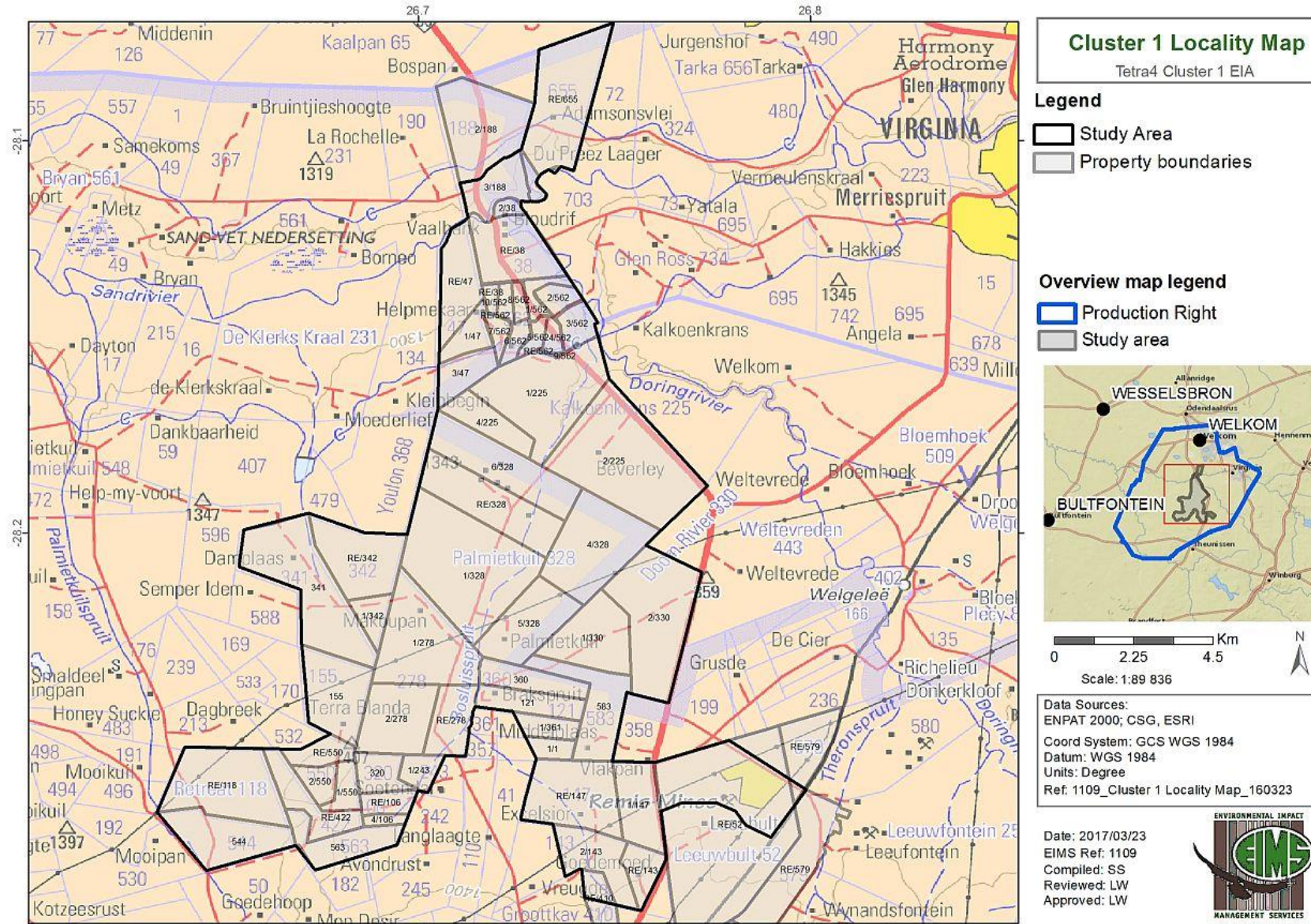


FIGURE 1: CLUSTER 1 LOCALITY MAP

### 3.2. ENVIRONMENTAL SENSITIVITY MAP

A composite environmental sensitivity map for the full field Production Area was prepared in support of the application for Production Right. This sensitivity map originated as a result of the original EIA process and specialist studies (primarily desktop).

Subsequent to the issuance of the Production Right, and as a consequence of the requirements of the EMPR, this environmental sensitivity map has, where relevant, been refined to account for the site specific production activities. As noted in Section 2.2, the intention of the EMPR is to account for the lack of detail regarding the extent and nature of the proposed full field Production Activities, through a process of supplementing the EMPR as applicable, with individual site specific assessments and their associated environmental sensitivity.

Please refer to APPENDIX 2 for a copy of the current composite sensitivity map as well as the stand-alone site specific sensitivities maps.

### 3.3. DESCRIPTION OF THE ASPECTS OF THE ACTIVITY

The granted Production Right spans approximately 187 000 hectares and was awarded to Tetra4 (then Molopo South Africa) in 2012 to develop gas fields around the town of Virginia in the Free State Province. Whilst the application for Production Right has been issued for the entire conceptual full field development area, the original Environmental Authorisation and associated EMPR, only applied to the areas with certified reserves only (refer to the green area). In the event that Tetra 4 wishes to extend the production operations into the entire application area then a further detailed EIA will be required to amend the EMPR to incorporate these extended areas. The area approved in the environmental authorisation issued together with the Production Right spans a total area of approximately 104 659 ha (Certified Reserves), as presented in FIGURE 2. When in full production, should conditions warrant it, the following was originally included in the Production Right:

- Approximately 260 production wells (boreholes) with associated infrastructure;
- Approximately 500km of intra field pipelines;
- Approximately 4 main high-pressure gas compressors; and
- Approximately 18-20 pipeline booster compressors.

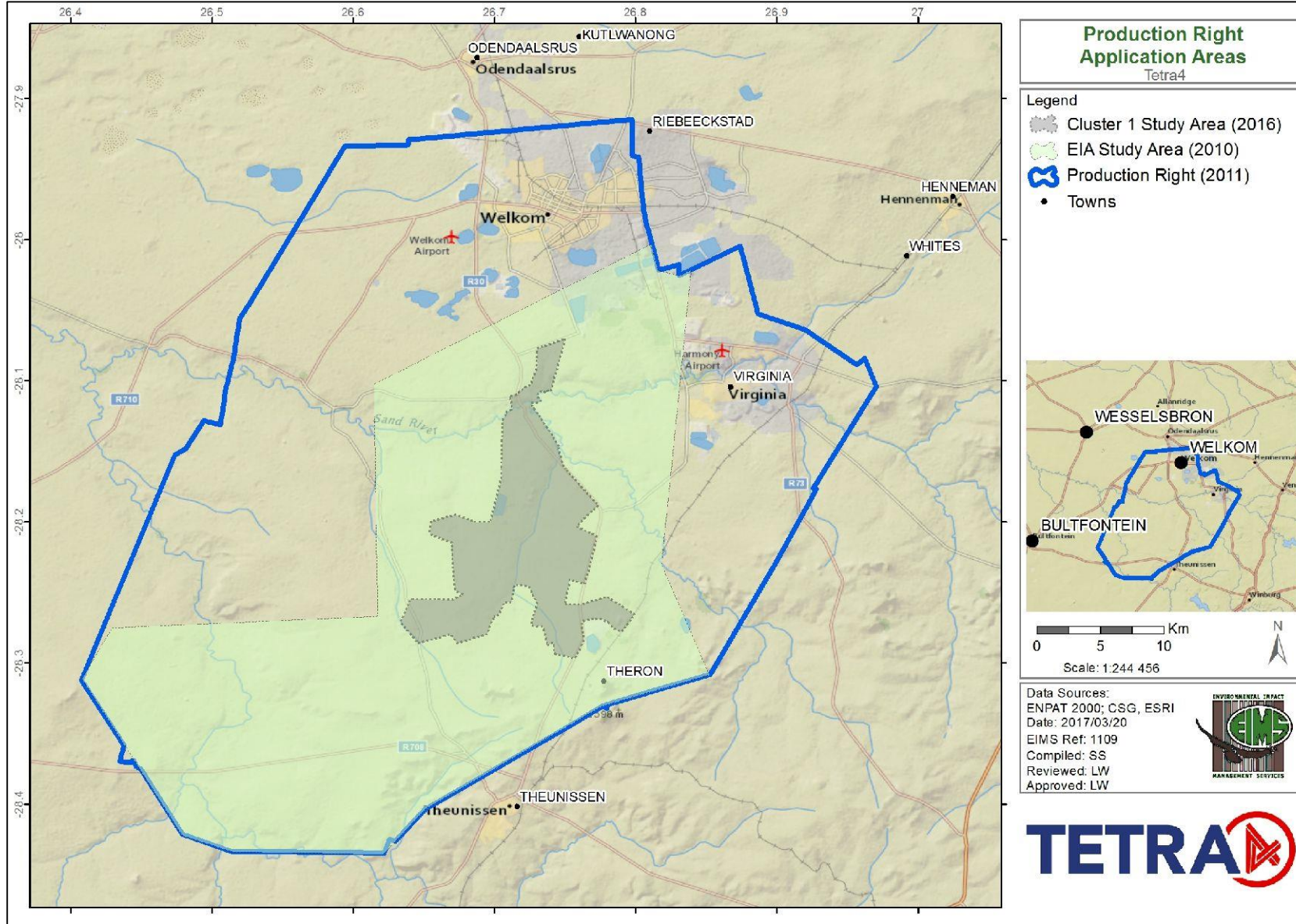


FIGURE 2: CONCEPTUAL FULL FIELD PRODUCTION RIGHT AREA



Due to the unconventional nature of the gas resource and the vast extent of the area, the issued Production Right included a license condition which requires that the license holder undertake site specific assessments for drilling activities planned within the Production Right area and that these site specific assessments be approved by the PASA prior to commencement.

The Production Right was issued by the PASA in 2012. As a result of the fact that the exact physical extent of the proposed production activities was unknown at the time of issuance of the Production Right, the following specific conditions were included in the Environmental Record of Decision (RoD):

- ✎ Condition 3.1.2: The applicant must ensure that the proposed project is carried out and managed in accordance with the approved EMPR and RoD conditions.
- ✎ Condition 3.1.11: Areas identified as sensitive sites must be treated as no go areas during the positioning of production infrastructure and where these areas are unavoidable, site specific environmental assessment must be undertaken and the addendum to the approved EMPR submitted for our consideration and approval.
- ✎ EMPR Section 7.1: Areas that are not sensitive will be covered through the general EMPR, while areas that would fall into the medium, high and very high sensitivity would require site specific EMPR's and mitigation measures.

The implication of these conditions was that should any production activities be proposed within any designated sensitive areas, then the holder is required to undertake a site specific assessment and prepare a site specific EMPR. In order to limit the number of individual site specific assessments required for exploration drilling activities within the approved Production Right area and avoid a “piece meal” approach to environmental assessment and management, Tetra4 intend to continue developing the Production operations through a process of Cluster and/or stand-alone assessments, where required.

### 3.3.1. CLUSTER 1 ACTIVITIES

Tetra 4 have identified 13<sup>1</sup> existing wells that will be utilised for initial production activities. These 13 wells and the supporting infrastructure required for production related activities is referred to as Cluster 1 and comprises the first gas field for development within the approved Production Right area. In addition to the pre-identified 13 wells, the drilling of 6 new wells within the boundary of Cluster 1 has been included in the EIA assessment undertaken. The drilling of these additional wells is required in order to ensure that the proposed Cluster 1 gas field development is economically viable and able to produce appropriate volumes of the gas resource.

Gas extracted from the existing and new wells will be compressed via centralised compressors and sent via pipeline through to the combined helium and CNG plant for processing. The final product of the gas processing includes helium and CNG, both of which will be temporarily stored in tankers and trucked away via trailer to be sold to end users. In addition to gas production and processing activities, further exploration wells will be drilled in accordance to the Production Right and if successful the exploration wells will be converted into production

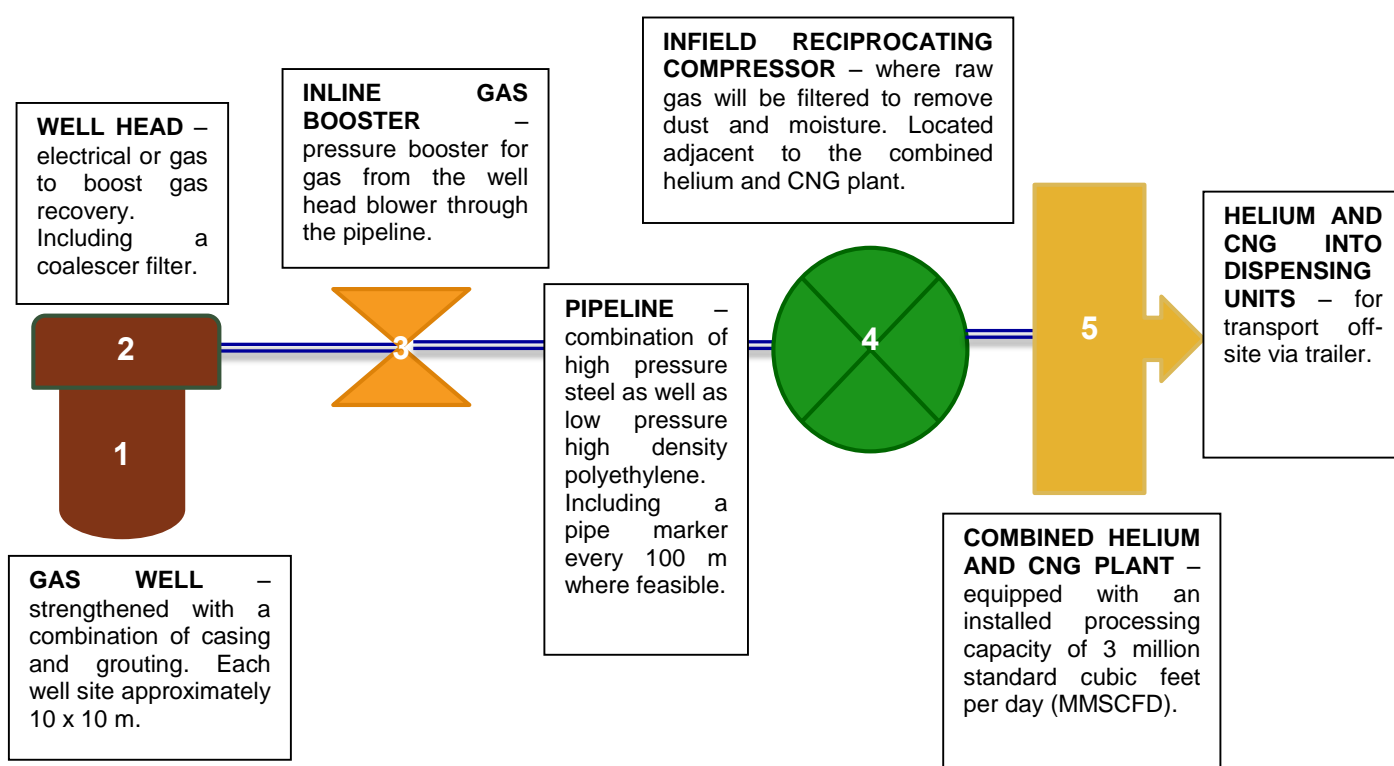
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<sup>1</sup> 10 existing wells were included in the scope of the project and time of specialist scoping investigations. Subsequent to the specialist scoping studies, 3 additional existing wells within the Cluster 1 study area boundary were included in the scope of work and have been considered in this scoping report. It was determined that the addition of the 3 existing wells did not have a significant impact on the specialist scoping investigations and reports. However, the EIA report (including specialist studies) will assess in detail the 13 existing wells as well as the proposed 6 new wells identified at the commencement of the project.

wells to be added to the Cluster 1 network. This EMPR includes the specific mitigation and management measures applicable to Production Activities within Cluster 1.

### 3.3.2. GAS PRODUCTION METHOD

The proposed Cluster 1 gas field production method to be employed entails the extraction of gas at 13 individual well sites already drilled and proposed new wells identified through ongoing exploration activities within the Production Right area. Gas extracted from the wells is compressed and sent via pipeline to further infield compressors and then piped through to the combined helium and compressed natural gas (CNG) plant for processing. The final product includes helium and CNG, both of which are temporarily stored in tankers and trucked away via trailer to be sold to end users. Each component, namely well sites, pipelines, infield centralised compressors and the combined helium and CNG plant is described below in more detail (refer to FIGURE 3 below for the simplified production method representation).



**FIGURE 3: FLOW DIAGRAM OF SIMPLIFIED PRODUCTION METHOD**

#### 3.3.2.1. EXPLORATION DRILLING

In addition to the 13 already drilled wells and the proposed new wells, further exploration wells will be drilled and, if successful, converted into production wells and added to the Cluster 1 network (where the environmental assessment indicated low sensitivity). The EIA sensitivity mapping exercise will be utilised to identify areas within suitable for exploration drilling. Furthermore, impacts pertaining to drilling and associated activities as well as recommendations for mitigation and management measures for those impacts were included in the scoping report and have since been refined during the EIA phase as presented in this report. Exploration drilling entails the use of a truck, trailer or skid mounted diamond drill rig to drill to varying depths in order to strike the gas reserve.

Percussion and diamond drills typically require clearance of an area of 30 m x 30 m in order to set up the rig and begin drilling activities. All exploration boreholes to be drilled in accordance with the requirements of the MPRDA Regulations, and will be sealed with a combination of casing and grouting to ensure vertical isolation of the gas from both the surrounding geology and hydrological regime. In addition to the drill rig, lined sumps will be required to store and recirculate water for the drilling process. A maximum of 6000 litres per day is required for drilling purposes and will be abstracted from existing water resources located within the Cluster 1 study area. Water abstraction will be undertaken following consultation with the relevant landowner / licence holder prior to use and will be well below the threshold limits for water use licensing.

In the event that an exploration borehole proves unsuccessful it will be sealed and cased (in accordance with the MPRDA Regulations) and the area rehabilitated. In the event that the exploration borehole proves successful it will be converted into a production well (as described below) and added to the network of gas producing wells for Cluster 1. The drilling of exploration boreholes is a temporary and short-lived activity and the equipment to be used during drilling activities includes a truck/trailer or skid mounted diamond drill rig, excavator, dozer, grader water cart, light motor vehicle for transport of personnel and chemical toilets.

### 3.3.2.2. WELL SITE CONNECTION

Cluster 1 entails the extraction of gas from 13 existing wells or blowers that have been previously drilled. These wells include (refer to FIGURE 4 for the location of these wells):

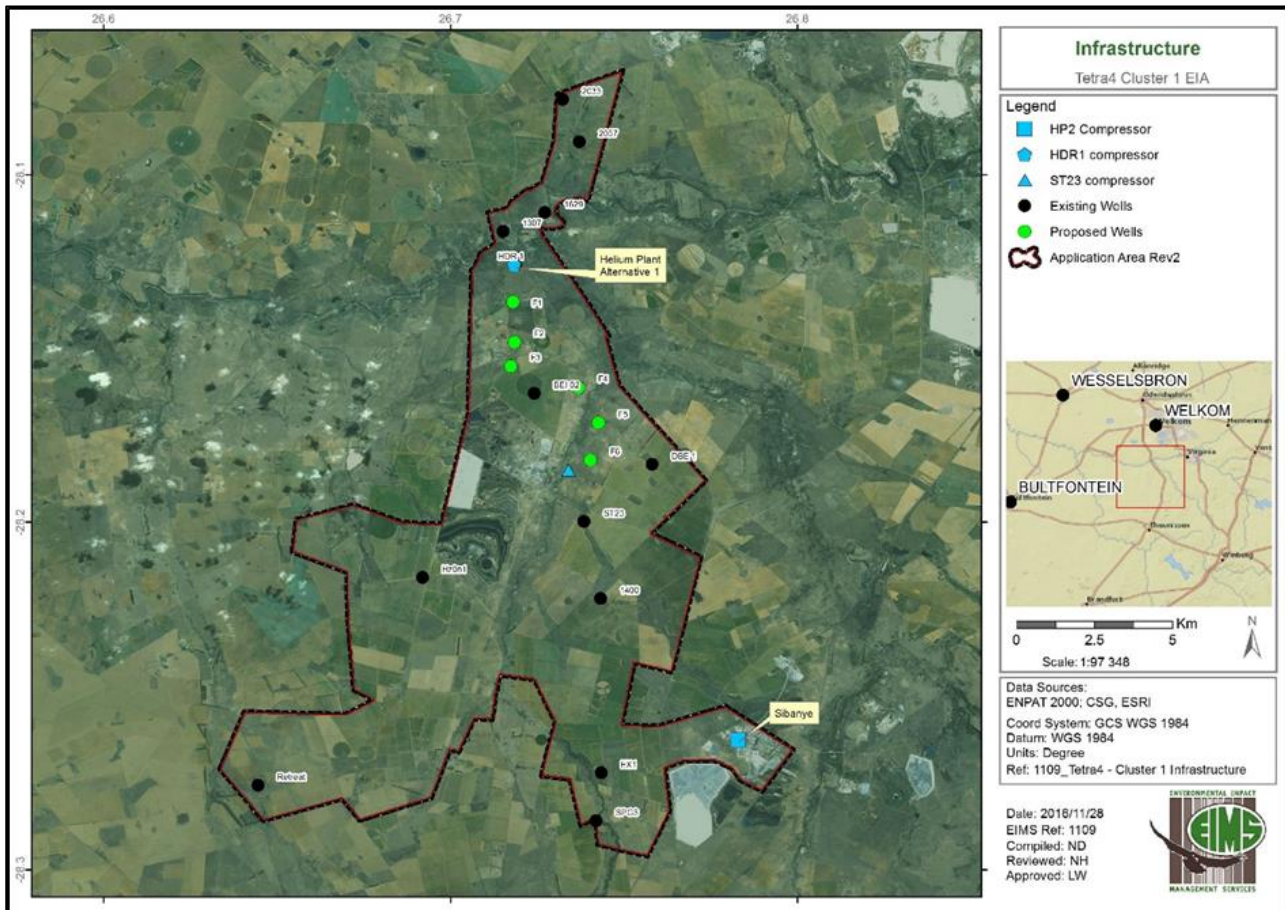
- |          |          |                |
|----------|----------|----------------|
| ↘ 2057   | ↘ HDR1;  | ↘ 2033;        |
| ↘ 1629   | ↘ BEI02; | ↘ RETREAT; and |
| ↘ 1307;  | ↘ HZON1; | ↘ SPG03.       |
| ↘ DBE01; | ↘ 1400   |                |
| ↘ ST23;  | ↘ EX01;  |                |

In addition to the 13 wells already identified, further wells will be drilled as a result of ongoing exploration activities and, if successful will be added to the well network of the Cluster 1 study area. Cluster 1 has identified 6 new potential wells sites at present, however there may be additional gas wells included based on the outcome of the exploration drilling and Cluster 1 environmental sensitivity mapping exercise. All future wells to be drilled will be within the boundary of the issued Production Right area and as such will be considered in the environmental site specific assessment to be undertaken for Cluster 1. Ongoing exploration activities and the identification and drilling of new wells are essential activities and required in order to ensure that the Cluster produces volumes of gas required to ensure economic viability.

All wells that are drilled and used for production purposes are strengthened with a combination of casing and grouting to average depths of 300 m. The casing and grouting ensures that the gas is isolated from surrounding geology and promotes the preferential flow of gas from the formation through the well and up to the surface. As the gas is naturally lighter than air, it rises naturally to the surface and no well stimulation is required. The combination of casing and grouting also serves to ensure that gas is isolated and prevented from interacting with the geohydrological regime.

Due to low gas pressures, each well will be equipped with an electrical or gas driven wellhead which boosts gas recovery by creating pressure differentials of up to 25 psi through vacuum suction. From the wellhead, the

blower will be connected via pipeline to an inline gas booster or a centralised infield reciprocating gas compressor. Pipelines will be a combination of high pressure steel as well as low pressure high density polyethylene (HDPE) and is installed at a minimum depth of 1.1m or below the plough line. The pipeline will be installed through the use of a back-actor and TLB. Where piping (e.g. for the compressors and driers) will be brought to surface, a 110 mm steel piping of approximately 10 m – 30 m will be utilised instead. Each production well site is approximately 10 m x 10 m and includes the installed wellhead. The well site infrastructure will include fencing, an alarm system, and short length of piping from the wellhead with monitoring and emergency features (e.g. pressure relief and check valves, etc.) prior to going underground.



**FIGURE 4: LOCATION OF EXISTING WELLS (BLACK), PROPOSED NEW WELLS (GREEN) AND OTHER CLUSTER 1 SURFACE INFRASTRUCTURE**

### 3.3.2.3. GAS BOOSTER AND RECIPROCATING INFIELD COMPRESSORS

There are two gas processing alternatives under consideration once the feed gas exists the wellheads and these are as follows:

- Localised inline gas booster compressors will be located approximately 10 m from each wellhead, which will feed pressurised gas via pipelines from the production wells to the combined helium and CNG plant; or
- The pressurised gas will enter the pipelines from the production wells towards centralised infield reciprocating compressors, to be pumped via trunkline to the combined helium and CNG plant.

The footprint of the wellhead is 10 m x 10 m, however should a localised booster compressor be required at any future well with very low pressure, then the combined footprint will be approximately 30 m x 20 m per well with booster. The footprint for a centralised reciprocating infield compressor including the gas drier station will be approximately 60 m x 60 m.

The centralised reciprocating infield compressor was identified as the preferred alternative to assess further in the EIA phase for use in the Cluster 1 gas field, thereby scoping out the option of localised compressors at each well site. However, as mentioned above should there be future wells added to the gas field with very low gas pressure, there may be a need to install booster pumps at those specific low pressure wells. For Cluster 1, raw gas received at the reciprocating compressors will be filtered to remove dust and moisture through the use of a combination water filter and an activated carbon filter that absorbs dust and unwanted organic compounds. Once filtered, the gas from the compressors will be dried to 7 pounds per MMSCF adjacent to the compressor stations, and then piped for final processing to the adjacent combined helium and CNG plant.

#### 3.3.2.4. COMBINED HELIUM AND CNG PLANT

Feed gas from either the booster compressors located at each of the well sites or from the centralised reciprocating infield compressors which will have driers in their vicinity, will be discharged into the prefabricated combined helium and CNG plant. The plant is equipped with an installed processing capacity of 3 million standard cubic feet per day (MMSCFD) of natural gas with a helium content of approximately 2.36 Vol %.

In order to achieve the required volumes of purified helium, the compressed feed gas is fed into a further installed gas pre-treatment unit which removes any additional condensate, traces of sulphur, mercury and hydrocarbons before entering the helium separating membranes and pressure swing adsorption (PSA) unit.

Once separated by the combination of membranes and the PSA unit, the plant will separate feed gas to a minimum of 99.999 Vol% helium. Purified helium is then liquefied and placed into dispensing units for transport off-site via trailer.

The proposed Helium Recovery Plant will consist of the following (refer to FIGURE 5 below):

- Feed Gas Compressor;
- Mercury / Sulphur Guard Bed;
- TSA Unit (Temperature Swing Adsorption);
- Membrane System;
- PSA Unit (Pressure Swing Adsorption);
- Helium Liquefaction Plant and Filling Station;
- Closed Loop Cooling Water System;
- Instrument Air Station;
- Interconnecting Piping & Peripheral Instrumentation;
- Process Control System / Electrical Switch Gears; and
- Commissioning Spare Parts

Natural gas removed of helium content is then re-circulated back into the plant where it is compressed into CNG. The CNG is then also placed into dispensing units for transport off-site also via trailer. The footprint of the combined helium and CNG plant (approximately 100 m x 100 m), as well as infield reciprocating compressors, temporary storage facilities and transport loading modules and mobile offices is approximately 6 hectares in extent. Refer to FIGURE 6 for the preliminary schematic representation and layout of the helium recovery unit.

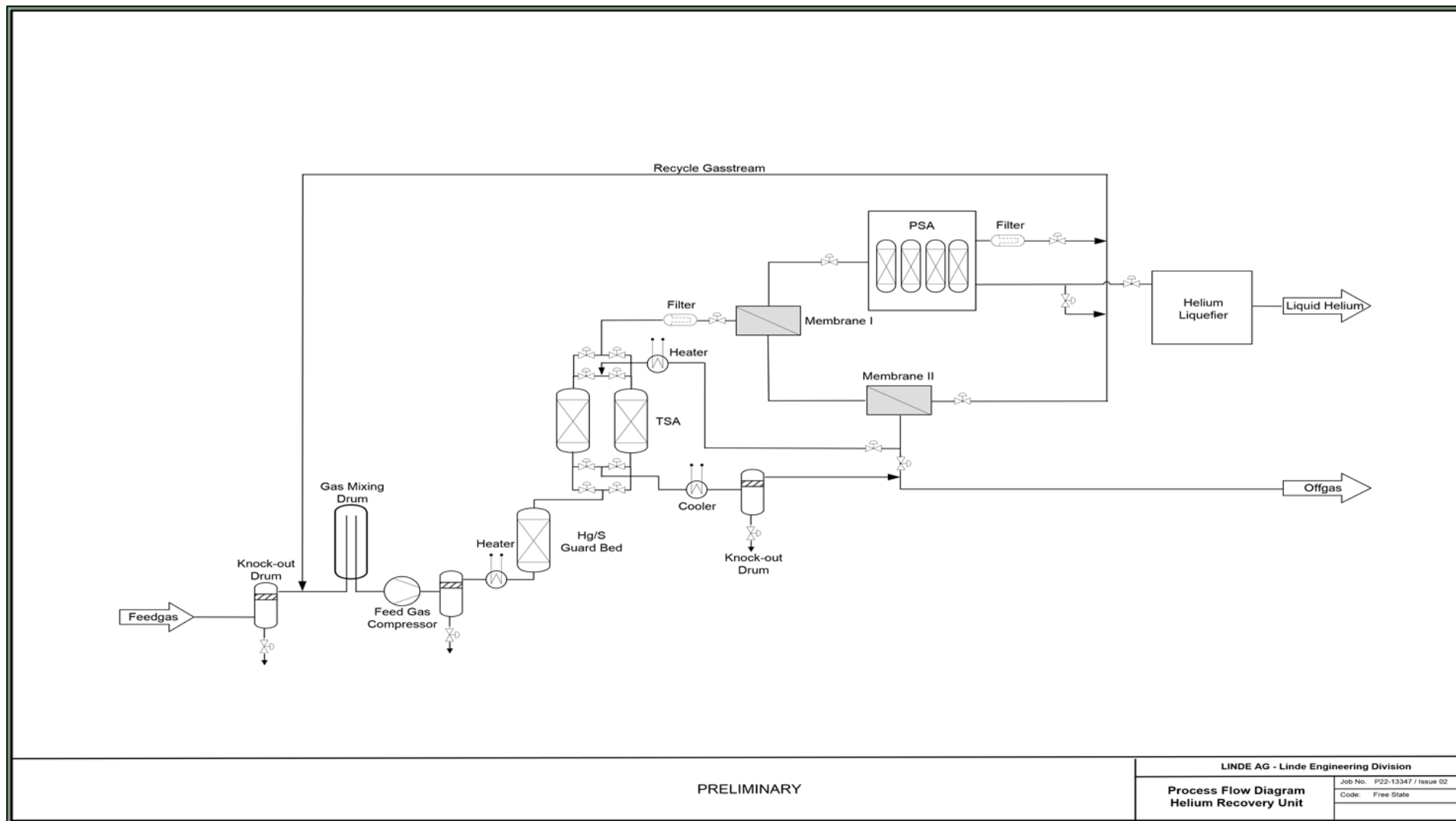


FIGURE 5: PRELIMINARY HELIUM RECOVERY UNIT PROCESS FLOW DIAGRAM

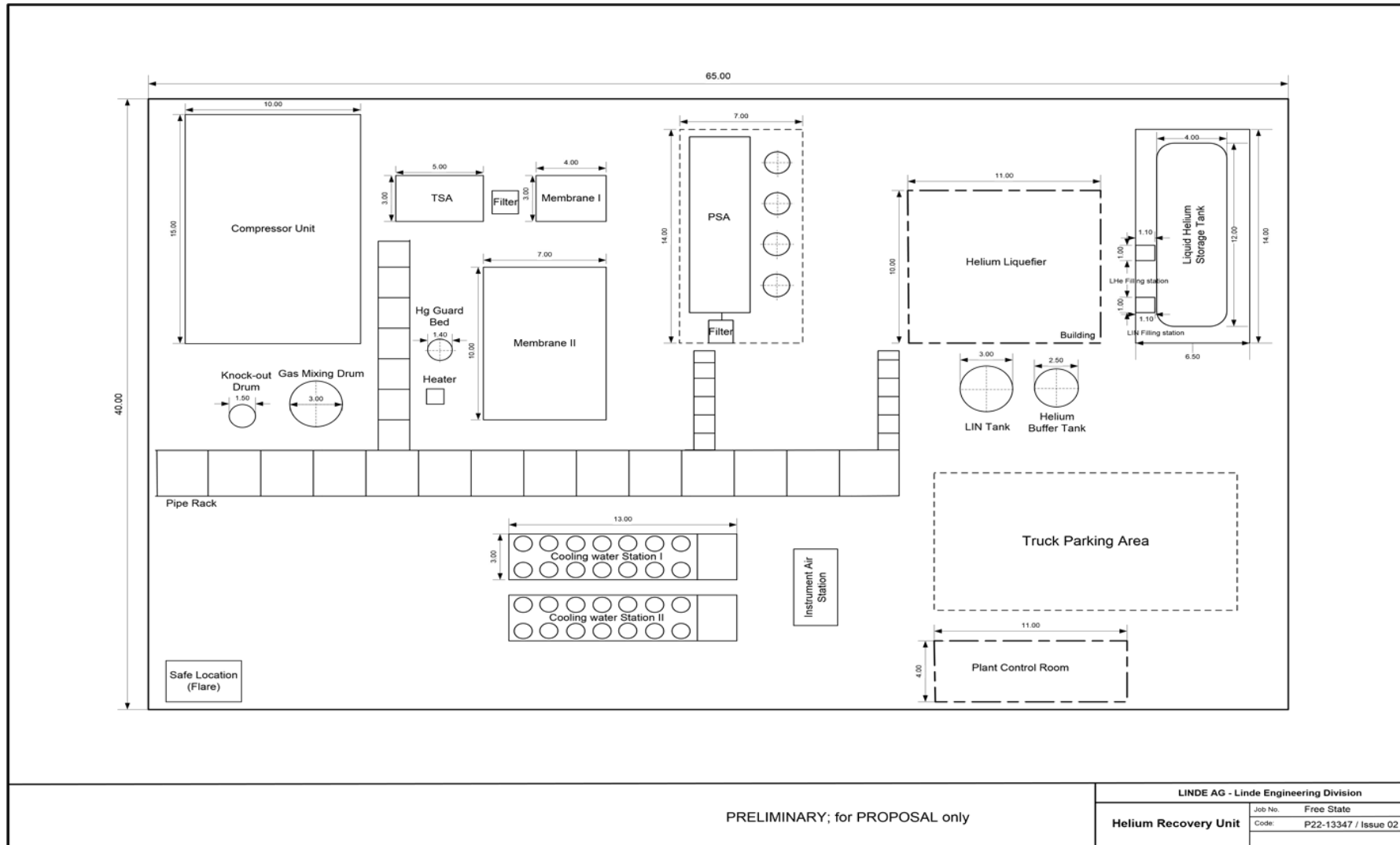


FIGURE 6: PRELIMINARY SCHEMATIC REPRESENTATION OF PROPOSED HELIUM RECOVERY UNIT



### 3.3.3. GAS PROCESSING

The proposed Cluster 1 will process raw gas at three primary stages during the production process. The first stage of gas processing occurs at the gas well or blower equipped with a wellhead. Raw gas from the wellhead equipped blower is fed through to a coalescer filter installed at the wellhead. The coalescer filter removes water vapour in the form of condensate from gas and then pipes the gas through to the second stage of gas processing at the inline booster compressors or the infield reciprocating gas compressors.

The second stage of processing at the inline booster compressors or at the infield reciprocating gas compressors which entails the removal of further condensate, dust and organic compounds through the use of an installed drier station and activated carbon filter. The third and final stage of gas processing occurs at the pre-treatment module of the combined helium and CNG plant. Through a combination of membranes, PSA unit and mercury guard bed any additional condensate, sulphur traces, mercury and hydrocarbons are separated out before the gas enters the helium purification and liquefaction process. Removed of impurities, the remaining helium free off-gas is then re-circulated into the plant and processed into high quality CNG. All gas processing is undertaken to ensure that feed gas to the combined helium and CNG plant does not damage the various membranes and PSA unit.

### 3.3.4. SURFACE INFRASTRUCTURE

The proposed Cluster 1 requires limited surface infrastructure. As such, the required infrastructure is listed below:

- Access roads;
- Pipelines;
- Coalescer filter or knockout drum at each well;
- Pipe markers (approximately every 100 m of the pipeline, where feasible);
- Wellheads;
- Booster pumps (where required);
- Inline booster compressors or infield reciprocating compressors;
- Gas driers;
- Fencing;
- Combined helium and CNG plant;
- Helium storage and dispensing units;
- CNG storage and dispensing units;
- Chemical storage;
- Temporary hazardous waste storage (including but not limited to waste water and waste containing hydrocarbons such as used oil and filters, diesel, lubricants, grease, etc.);
- Temporary general waste storage; and
- Mobile offices and ablutions facilities.

Significant infrastructure required for the Cluster 1 gas field development is broadly split between: a) infrastructure required for gas extraction and transport at well sites; and b) infrastructure required for gas processing and transport of final product. Infrastructure required for gas extraction includes wellheads, pipelines, inline boosters and fencing. Infrastructure for gas processing includes infield compressors, the combined helium and CNG plant, product storage and dispensing units and mobile offices.

#### 3.3.4.1. DESIGN PHILOSOPHIES

The proposed Cluster 1 is located in an area with several significant environmental aspects that have been considered in the determination of the final plant and compressor site layout, pipeline route and locations of wells to be drilled. As such, due consideration has been given to the placement, location and orientation of required infrastructure and activities in relation to these and other environmental aspects. The following factors have also been considered in the design and planning philosophies of infrastructure and activities during the EIA phase:

- ✎ Environmental sensitivity and constraints;
- ✎ Energy and water efficiency; and
- ✎ Compliance with statutory requirements.

#### 3.3.4.2. MOBILE OFFICE AND ABLUTION FACILITY

As the proposed Cluster 1 requires limited surface infrastructure, consisting of offices, ablution and storage facilities will be provided for a maximum of ten employees to manage and maintain operations at the combined helium and CNG plant and in field. The offices and ablutions facility will be temporary whereby the offices will serve as the base of operations for coordinating the operation and the ablution block will serve as a change room and ablution facility for employees while on site.

#### 3.3.4.3. SITE ACCESS CONTROL

Access to the individual well sites, compressor stations, and combined helium and CNG plant will be controlled through a single entrance and exit point. Well sites will be accessed via existing access roads (as far as possible) and the plant via an access road leading on to the R30 for combined helium and CNG plant alternative 1 (HP1) and existing Sibanye mine roads for combined helium and CNG plant alternative 2 (HP2). All production well sites, compressor stations, and the combined helium and CNG plant will be fenced off with 1.8 m high razor diamond mesh fencing or an equivalent product. Site access and traffic flow shall be designed to optimise control over the flow of public, contractors and operational vehicles as well as pedestrians. All visitors to the sites will be required to sign in at the security check point located at the entrance gates. A third party security company shall be utilised for the security check point. Employees will be required to retain proof of identification whilst on site.

#### 3.3.4.4. ROADS

Access to the combined helium and CNG plant will be either via the R30, a surfaced two lane provincial road which links to the R73 and the town of Virginia if HP1 is the preferred plant location, and existing Sibanye mine roads should HP2 be the preferred location subject to the conclusion of an agreement with Sibanye. Exploration and production wells will be accessed via existing access roads located within the Cluster 1 boundary where possible. Although access to exploration and production wells will be via existing access roads, there may be a

requirement to upgrade particular sections of those access roads in order to cater for exploration and production related infrastructure and activities, (i.e. widening roads for larger vehicles, drill rigs, etc.) as well as an effort to locate activities outside of environmentally sensitive areas and the 1:100 year floodline.

### 3.3.5. POWER SUPPLY

As the combined helium and CNG plant is a prefabricated unit, little power is required to assemble and commission it. As such, diesel generators will be utilised during construction of the plant. In addition, diesel will be utilised by drill rigs drilling further exploration wells. In order to power the plant for operation, electricity generated from an Eskom substation generating < 5Mva may be required or gas driven generator sets. As such it is anticipated that electricity will be obtained from the existing electrical distribution network in the area. Both the electrical connection point, substation and transmission routes will be determined after further investigations are undertaken as part of a separate study from this EIA process.

### 3.3.6. WATER MANAGEMENT

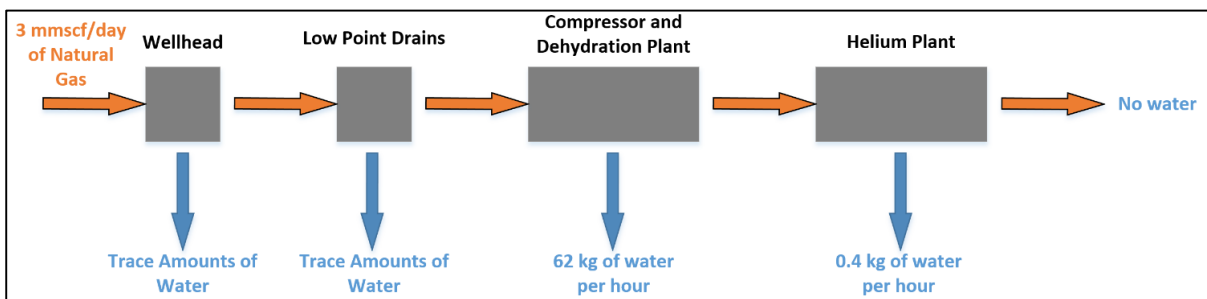
Water management for the proposed Cluster 1 gas production project refers to the water requirements for exploration and limited amounts for production activities, as well as the management of waste water such as condensate and formation water.

#### 3.3.6.1. BULK WATER REQUIREMENTS

The proposed Cluster 1 will not require bulk water for its operations. Water for drinking and domestic purposes will be brought in or sourced from existing municipal supply, while water for additional drilling of wells (temporary use) will be abstracted from registered boreholes in agreement with landowners and are anticipated to be below the threshold limits for water use licensing.

#### 3.3.6.2. WASTE WATER

Waste water from the Cluster 1 gas production components will consist of either condensate (waste water from condensation out of the gas) or very rarely, formation water (a natural layer of water inside oil and gas reservoirs). The amount of condensate likely to be produced during the Cluster 1 gas production and processing activity is as per the schematic diagram in FIGURE 7 below. The condensate and any formation water encountered will be disposed of as per the legislative requirements which includes disposal by a licensed contractor at a suitably registered waste disposal facility.



**FIGURE 7: SCHEMATIC DIAGRAM REPRESENTING THE POTENTIAL AMOUNT OF WASTE WATER PRODUCED DURING GAS PRODUCTION AND PROCESSING**

### 3.3.7. WASTE MANAGEMENT

The design philosophies for waste management are based on applicable legislation, in particular NEMWA, DWAF (DWS) best practice guidelines, and currently accepted good industry practice for waste management. Principles of waste minimisation at source, segregation for reuse, recycling and treatment or disposal will be applied to the handling of waste, wherever possible.

The waste (general and hazardous) generated during construction and operations will be addressed as per the details below.

#### 3.3.7.1. GENERAL WASTE

The following types of general waste (produced mainly during construction, with minimal amounts post-construction) will be generated by the proposed Cluster 1:

- Domestic solid waste;
- Scrap metal; and
- Building rubble.

The proposed Cluster 1 will utilise a temporary general waste storage facility and all waste will be collected by an approved, licenced waste contractor for removal and final disposal at a registered general waste disposal facility. No landfill will be established on the proposed site.

#### 3.3.7.2. HAZARDOUS WASTE

Hazardous waste, including but not limited to hydrocarbon containing waste (used oil and filters, diesel, lubricants, and grease) will be stored in clearly marked skip bins (solids) and containers (liquids). These skip bins/ containers will be placed in an isolated area on a hard, impervious surface. When full, the bins/ containers will be collected by a contractor for safe disposal or recycling companies which will be appointed to collect waste. A waste disposal certificate will be required from the contractor to ensure safe disposal.

Condensate (including effluent from the filters and drop out water) removed from gas processing at the various stages described previously will also be stored in clearly marked containers (should it not be within DWS livestock watering and irrigation standards) for final disposal offsite at a registered hazardous waste disposal facility by a licensed contractor.

Mercury and other trace metals absorbed by the membranes and guard beds equipped at the combined helium and CNG plant are designed to last for approximately 10 years before requiring replacement and will be collected by a licenced contractor for safe disposal also at a registered hazardous waste disposal site. Records of all final waste disposal certificates will be kept.

Other liquid waste such as sewage and domestic waste water will be generated and these will also need to be collected and disposed offsite appropriately by licenced contractors to registered disposal facilities.

### 3.3.8. PROJECT SCHEDULE

The proposed Cluster 1 gas production development refers to the first two phase of the overall Tetra 4 production right gas field near the town of Virginia, and is scheduled to take place over a period of 5 years. TABLE 3 below presents Tetra 4's proposed Cluster 1 gas production schedule. The production schedule indicates that there will be a Phase 1 and Phase 2 component to the Cluster 1 gas production activities.

However, Phase 1 will involve two parts to be referred to as Phase 1A and Phase 1B. Phase 1A will be the connection of existing wells (MD03, MDR5, and possibly DB02) via pipeline to the existing CNG facility at HDR1. Phase 1A is not related to the current EIA project but is subject to the approved Production Right and its conditions, whereby the drilling and pipeline connection activities are already approved in areas within the Production Right not found to be of medium to high environmental sensitivity. Phase 1B and Phase 2 of Cluster 1 will take place from year 2 through to year 5, and will entail: the drilling on the proposed new wells F1 to F6; and connecting the 6 new and the 13 existing wells via pipeline; through centralised compressors leading to the combined helium and CNG plant.

**TABLE 3: CLUSTER 1 GAS PRODUCTION SCHEDULE**

| Year  | Wells to Connect via Pipeline | Wells to be Drilled | Boosters/ Compressors | Other Infrastructure   |
|---|-------------------------------|---------------------|-----------------------|------------------------|
| <b>Year 1</b>   | HDR1                          | 0                   | 0                     | Pipeline to each well  |
| <b>Phase 1A – Not part of Cluster 1 EIA study. Infrastructure construction can commence prior to the completion of the Cluster 1 project as the activities are within the approved the production right conditions.</b> | MDR5                          |                     |                       | Pipeline to HDR1       |
|   | MD03                          |                     |                       | Fencing                |
|   | BE02 <sup>2</sup>             |                     |                       | Access roads (limited) |
| <b>Year 2</b>   | BE02                          | F1                  | HDR compressor        | Pipeline to each well  |
| <b>Phase 1B – Cluster 1</b>   | DBE01                         | F2                  | ST23 compressor       | Pipeline to HDR1       |
|   | ST23                          | F3                  |                       | Pipeline to ST23       |
|   | 1400                          |                     |                       | Fencing                |
|   | HZON1                         |                     |                       |                        |
| <b>Year 3</b>   | 1307                          | F4                  | HP2 compressor        | Pipeline to each well  |
| <b>Phase 2 – Cluster 1</b>  | 2033                          | F5                  |                       | Trunk line to ST23     |
|   | 2057                          | F6                  |                       | Fencing                |
|   | 1629                          |                     |                       | Access roads (limited) |
|   |                               |                     |                       | CNG Plant              |
| <b>Year 4</b>   | Retreat                       | 3 (TBD near 2033)   | 0                     | Pipeline to each well  |
| <b>Phase 2 – Cluster 1</b>  | EX01                          |                     |                       | Trunk line to HP2      |
|   | SPG03                         |                     |                       | Fencing                |
|   |                               |                     |                       | Access roads (limited) |
| <b>Year 5</b>   | 3 (TBD)                       | 3 (TBD near HDR1)   | 0                     | Helium Plant           |
| <b>Phase 2 – Cluster 1</b>  |                               |                     |                       |                        |

<sup>2</sup> Existing well BE02 will either be part of phase 1A or Phase 1b, this is still to be determined and thus this well has been included under both phases until a decision is made.

## 4. DETAILS OF THE EAP

EIMS was appointed by Tetra4 to act as the Independent Environmental Assessment Practitioner (EAP) and to assist in preparing and submitting the EA application, Scoping and EIA Reports, and undertaking a Public Participation Process (PPP) in support of the gas production operations, near Virginia. The contact details of the EIMS consultant who compiled the EIA Report and site specific EMPR are as follows:

Name of the Practitioner: Nobuhle Hughes

Tel No.: 011 789 7170

Fax No.: 011 787 3059

E-mail address: tetra@eims.co.za

### 4.1.1. SUMMARY OF EAP QUALIFICATIONS

In terms of Regulation 13 of the EIA Regulations, an independent EAP, must be appointed by the applicant to manage the application. EIMS has been appointed by the Applicant as the EAP and is compliant with the definition of an EAP as defined in Regulations 1 and 13 of the EIA Regulations as well as Section 1 of the NEMA. This includes, *inter alia*, the requirement that EIMS is:

- ✎ Objective and independent;
- ✎ Has expertise in conducting EIA's;
- ✎ Comply with the NEMA, the environmental regulations and all other applicable legislation;
- ✎ Takes into account all relevant factors relating to the application; and
- ✎ Provides full disclosure to the applicant and the relevant environmental authority.

Nobuhle Hughes, the EIMS consultant involved in the EIA process and the compilation of this report holds a Masters' degree in Botany from the University of the Cape Town.

### 4.1.2. SUMMARY OF EAP EXPERIENCE

EIMS is a private and independent environmental management-consulting firm that was founded in 1993. EIMS has in excess of 20 years' experience in conducting EIAs, including many EIAs for mines and mining related projects. Please refer to the EIMS website ([www.eims.co.za](http://www.eims.co.za)) for examples of EIA documentation currently available.

Nobuhle Hughes is a senior consultant at EIMS and has been involved in numerous significant projects the past 6 years that she has been with the firm. She has experience in Project Management, small to large scale Environmental Impact Assessments, Environmental Auditing, and Public Participation.

The declaration of independence and the Curriculum Vitae (indicating the experience with environmental impact assessment and relevant application processes) of the EAP are attached as Appendix A.

## 5. POLICY AND LEGISLATIVE CONTEXT

This section provides an overview of the governing legislation identified which may relate to the proposed project. The primary legal requirement for this project stems from the need for an EA to be granted by the competent authority, which is the PASA, in accordance with the requirements of both the NEMA and MPRDA.

In addition, there are numerous other pieces of legislation governed by many acts, regulations, standards, guidelines and treaties on an international, national, provincial and local level, which should be considered in order to assess the potential applicability of these for the proposed activity. The legislation that was considered for this project includes, but not limited to, the following:

- ✎ The MPRDA (Act No. 28 of 2002);
- ✎ The NEMA (Act No. 107 of 1998);
- ✎ NEMWA (Act No. 59 of 2008);
- ✎ The NEMAQA (Act No 39 of 2004);
- ✎ The NWA (Act No. 36 of 1998);
- ✎ The NHRA (Act No 25 of 1995);
- ✎ The National Environmental Management: Biodiversity Act (Act No. 10 of 2004);
- ✎ The National Environmental Management Biodiversity: Alien and Invasive Species List (2014);
- ✎ The National Forests Act (Act No. 84 of 1998);
- ✎ The South African National Roads Agency Limited and National Roads Act (Act 7 of 1998);
- ✎ The Constitution (Act No. 108 of 1996);
- ✎ The National Energy Act (Act 34 of 2008); and
- ✎ The National Gas Act (Act 48 of 2001).

## 5.1. APPLICABLE NATIONAL LEGISLATION

On the national level, the legislation discussed below has relevance to this project.

### 5.1.1. **MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT (MPRDA, ACT NO. 28 OF 2002)**

The MPRDA aims to “make provision for equitable access to, and sustainable development of, the nation’s mineral and petroleum resources”. The MPRDA outlines the procedural requirements that need to be met to acquire mineral and petroleum rights in South Africa.

In terms of Section 83 of the MPRDA, a Production Right must be issued prior to the commencement of any gas production activities. However, several amendments have been made to the MPRDA. These include, but are not limited to, the amendment of Section 102, concerning amendment of rights, permits, programmes and plans, to requiring the written permission of the Minister for any amendment or alteration; and the Section 5A(c) requirement that landowners or land occupiers receive twenty-one (21) days’ written notice prior to any activities taking place on their properties. One of the most recent amendments requires all mining and production related activities to follow the full NEMA process as per the EIA Regulations which came into effect on 4 December 2014 for any new applications. A Production Right is subject to prescribed terms and conditions and is valid for the period specified in the right, which periods, each of which may not exceed 30 years, and becomes effective on the effective date. Cluster 1 requires amendment of the production right to include all gas activities that were not part of the approved production right application process, particularly the combined helium and CNG

(processing) plant. Furthermore, the approved general EMPR is being amended to include Cluster 1 site specific management measures and as such also triggers Section 102 of the MPRDA.

#### 5.1.2. **MPRDA REGULATIONS FOR PETROLEUM EXPLORATION AND PRODUCTION (GN R. 466)**

On 3 June 2015, GN R.466 of the MPRDA Regulations was published. The notice outlines the requirements for amendments made to petroleum exploration and production activities, particularly with regards to the following that affect Cluster 1:

The EIA process required;

Well design and construction;

Operations and management (including the management of water, waste, and pollution); and

Well suspension and decommissioning.

The compilation of Cluster 1 EIA Report is part of the NEMA EIA process being undertaken towards an application for environmental authorisation. The well design and construction requirements of the MPRDA regulations have informed some of the mitigation measures recommended to manage potential impacts from Cluster 1 activities. The management of water, waste and pollution is addressed through the impact assessments by the relevant specialists which also informed the proposed mitigation measures presented in the EIA report and this EMPR. The impacts identified include those for the decommissioning and rehabilitation and closure phases, and the mitigation and management measures recommended in this EMPR have taken these Regulations into account.

#### 5.1.3. **NATIONAL ENVIRONMENTAL MANAGEMENT ACT (NEMA, ACT NO. 107 OF 1998)**

The main aim of the NEMA as amended, is to provide for co-operative governance by establishing decision-making principles on matters affecting the environment. In terms of the NEMA EIA Regulations (2014), the proponent is required to appoint an environmental assessment practitioner (EAP) to undertake an EIA as well as the public participation process. In South Africa, EIA's became a legal requirement in 1997 with the promulgation of regulations under the Environment Conservation Act (ECA), subsequently, NEMA was passed in 1998. Section 24 (2) of NEMA empowers the Minister and any MEC, with the concurrence of the Minister, to identify activities which must be considered, investigated, assessed and reported on to the competent authority responsible for granting the relevant EA. On 21 April 2006 the Minister of Environmental Affairs and Tourism promulgated regulations in terms of Chapter 5 of the NEMA, and these EIA Regulations were amended on the 4th December 2014.

The objective of the EIA Regulations is to establish the procedures that must be followed in the consideration, investigation, assessment, and reporting of the activities that have been identified. The purpose of these procedures is to provide the competent authority with adequate information to make decisions which ensure that activities which may impact negatively on the environment to an unacceptable degree are not authorized, and that activities which are authorized are undertaken in such a manner that the environmental impacts are managed to acceptable levels.

In accordance with the provisions of Sections 24 (5) and Section 44 of the NEMA the Minister has published Regulations (GN R. 982) pertaining to the required process for conducting EIA's in order to apply for, and be



considered for, the issuing of an EA. These Regulations provide a detailed description of the EIA process to be followed when applying for EA for any listed activity. The Regulations differentiate between a simpler Basic Assessment Process (required for activities listed in GN R. 983 and 985) and a more complete EIA process (activities listed in GN R. 984 of the EIA Regulations, 2014, as discussed in detail in the EIA Report.). The activities triggered by Cluster 1 fall under GN R. 984 and as such a full EIA process was undertaken. Furthermore, Appendix 4 of the EIA regulations (2014) details the requirements of an EMPR and these requirements have been adhered to for this EMPR as indicated in TABLE 1.

## **5.2. ENVIRONMENTAL MANAGEMENT PRINCIPLES**

### **5.2.1. HOLISTIC PRINCIPLE**

The Holistic principle, as defined by NEMA (Section 2(4)(b) requires that environmental management must be integrated, acknowledging that all elements of the environment are linked and inter-related and it must take into account the effect of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option (defined below). Holistic evaluation does not mean that a project must be looked at as a whole. It rather means that it must be accepted that there is a whole into which a project introduced. If the indications are that the project could have major adverse effects, the project must be reconsidered and where appropriate re-planned or relocated to avoid an adverse impact or to ensure a beneficial impact.

### **5.2.2. BEST PRACTICABLE ENVIRONMENTAL OPTION**

When it is necessary to undertake any action with environmental impacts, the different options that could be considered for the purpose must be identified and defined. The Best Practicable Environmental Option (BPEO) is defined in NEMA as “the option that provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term.” Other guidelines typically used for environmental management in terms of other legislation include: BPM which is the Best Practicable Means and BAT which is the Best Available Technology.

### **5.2.3. SUSTAINABLE DEVELOPMENT**

The concept of sustainable development was introduced in the 1980's with the aim to ensure that the use of natural resources is such that our present needs are provided without compromising the ability of future generations to meet their own needs. The constitution of South Africa is built around the fact that everyone has the right to have the environment protected through reasonable legislative and other measures that secure ecologically sustainable development. The National Environmental Principles included in the NEMA require development to be socially, environmentally and economically sustainable.

### **5.2.4. PREVENTATIVE PRINCIPLES**

The preventative principle is fundamental to sustainable development and requires that the disturbance to ecosystems and the pollution and/or degradation of the environment and negative impacts on the environment be avoided, or, where they cannot be altogether avoided, are minimised and remedied.

### **5.2.5. THE PRECAUTIONARY PRINCIPLE**

The precautionary principle requires that where there is uncertainty, based on available information and as a matter of precaution, that said impact will be harmful to the environment until such time that it can be proven

otherwise. The precautionary principle requires that decisions by the private sector, governments, institutions and individuals need to allow for and recognise conditions of uncertainty, particularly with respect to the possible environmental consequences of those decisions. In South Africa, the DWA adopted a BPEO guideline in 1991 for water quality management and in 1994 in the Minimum Requirements document for waste management.

In terms of DWAF (now DWS) Minimum Requirements for the Handling and Disposal of Hazardous Waste, 1994, the precautionary principle is defined as, "Where a risk is unknown; the assumption of the worst case situation and the making of provision for such a situation." Here the precautionary principle assumes that a waste or an identified contaminant of a waste is "both highly hazardous and toxic until proven otherwise."

In the context of the EIA process in South Africa, the precautionary principle also translates to a requirement to provide sound, scientifically based, information that is sufficient to provide the decision making authority with reasonable grounds to understand the potential impacts on the environment, the extent thereof and how impacts could be mitigated. If such information is not adequate for this purpose, the relevant authority cannot be satisfied as is required and then the authority should require that further information be collected and provided.

#### **5.2.6. DUTY OF CARE AND CRADLE TO GRAVE PRINCIPLE**

In terms of the NEMA Section 28, "Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment."

By way of example, the principle of "duty of care" in terms of waste management emphasises the responsibility to make sure that waste is correctly stored and correctly transported, as it passes through the chain of custody to final point of disposal. This means that waste must always be stored safely and securely. The company removing and disposing of waste also holds the responsibility to hold the relevant licenses, and that waste is transported alongside the necessary paperwork.

"Cradle to Grave" refers to the responsibility a company takes for the entire life cycle of a product, service or program, from design to disposal or termination. In terms of the DWAF Minimum Requirements for the Handling and Disposal of Hazardous Waste, 1994, "any person who generates, transports, treats or disposes of waste must ensure that there is no unauthorised transfer or escape of waste from his control. Such a person must retain documentation describing both the waste and any related transactions. In this way, he retains responsibility for the waste generated or handled." This places responsibility for a waste on the Generator, and is supported by the "Cradle to Grave" principle, according to which a "manifest" accompanies each load of Hazardous Waste until it is responsibly and legally disposed. This manifest is transferred from one transporter to the next along with the load, should more than one transporter be involved. Once the waste is properly disposed of at a suitable, permitted facility, a copy of the manifest must be returned to the point of origin." Duty of Care offers one strategy to implement sustainable development.

#### **5.2.7. POLLUTER PAYS PRINCIPLE**

The "polluter pays principle" holds that the person or organisation causing pollution is liable for any costs involved in cleaning it up or rehabilitating its effects. It is noted that the polluter will not always necessarily be the generator, as it is possible for responsibility for the safe handling, treatment or disposal of waste to pass from one competent contracting party to another. The polluter may therefore not be the generator, but could be

a disposal site operator or a transporter. Through the 'duty of care' principle, however, the generator will always be one of the parties held accountable for the pollution caused by the waste. Accordingly, the generator must be able to prove that the transferral of management of the waste was a responsible action. The polluter pays principle according to NEMA dictates that “the cost of remedying pollution, environmental degradation and consequent adverse effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment.”

#### 5.2.8. DUTY OF CARE RESPONSIBILITIES

The principle of duty of care is especially important to understand when it comes to pollution that arises as a result of an activity. Notwithstanding any licences or permits that may exist, the exploration works would still have a responsibility to take suitable measures should pollution arise as a result of the activities.

Training and awareness should be fostered in all staff working to ensure that they can perform their duties. Failure to comply with the provisions in the EMPR and NEMA would be a contravention of the Act. The relevant sections of NEMA are provided below, to outline the duty of care and responsibility that the applicant and all employees have towards the environment. The National Environmental Management Act (Act 107 of 1998) (NEMA) Section 28 makes provision for duty of care and remediation of environmental damage. The binding principals are described below:

1. Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.
2. Without limiting the generality of the duty in subsection (1), the persons on whom subsection (1) imposes an obligation to take reasonable measures, include an owner of land or premises, a person in control of land or premises or a person who has a right to use the land or premises on which or in which-
  - a) any activity or process is or was performed or undertaken; or
  - b) any other situation exists, which causes, has caused or is likely to cause significant pollution or degradation of the environment.
3. The measures required in terms of subsection (1) may include measures to-
  - a) investigate, assess and evaluate the impact on the environment;
  - b) inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation of the environment;
  - c) cease, modify or control any act, activity or process causing the pollution or degradation;
  - d) contain or prevent the movement of pollutants or the cause of degradation;
  - e) eliminate any source of the pollution or degradation; or
  - f) remedy the effects of the pollution or degradation.

Any person convicted of an offence in terms of the NEMA may incur a fine not exceeding R1 to R10 million or to imprisonment for a period not exceeding 1 to 10 years or to both such a fine and such imprisonment.

## **6. ROLES AND RESPONSIBILITIES**

Tetra 4 will be responsible for ensuring overall compliance with the provisions of the EMPR. In order to ensure that the EMPR and its mitigation measures are implemented, roles and responsibilities need to be clearly defined and documented. TABLE 4 provides a breakdown of the assigned roles and responsibilities provided for in this EMPR.

TABLE 4: ROLES AND RESPONSIBILITIES

| Role                    | Abbreviation | Description  |
|-------------------------|--------------|--|
| Tetra 4 (Rights Holder) | Tetra 4      | <p>The Holder is the principal party of the Production operations. The legal accountability for correct implementation of the relevant requirements of the EA and EMPR falls upon the Holder. Where activities are contracted out (e.g. to Contractors and Subcontractors), the liability associated with non-compliance still rests with the Holder (unless otherwise agreed upon between the authorities, the Holder and the contracting parties). It is therefore important that these requirements are enforced on any contractor, agent or service provider acting on behalf of the applicant in relation to this project. It is therefore important that the relevant licenses, authorizations, permits, EMPR and any other relevant environmental norms and standards are included in the contractual conditions of any such parties acting on the Holders behalf.</p> <p>The Holder (and not the Contractor) is responsible for liaising directly with the relevant authorities with respect to the preparation and implementation of the EMPR. All project activities must adhere to and comply with all South African legislation and regulations and this requirement must also be included in the Contractors'/Applicant conditions. Should there be changes in legislation and/or regulations then action will be taken to incorporate such changes and to pass these requirements on to the Contractors.</p> <p>The Holder's role includes:</p> <ul style="list-style-type: none"> <li>• Provide all necessary supervision during the execution of the project. Representation from the Holder should be available on site all the time;</li> <li>• Provide the necessary support in terms of resources (people, financial and technical) to ensure successful implementation of the EMPR, EA and all other relevant environmental commitments;</li> <li>• Appoint a suitably qualified, competent EO that will be responsible for among others, ensuring daily compliance with the EMPR, and EA and other relevant environmental standards throughout all phases;</li> <li>• Appoint a suitably qualified, competent and Independent ECO to verify environmental performance through regular audits;</li> <li>• Notify authorities (e.g. PASA, DEA, DWS) of any significant changes in the Production operations which would require amendments to existing licences, authorisations, permits or other relevant approvals (such as this EMPR);</li> </ul> |

| Role                                 | Abbreviation | Description  |
|--------------------------------------|--------------|--|
|                                      |              | <ul style="list-style-type: none"> <li>Notify authorities of any reportable incidents in terms of National Legislation (e.g. Section 30 of NEMA, Section 20 of NWA);</li> <li>Review Independent Environmental Auditor reports and other environmental compliance reports and ensure corrective actions are assigned to relevant parties for rectification;</li> <li>Ensure the projects' overall compliance with National Law and any relevant environmental standards and regulations; and</li> <li>To implement the projects as per the approved project plan.</li> </ul> <p>To comply with special conditions as stipulated by surrounding Landowners during the negotiation process (if any).</p>   |
| <b>Environmental Control Officer</b> | ECO          | The ECO is appointed by the Holder and is responsible for independent compliance monitoring, and auditing function as well as the explanation/ clarification of environmental issues contained in this EMPR to anyone working on the site. The ECO will have the responsibility to monitor that the mitigation/rehabilitation measures and recommendations referred to in the EA and associated documents are implemented and to ensure compliance with the provisions of this EMPR. The ECO must be a suitably qualified and/or experienced environmental scientist.  |
| <b>Environmental Officer</b>         | EO           | <p>The Holder shall appoint an EO who is a suitably qualified individual (and preferably be a senior member of staff) that will be responsible to oversee day to day compliance with the EMPR and ensure its correct implementation throughout the construction and operation of the Production. The EO will also be responsible for correct implementation of other environmental commitments such as compliance with the EA, Permits, licenses and other relevant environmental procedures and documentation (e.g. method statements and monitoring programs). The EO must have appropriate environmental training and experience to ensure adequate implementation of the EA, EMPR and relevant environmental norms and standards. In this regard, the EO should have a tertiary qualification in an Environmental Sciences or Environmental Management field and experience with environmental management in the mining/petroleum industry. The EO is responsible for adequate environmental training of staff and employees throughout the operation of the facility.</p> <p>The EO roles will include:</p> |

| Role | Abbreviation | Description  |
|------|--------------|--|
|      |              | <ul style="list-style-type: none"> <li>• Conveying the contents of the EA, EMPR and any other relevant permits or approvals to the site employees (workers and staff). This should take the form of formal induction and awareness training to be done with all main and sub-contractors. Records of the training date, meeting attendees and discussion points shall be kept by the EO;</li> <li>• Daily inspections of the work area(s) to ensure adequate on site environmental performance;</li> <li>• Complete Site Inspection Forms/records on a regular basis (weekly) throughout the project;</li> <li>• Compilation, and review and approval of contractor's, Environmental Method Statements;</li> <li>• Auditing of the Contractors' environmental performance and documentation during the construction phase;</li> <li>• Issuing of site instructions to the Contractor for corrective actions required;</li> <li>• Ongoing environmental awareness training of the site personnel throughout the Operational phase;</li> <li>• Maintain a record of environmental incidents (spills, impacts, injuries, complaints, legal transgressions etc.) as well as corrective and preventive actions taken, for submission to the Holder and ECO;</li> <li>• Maintain an external grievance register in which all complaints/grievances are recorded, as well as action taken, for submission to the Holder and ECO;</li> <li>• Ensure required corrective actions are taken within specified time frame in respect of non-conformances and environmental incidents;</li> <li>• Attendance at HSE meetings, toolbox talks and awareness training programs;</li> <li>• Ensure that waste management on site conforms to the necessary requirements specified in this EMPR;</li> <li>• Ensuring that environmental signage and barriers are correctly placed and maintained; and</li> <li>• To inform and educate all employees about the environmental risks associated with their activities and how to avoid and mitigate significant impacts to the environment.</li> </ul> |

| Role                             | Abbreviation | Description   |
|----------------------------------|--------------|---|
| <b>Contractor</b>                | Con          | <p>The contractor is usually a third party/ies appointed by the Holder to undertake the actual construction of the project. The Contractor is answerable to the Holder and ECO for all environmental issues associated with the project. Contractor performance will, amongst others, be assessed on health, safety and environmental management criteria. The principal contractor, any other contractors and sub-contractors will be required to comply with the provisions contained herein, and accordingly, the EMPR and its provisions must form part of any contractual arrangements between the applicant and contractors. The contractor must comply with EMPR and ensure that all his employees and sub-contractors appointed by him are familiar with the EMPR. The legal accountability for correct implementation of the relevant requirements of the EA and EMPR must be contractually bound to the appointed contractor.</p> <p>The Contractor/s role includes:</p> <ul style="list-style-type: none"> <li>• Provide all necessary supervision during the execution of the project. They should be available on site all the time;</li> <li>• Where relevant appoint a suitably qualified, competent Contractors EO that will be responsible for among others, ensuring daily compliance with the EMPR, EA during the construction phase;</li> <li>• To implement the projects as per the approved project plan;</li> <li>• To ensure that implementation is conducted in an environmentally acceptable manner;</li> <li>• To fulfill all obligations as per the agreed contract;</li> <li>• To comply with special conditions as stipulated by surrounding Landowners during the negotiation process (if any);</li> <li>• Ensure that the Contractors staff and employees have received the appropriate environmental awareness training prior to commencing construction; and</li> <li>• Ensuring that environmental signage and barriers are correctly placed and maintained during the operational phase.</li> </ul> |
| <b>Community Liaison Officer</b> | CLO          | <p>The CLO is a dedicated person appointed by Tetra 4 to communicate with the landowners. It is important for the landowners to build a relationship with this person. The person must have enough authority and access to management to ensure that he or she</p>  |



| Role | Abbreviation | Description  |
|------|--------------|--|
|      |              | <p>can assist with dealing with everyday issues. It is important that the landowners trust the person and have faith in their ability to address issues. The CLO's role includes the following:</p> <ul style="list-style-type: none"><li data-bbox="611 352 2083 427">• To deal with the affected landowners/ community and keep records of all the communication with affected landowners/community and any claims raised throughout the life of the project;</li><li data-bbox="611 464 2083 496">• To report any incidents brought forward by landowners/ community to the attention of the EO;</li><li data-bbox="611 528 2083 651">• To arrange at least two meetings per year (can be more but not less) through the community liaison forum created to communicate the mitigation and monitoring measures to the affected parties. This forum can also act as a platform to discuss environmental issues between tetra 4 and the landowners/community;</li><li data-bbox="611 683 2083 758">• Keep verified and signed copy of compiled asset and infrastructure baseline record of any landowner infrastructure that may be affected by the project; and</li><li data-bbox="611 790 2083 865">• To check if signage is visible and in place on weekly basis, and communicate with roads authority if there are any traffic safety issues.</li></ul> |

## 7. ENVIRONMENTAL IMPACT MANAGEMENT

### 7.1. IDENTIFIED ENVIRONMENTAL IMPACTS

#### 7.1.1. PRODUCTION RIGHT EIA

The following summary of impacts has been extracted from the original Production right EIA:

*“Medium significance impacts that may arise from the production activity include the impact on agricultural land, disposal of saline deep aquifer water, and health and safety impacts. These impacts can all be successfully mitigated to a negligible level. The receiving environment has unique features that need to be protected from anthropogenic disturbance. There exists a potential to impact on sensitive fauna and flora species, and to disturb cultural heritage sites that date from the Stone Age, up to the historical age. Surface water features are also considered to be vulnerable to pollution.*

*The sensitivity map will guide the location of gas wells and infrastructure, to reduce environmental impacts during their respective planning and design phases, by indicating which geographical areas are sensitive, thus indicating where special site specific measure are to be implemented, or where sites should be avoided. This approach is considered to be a practical method that would allow sustainable gas production for the envisaged phase development over 25 years. Due to the uncertainty regarding the potential location of viable gas wells, this strategic planning approach would allow the applicant to assess the risk and mitigation required to extract gas in a specific geographical area.*

*The project will have the potential to increase economic development in the region, and assist in securing a viable alternative energy source. The project should not impact significantly on the environment, with the proactive mitigation proposed in the sensitivity map, and the reactive mitigation measures proposed in the EMPR. Where particularly sensitive areas are to be affected, site specific measures will be identified and implemented to negate the impacts as far as possible”.*

#### 7.1.2. CLUSTER 1 IMPACT STATEMENT

The proposed gas production activities, particularly in relation to well sites, compressor stations, pipelines and the combined helium and CNG plant, have the potential to positively and negatively impact the receiving environment within and surrounding the Cluster 1 study area.

##### 7.1.2.1. IDENTIFYING IMPACTS

The potential impacts from the proposed Cluster 1 activities on the receiving environment were determined by various specialists and the EAP based on experience with similar developments, knowledge of the study area, and site assessments. Input on potential impacts was also obtained from public consultation with affected and surrounding landowners and occupiers, as well as relevant organs of state and key stakeholders. Various impacts were identified during the scoping phased, largely based on desktop investigations which were subsequently verified through broad on-site assessments and I&AP input. Impacts identified during scoping were filtered to ascertain which impacts would be assessed further in more detailed on-site assessments of the Cluster 1 proposed production footprint

alternatives (well sites, pipeline routes, compressor stations, and combined helium and CNG plant locations). Certain identified impacts were scoped out based on the following:

- The EIA phase would not result in significant new information to alter/change the impact significance score;
- No fatal flaws were identified;
- The impact significance score would not vary regardless of final/ preferred alternative(s) in particular the location of the combination helium and CNG plant; and
- The impact can be managed adequately through standard management and mitigation measures.

The remaining impacts assessed in detail during the EIA phase pertain to the following aspects: heritage, social, economics, soil and agricultural potential, ecology, aquatic ecology and wetlands, hydrology (surface water), hydrogeology (groundwater), noise, and air quality. These impacts were assessed and are presented in the EIA Report. The significance of each impact pre-mitigation was calculated as well as the post-mitigation score in accordance with the impact assessment methodology. The post-mitigation score was either the same or an improvement on the pre-mitigation score, based on the proposed mitigation measures. This indicates that should the proposed mitigation and management measures be implemented successfully, the impact would either be reduced to a lower significance or at least remaining the same.

Thereafter, it was necessary to further assess each potentially significant impact in terms of:

- Cumulative impacts;
- The degree to which the impact may cause irreplaceable loss of resources; and
- The inclusion of public opinion and sentiment regarding a prospective development and consequent potential impacts is considered in the decision making process.

In an effort to ensure that these factors were considered, an impact prioritisation factor (PF) was applied to each post-mitigation impact score. This prioritisation factor does not detract from the risk ratings (ER) but rather focuses the attention of the decision-making authority on the higher priority/significance issues and impacts. In order to determine the final impact significance the PF is multiplied by the ER of the post mitigation scoring. The ultimate aim of the prioritisation factors (cumulative impacts, degree of irreplaceable loss and public opinion) is to be able to increase the post-mitigation environmental risk rating by a full ranking class, if all the priority attributes are high (i.e. if an impact comes out with a medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential, significant public response, and significant potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a high significance). Based on these steps, the final significance scores of all identified and assessed impacts were determined, and then compared to ascertain which impacts were of a higher significance to the environment as a result of Cluster 1 gas

production activities. Table 5<sup>3</sup> below presents the Cluster 1 impacts found to be of medium to high (positive and negative) final significance, including an indication of their pre- and post-mitigation significance scores.

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<sup>3</sup> Medium final significance = score equal to or greater than 10 but less-than 20; and High final significance = score equal to or greater than 20

**TABLE 5: CLUSTER 1 IMPACTS WITH MEDIUM TO HIGH POSITIVE OR NEGATIVE FINAL SIGNIFICANCE SCORES**

| IMPACT  | PHASE        | PRE-MITIGATION | POST-MITIGATION | FINAL SCORE |
|---|--------------|----------------|-----------------|-------------|
| Interference with existing land uses/livelihoods  | Planning     | -12.50         | -9.00           | -15.00      |
| Damage to farm roads and existing infrastructure  | Planning     | -10.00         | -9.00           | -13.50      |
| Impacts on livelihoods due to behaviour of contractors (leaving gates open, driving off-road, leaving garbage on the properties, lack of sanitation facilities) | Planning     | -12.00         | -11.00          | -20.17      |
| Alternative land-use  | Construction | -7.50          | -7.50           | -11.25      |
| Black economic transformation   | Construction | +10.00         | +10.00          | +15.00      |
| Country and industry competitiveness  | Construction | +15.00         | +15.00          | +22.50      |
| Economic development per capita   | Construction | +7.00          | +7.00           | +10.50      |
| Employment impacts  | Construction | +8.00          | +8.00           | +10.67      |
| GDP impact  | Construction | +10            | +10.00          | +13.33      |
| Need and desirability   | Construction | +12            | +12.00          | +18.00      |
| Interference with existing land uses/livelihoods  | Construction | -13.00         | -11.00          | -20.17      |
| Increase in poaching incidents  | Construction | -11.00         | -9.00           | -10.50      |
| Nuisance factor due to increase in ambient dust and noise levels  | Construction | -9.00          | -9.00           | -10.50      |
| Obstruction of access routes/interference with existing movement patterns   | Construction | -10.00         | -9.00           | -10.50      |
| Safety of all road users compromised as a result of access points on the R30  | Construction | -12.00         | -11.00          | -20.17      |
| Impacts on livelihoods due to behaviour of contractors (leaving gates open, driving off-road, leaving garbage on the properties, lack of sanitation facilities) | Construction | -12.00         | -11.00          | -20.17      |
| Impacts on safety and security of local residents due to presence of unfamiliar people in the area  | Construction | -17.50         | -16.25          | -32.50      |
| Impacts on existing services and infrastructure   | Construction | -11.00         | -10.00          | -13.33      |
| Loss/change of sense of place due to visual impacts and project activities  | Construction | -16,25         | -15             | -27.50      |
| Increase in social licence to operate due to management of nuisance impact  | Construction | +6.00          | +9.00           | +15.00      |
| Increase in social pathologies such as prostitution, sexually transmitted diseases, teenage pregnancies and alcohol and substance abuse                         | Construction | -14.00         | -13.00          | -19.50      |
| Establishment of informal settlements close to the project area   | Construction | -12.00         | -11.25          | -20.63      |
| Disruption of watercourse hydrology along proposed pipeline/trunkline alignments, and at proposed new wells   | Operation    | -18.75         | -7.50           | -10.00      |
| Decrease in surface water quality at Compressor ST23 (edge effects):  | Operation    | -15.00         | -10.00          | -10.00      |
| Decrease in surface water quality at Sibanye compressor and helium plant Alternative 2  | Operation    | -11.00         | -7.50           | -10.00      |
| Alternative land-use  | Operation    | -10.00         | -10.00          | -15.00      |
| Black economic transformation   | Operation    | +12.00         | +12.00          | +18.00      |

| IMPACT  | PHASE           | PRE-MITIGATION | POST-MITIGATION | FINAL SCORE |
|---|-----------------|----------------|-----------------|-------------|
| Country and industry competitiveness  | Operation       | +18.00         | +18.00          | 27.00       |
| Economic development per capita   | Operation       | +9.00          | +9.00           | +13.50      |
| Employment impacts  | Operation       | +10.00         | +10.00          | +13.33      |
| Fiscal income   | Operation       | +13.00         | +13.00          | +13.00      |
| Forex savings   | Operation       | +11.00         | +11.00          | +11.00      |
| GGP impact  | Operation       | +12.00         | +12.00          | +16.00      |
| Need and desirability   | Operation       | +14.00         | +14.00          | +21.00      |
| Reducing groundwater available to existing users  | Operation       | -14.00         | -6.00           | -10.00      |
| Stray gas migration affecting groundwater quality   | Operation       | -12.00         | -6.00           | -11.00      |
| Potential to use local service providers and contribute directly to local economy   | Operation       | +8.25          | +12.00          | +16.00      |
| Impacts on livelihoods due to behaviour of contractors (leaving gates open, driving off-road, leaving garbage on the properties, lack of sanitation facilities) | Operation       | -13.00         | -12.00          | -22.00      |
| Interference with livelihoods   | Operation       | -14.00         | -12.00          | -22.00      |
| Nuisance factor due to increase in ambient dust and noise levels  | Operation       | -10.00         | -10.00          | -11.67      |
| Interference with existing road use patterns  | Operation       | -11.00         | -10.00          | -11.67      |
| Safety of all road users compromised as a result of access points on the R30  | Operation       | -13.00         | -12.00          | -22.00      |
| Loss/change of sense of place due to visual impacts and project activities  | Operation       | -17.50         | -16.25          | -29.79      |
| Safety and security of local residents due to movement of people across the servitude, especially at night time   | Operation       | -18.75         | -17.5           | -35.00      |
| Black economic transformation   | Decommissioning | -16.00         | -16.00          | -29.33      |
| Country and industry competitiveness  | Decommissioning | -19.00         | -19.00          | -34.83      |
| Economic development per capita   | Decommissioning | -7.00          | -7.00           | -12.83      |
| Employment impacts  | Decommissioning | -8.00          | -8.00           | -16.00      |
| Fiscal income   | Decommissioning | -16.25         | -16.25          | -21.67      |
| Forex savings   | Decommissioning | -13.75         | -13.75          | -27.50      |

| IMPACT   | PHASE             | PRE-MITIGATION | POST-MITIGATION | FINAL SCORE |
|--|-------------------|----------------|-----------------|-------------|
| GGP impact   | Decommissioning   | -10.00         | -10.00          | -20.00      |
| Need and desirability  | Decommissioning   | -12.00         | -12.00          | -18.00      |
| Potential to use local service providers and contribute directly to local economy                  | Decommissioning   | +7.50          | +11.00          | +14.67      |
| Interference with existing land uses   | Decommissioning   | -13.00         | -11.00          | -20.17      |
| Impacts on existing services and infrastructure  | Decommissioning   | -13.00         | -11.00          | -20.17      |
| Re-instate access routes give access to land/infrastructure that was cut off by the project        | Decommissioning   | +6.75          | +10.00          | +11.67      |
| Increase in social licence to operate due to management of nuisance impacts                        | Decommissioning   | +6.00          | +9.00           | +15.00      |
| Impacts on safety and security of local residents due to presence of unfamiliar people in the area | Decommissioning   | -17.50         | -16.25          | -32.50      |
| Alternative Land-use   | Rehab and closure | +11.25         | +11.25          | +13.13      |
| Black economic transformation  | Rehab and closure | -16.00         | -16.00          | -29.33      |
| Country and industry competitiveness   | Rehab and closure | -16.00         | -16.00          | -29.33      |
| Economic development per capita  | Rehab and closure | -12.50         | -12.50          | -22.92      |
| Employment impacts   | Rehab and closure | -13.75         | -13.75          | -27.50      |
| Fiscal income  | Rehab and closure | -16.25         | -16.25          | -21.67      |
| Forex savings  | Rehab and closure | -13.75         | -13.75          | -27.50      |
| GGP impact   | Rehab and closure | -16.25         | -16.25          | -32.50      |
| Need and desirability  | Rehab and closure | -15.00         | -15.00          | -22.50      |
| Well casing and/or cementation failure affecting groundwater quality                               | Rehab and closure | -12.75         | -7.50           | -13.75      |
| Potential to use local service providers and contribute directly to local economy                  | Rehab and closure | +7.50          | +11.00          | +14.67      |
| Impacts on safety and security of local residents due to presence of unfamiliar people in the area | Rehab and closure | -17.50         | -16.25          | -32.50      |
| Interference with existing land uses/livelihoods   | Rehab and closure | -13.00         | -11.00          | -20.17      |

| IMPACT  | PHASE             | PRE-MITIGATION | POST-MITIGATION | FINAL SCORE |
|---|-------------------|----------------|-----------------|-------------|
| Increase in social licence to operate due to management of nuisance impacts | Rehab and closure | +6.00          | +9.00           | +15.00      |



#### 7.1.2.2. KEY FINDINGS

Overall, most impacts assessed during the EIA phase, as well as those scoped out during the scoping phase, were found to be of low to medium final significance should all recommended mitigation and management measures be implemented. However, there are a number of impacts that yielded high final positive and negative significance scores, as presented in Table 6. All positive and negative high significance impacts were either economic or social. The positive economic significance is related to the economic potential for Cluster 1 to positively enhance the country and industry competitiveness regarding gas production, as well as the overall need and desirability of the project during the construction and operational phases. The decommissioning and closure phases of Cluster 1 yield negative economic impact significance due to the loss of the gas production to the local and national economy. With regards to the negative high significance social impacts, these are largely related to the affected landowners/ community perceptions and previous experience with large mining projects which have taken place in the vicinity of the proposed Cluster 1 activities. Extensive mitigation measures have been proposed for all identified impacts, including those related to the socio-economic environment. Therefore, with the successful implementation of all proposed mitigations as well as regular communication with landowners and occupiers, and efficient and timely responses to raised issues throughout the duration of the gas production activities, these impacts can be successfully managed. As such, it is the EAP's opinion that there are no identified fatal flaws or impacts of great concern from Cluster 1 gas production activities that cannot be managed and mitigated to a satisfactory level.

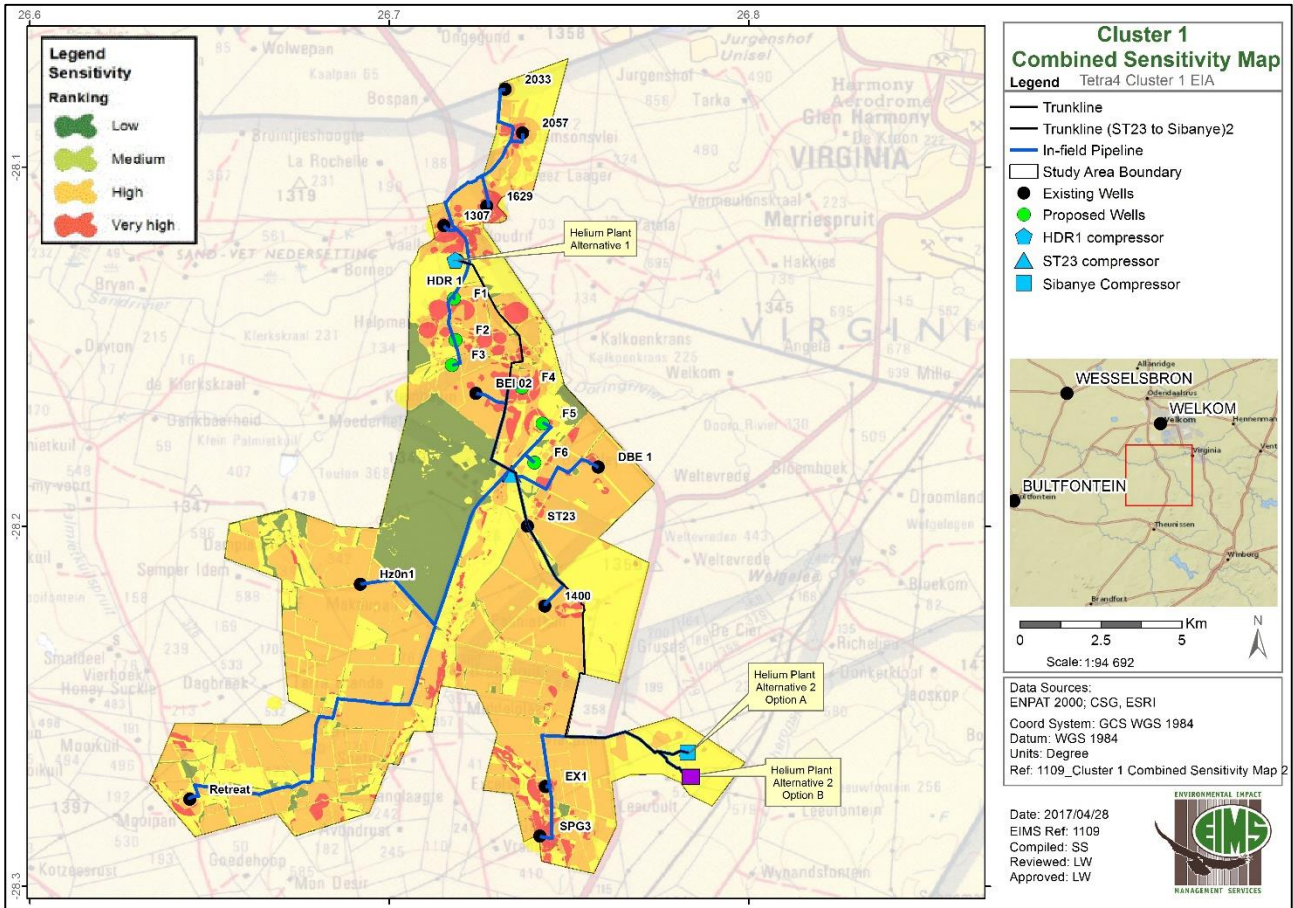
TABLE 6: SUMMARY OF CLUSTER 1 POSITIVE AND NEGATIVE HIGH FINAL SIGNIFICANCE IMPACTS

| MEDIUM TO HIGH POSITIVE IMPACTS (BASED ON FINAL SIGNIFICANCE SCORE)   | PHASE                      | MEDIUM TO HIGH NEGATIVE IMPACTS (BASED ON FINAL SIGNIFICANCE SCORE)  |
|---|----------------------------|--|
| None.   | Planning                   | <ul style="list-style-type: none"> <li>✘ Impacts on livelihoods due to behaviour of contractors (leaving gates open, driving off-road, leaving garbage on the properties, lack of sanitation facilities)</li> </ul>  |
| <ul style="list-style-type: none"> <li>✘ Country and industry competitiveness</li> </ul>                                  | Construction               | <ul style="list-style-type: none"> <li>✘ Interference with existing land uses/livelihoods</li> <li>✘ Safety of all road users compromised as a result of access points on the R30</li> <li>✘ Impacts on livelihoods due to behaviour of contractors (leaving gates open, driving off-road, leaving garbage on the properties, lack of sanitation facilities)</li> <li>✘ Impacts on safety and security of local residents due to presence of unfamiliar people in the area</li> <li>✘ Loss/change of sense of place due to visual impacts and project activities</li> <li>✘ Establishment of informal settlements close to the project area</li> </ul> |
| <ul style="list-style-type: none"> <li>✘ Country and industry competitiveness</li> <li>✘ Need and desirability</li> </ul> | Operation                  | <ul style="list-style-type: none"> <li>✘ Impacts on livelihoods due to behaviour of contractors (leaving gates open, driving off-road, leaving garbage on the properties, lack of sanitation facilities)</li> <li>✘ Interference with livelihoods</li> <li>✘ Safety of all road users compromised as a result of access points on the R30</li> <li>✘ Loss/change of sense of place due to visual impacts and project activities</li> <li>✘ Safety and security of local residents due to movement of people across the servitude, especially at night time</li> </ul>  |
| None.   | Decommissioning            | <ul style="list-style-type: none"> <li>✘ Black economic transformation</li> <li>✘ Country and industry competitiveness</li> <li>✘ Fiscal Income</li> <li>✘ Forex savings</li> <li>✘ GGP impact</li> <li>✘ Interference with existing land uses</li> <li>✘ Impacts on existing services and infrastructure</li> <li>✘ Impacts on safety and security of local residents due to presence of unfamiliar people in the area</li> </ul>   |
| None.   | Rehabilitation and closure | <ul style="list-style-type: none"> <li>✘ Black economic transformation</li> <li>✘ Country and industry competitiveness</li> <li>✘ Economic development per capita</li> <li>✘ Employment impacts</li> <li>✘ Fiscal income</li> <li>✘ Forex savings</li> </ul>   |

|  |  |  |
|--|--|--|
|  |  | <ul style="list-style-type: none"><li>☒ GGP impact</li><li>☒ Need and desirability</li><li>☒ Impacts on safety and security of local residents due to presence of unfamiliar people in the area</li><li>☒ Interference with existing land uses/livelihoods</li></ul> |
|--|--|--|

### 7.1.2.3. IDENTIFIED ALTERNATIVES

Based on the identified and assessed impacts, key findings from specialists and the EAP informed by the detailed site assessments, as well as I&AP input, various alternatives were investigated including those related to the location of the Cluster 1 activities (new gas wells, compressor station, pipeline routes and the combined helium and CNG plant). Sensitivity mapping was utilised to identify the final preferred location alternatives as presented in Figure 8 below.



**FIGURE 8: FINAL SENSITIVITY AND LOCATION ALTERNATIVES FOR WELLS, PIPELINE ROUTES, COMPRESSOR STATIONS AND THE COMBINED HELIUM AND CNG PLANT**

Based on the key findings of the impact assessment and sensitivity analysis, there was very little difference between the two pipeline alternatives considered towards selecting the preferred option, pipeline route P2 with two compressor stations at HDR1 and ST23, leading to the combined helium and CNG plant near HDR1 referred to as HP1; as well as the pipeline route alternative P4 which has three compressor stations at HDR1, ST23, and at Sibanye shaft 1 complex, leading to the combined helium and CNG plant also at Sibanye shaft 1 complex referred to as HP2. However, the specialist impact assessments indicated a slight preference for the location of the combined helium plant at HP2.

The HP2 location was slightly preferred largely as it is located on an already disturbed site with existing mining activities and is removed from most residential areas and main rivers. HP2, has been allocated two location options (Option A and Option B) for the location of the plant due to the present of an artificial wetland in the vicinity of one of the options (Option A). Both options of HP2 are recommended for approval. The location of the plant at HP2 however, is subject to the timely conclusion of a signed agreement between Tetra 4 and

Sibanye. In the event that an agreement is not reached, then HP1 will become the preferred location of the combined helium and CNG plant.

With regards to the selection of the final preferred pipeline route alignment, although these were deemed very similar by the various specialists, the final preferred pipeline route was preceded by three revisions incorporating inputs from landowner consultations, specialist assessments, and inputs from the engineering design teams (as described in Section 9 of the EIA report).

It should also be noted that approval for the proposed Cluster 1 pipeline routes be for a 50 m (25 m on either side of the pipeline centre line) corridor, as per the area assessed in detailed during the EIA phase. This corridor will allow for the micro-siting of the pipeline placement during construction whereby any sensitivities and limitations on site may be avoided accordingly. Furthermore, as the final location of the new wells is not yet definite, it is recommended that approval for the new wells be such that the well sites should be located within the area assessed in detail during the EIA phase (1 km). The final locations of the well sites within the assessed 1 km buffer area should be informed by the final sensitivity map whereby the wells are kept within the low environmental sensitivity areas as far as possible.

It is therefore, the EAP's opinion that pipeline route alternative P4 associated with plant location at HP2 (either options A and B) are slightly preferred. However overall, both P2 and HP1 as well as P4 and HP2 can be approved as there is very little difference between them with regards to their potential impacts, sensitivities, and associated mitigation measures in relation to proposed Cluster 1 gas production activities.

Please refer to APPENDIX 1 for the full list of impacts identified for Cluster 1, together with the summary of the significance assessment. These impacts have been utilised to populate the management and mitigations measures listed in this EMPR which will control Production Activities.

## 7.2. ENVIRONMENTAL SENSITIVITY

The sensitivity/constraint map will form an integral part of proactive mitigation of impacts during the planning and design phase of the ongoing Production Operations extending across the entire production Right area. The sensitivity map will guide development by the applicant for the total full field development over the Life of Production, by restricting the impact footprint in certain areas deemed as sensitive. Areas that are not sensitive will be covered through this general EMPR, while areas that would fall into the medium, high and very high sensitivity would require site specific EMPR's and mitigation measures, of which Cluster 1 represents a site specific/cluster specific EMPR. This would allow for a strategic approach to be adopted where additional mitigation measure are introduced to mitigate impacts in sensitive areas, while also providing the applicant with an indication of potential environmental issues to be expected in the sensitive geographical locations. Please refer to APPENDIX 2 for the Sensitivity Map/s.

As the production phase continues to expand the number of wells, the sensitivity approach would continually guide development and mitigation through identifying areas that require a site specific EMP. Before a new activity is constructed its location will be identified on the sensitivity map, this will inform Tetra 4 on whether a site specific EMPR will be required, once this is confirmed, specialist input is obtained to mitigate potential impacts for that specific site in addition to the general EMPR provisions. Any new activity which falls within an area designated as medium or high sensitivity will be subject to the requirements of a site specific EMPR (refer to FIGURE 9). The intention will be that as the Production Activities expand on a spatial and temporal scale

that this EMPR will be supplemented as is required with separate site specific EMPR's (similarly to what has been done for Cluster 1).

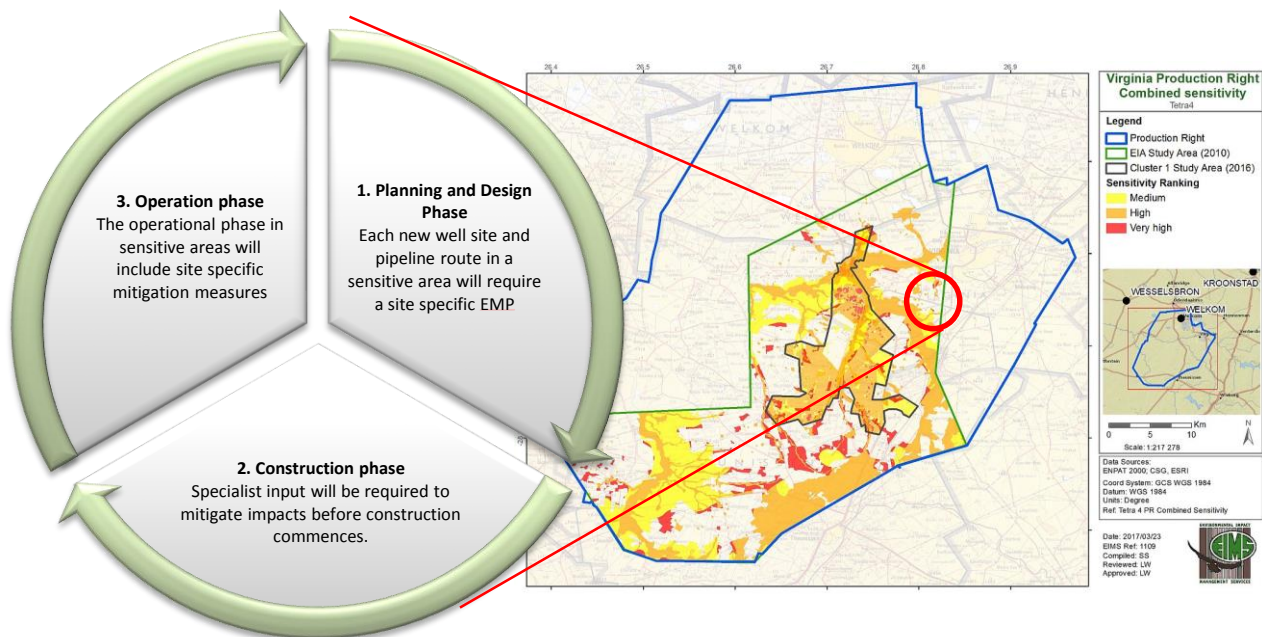


FIGURE 9: SENSITIVITY IMPLEMENTATION CYCLE FOR THE PRODUCTION APPLICATION

### 7.3. IMPACT MANAGEMENT OBJECTIVES, OUTCOMES, AND ACTIONS

This EMPR sets out the methods by which proper environmental controls are to be implemented by Tetra 4 and where relevant its appointed contractors. It has been compiled as a guideline for the mitigation and management measures to be implemented throughout the Production lifecycle (planning through to closure). The EMPR provides specifications that must in all instances be adhered to. It is however the responsibility of all people involved to commit to the implementation of the EMPR in all phases of the project.

The broad objective for the management of environmental impacts is to reduce the significance of each negative impact and enhance positive impacts which have been identified during the EIA through a combination of the following:

1. Minimize disturbance to the physical and biological environment;
2. Minimize or prevent disturbance to any sites of cultural or heritage values; and to
3. Minimize or enhance any socio-economic impacts that might result from the proposed activity.

Failure to comply with the EMPR may result in the suspension of part or all of the works if the responsible party causes damage to the environment by not adhering to the specifications set within the EMPR. The suspension will be enforced until such time as the offending parties' actions, procedure and/or equipment are corrected.

It should be noted that the EMPR as provided in represents the outcome of both the original EIA undertaken for the overall Production Right, as well as the relevant inputs provided and required as a consequence of the ongoing site specific impact assessment and EMPR's. Effort has been made in the EMPR and specifically

APPENDIX 3 to allow for distinction between management and mitigations measures which apply to all aspects of the Production Right in general terms, and those management and mitigation measures which apply to a specific activity and/or area (e.g. Cluster 1).

As further areas and site specific management and mitigations measures are identified throughout the future phases of Production, this EMPR will be supplemented. Unless otherwise specified all conditions contained herein will apply to all relevant aspects of the current and future production activities.

## 8. ENVIRONMENTAL INCIDENTS

For the purposes of this project, an environmental incident can be divided into three levels, i.e. major, medium and minor. All Major and Medium environmental incidents shall be recorded in the incident register (either separate or consolidated with a Non-compliance Register). Minor incidents do not need to be reported, but require immediate rectification on site. Definitions and examples of environmental incidents are provided in TABLE 7.

**TABLE 7: DESCRIPTION OF INCIDENTS AND NON-CONFORMANCES FOR THE PURPOSE OF THE PROJECT**

|                                      |   |
|--------------------------------------|---|
| <b>Non-Conformance</b>               | Any deviation from work standards, practices, procedures, regulations, management system performance etc. that could either directly or indirectly lead to injury or illness, property damage, damage to the workplace environment, or a combination of these.  |
| <b>Major Environmental Incident</b>  | <p>An incident or sequel of incidents, whether immediate or delayed, that results or has the potential to result in widespread, long-term, irreversible significant negative impact on the environment and/or has a high risk of legal liability.</p> <p>A major environmental incident usually results in a significant pollution and may entail risk of public danger. Major environmental incidents usually remain an irreversible impact even with the involvement of long-term external intervention i.e. expertise, best available technology, remedial actions, excessive financial cost etc. Major environmental incidents may be required to be reported to the authorities. The ECO shall make the final decision as to whether a particular incident should be classified as a Major incident.</p> <p>An example of a Major environmental incident would be a significant spillage (e.g. 500 litres) of fuel into a watercourse.</p> |
| <b>Medium Environmental Incident</b> | <p>An incident or sequel of incidents, whether immediate or delayed, that results or has the potential to result in widespread or localised, short term, reversible significant negative impact on the environment and/or has a risk of legal liability.</p> <p>A medium environmental incident may be reported to the authorities, can result in significant pollution or may entail risk of public danger. The impact of medium environmental incidents should be reversible within a short to medium term with or without intervention. The ECO shall make the final decision as to whether a particular incident should be classified as a Medium incident.</p>   |

|                                     |   |
|-------------------------------------|---|
|                                     | An example of a Medium environmental incident would be a large spill of fuel (e.g. 20 – 50 litres) onto land.   |
| <b>Minor Environmental Incident</b> | <p>An incident or sequel of incidents, whether immediate or delayed, where the environmental impact is negligible immediately after occurrence and/or once-off intervention on the day of occurrence.</p> <p>An incident where there is unnecessary wastage of a natural resource is also classified as a minor environmental incident. An example would be leaking water pipes that result in the wastage of water.</p> <p>A minor environmental incident is not reportable to authorities. An example of a minor incident is day to day spills of fuel or oil onto the ground where the spill is less than one or two litres. Minor incidents are easily rectified and shall be addressed immediately after being identified on site.</p> |

The following incident reporting procedures shall apply to this project:

- ✎ All environmental incidents shall be reported to Contractor's EO and Holders EO who shall ensure that the appropriate rectification is undertaken;
- ✎ The EO shall record all medium and major incidents in the incident register and advise on the appropriate measures and timeframes for corrective action;
- ✎ An incident report shall be completed by party responsible for the incident for all medium and major incidents and the report shall be submitted to the Production Manager and EO within 5 calendar days of the incident;
- ✎ The EO shall investigate all medium and minor incidents and identify any required actions to prevent a recurrence of such incidents;
- ✎ In the event of an emergency incident (unexpected sudden occurrence), including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution of or detriment to the environment, whether immediate or delayed, the Applicant shall notify the relevant authorities in accordance with legal requirements (e.g. Section 30 of NEMA and Section 20 of the NWA). In the event of a dispute in terms of the classification of a such an incident, the Applicant shall engage the ECO to advise on the potential reporting requirements in terms of the above.

## 9. ENVIRONMENTAL EMERGENCIES AND REMEDIATION

### 9.1. PROCEDURE FOR ENVIRONMENTAL EMERGENCIES AND REMEDIATION

The Holder must identify potential emergencies and develop procedures for preventing and responding to them. There are several options for dealing with high priority impacts and risks, as the paradigm has two components, probability and consequence. The design of control measures rest on the understanding the cause and effect. Best practise is to intervene with the ultimate factors were feasible, rather than treat the outcomes. Emergency response therefore has the option of reducing probability, or reducing the consequence,



reducing the probability is the preferred option. Below are some common emergency preparedness approaches:

- ✎ Threat consequence if and when the risk eventuates, when the risk becomes an issue;
- ✎ Combine reducing the probability and treating the consequence;
- ✎ Offset environmental losses by investing in other assets;
- ✎ Not manage some of the risks because there are too many; and
- ✎ Make provision to manage residual impacts or issues that arise because of shortcomings in risk identification and rating, avoidance and mitigation or because a rare event has occurred.

Residual impacts are those impacts that despite reducing the probability and consequence might still occur. In these cases parties will have to be compensated, pollution cleaned up and damage to the environment remediated.

The Holder shall be required to develop and implement an Emergency Preparedness and Response Plan (EPRP). The EPRP should be based on a baseline Hazard and Risk Assessment and should provide for the following as a minimum:

- ✎ Risk assessment (identification of areas where accidents and emergency situations may occur, communities and individuals that may be impacted);
- ✎ Response procedures;
- ✎ Provision of equipment and resources;
- ✎ Designation of responsibilities;
- ✎ Communication and reporting (including that with potentially Affected Communities)
- ✎ Periodic training to ensure effective response; and
- ✎ Periodic review and revision, as necessary, to reflect changing conditions.

The Holder must ensure that the EPRP makes provision for environmental emergencies, including, but not limited to;

- ✎ Fire Prevention;
- ✎ Fire Emergency Response;
- ✎ Spill prevention;
- ✎ Spill Response;
- ✎ Contamination of a water resource;
- ✎ Accidents to employees; and
- ✎ Use of hazardous substances and materials, etc.

The Holder and Contractor must ensure that lists of all emergency telephone numbers/contact persons (including fire control) are kept up to date and that all numbers and names are posted at relevant locations throughout the lifespan of the project.

## **9.2. FIRE PREVENTION AND RESPONSE**

Fires represent a significant risk to petroleum production activities and require special attention in the Emergency Response Plan. Sparks generated during construction and operations (e.g. welding, cutting of metal or gas cutting can result in fires). Every possible precaution shall therefore be taken when working with this equipment near potential sources of combustion. The contractor/Holder must take all reasonable measures to ensure that fires are not started as a result of activities on site. No smoking is allowed near hydrocarbon sources or containers with flammable contents or at areas that are highly flammable. Smoking is only permitted at areas designated for smoking. No open fires are permitted on site and no burning of waste is to be allowed on site. The contractor/Holder shall ensure that there is sufficient firefighting equipment available on site at all times. Such precautions include having an approved fire extinguisher immediately available at the site of any such activities. The contractor/Holder is to ensure that he/she has the contact details of the nearest fire station in case of an emergency. Appropriate and correctly serviced equipment must be available for all activities that are likely to generate fire.

It is further anticipated that firebreaks may be required around the site perimeter. It is recommended that such fire prevention measures are implemented in consultation with adjacent landowners and where necessary that the Holder coordinates fire prevention efforts with local FPA.

## **9.3. HEALTH AND SAFETY**

The Holder and Contractor/s shall make allowance for the supply, erection, maintenance and removal of the information boards where appropriate. Information boards shall also provide the name of the relevant contact person and contact number. This will ensure that the public access to request information and/or to lodge any complaints. The boards will essentially be to advise the public of the construction activities to be undertaken, or being undertaken and where applicable to advise of the prohibition of entering demarcated “no-go” areas.

The Holder and Contractor must ensure that compliance with the Mine Health and Safety Act (Act No. 29 of 1996) (where applicable) and the Occupational Health and Safety Act (Act No. 85 of 1993) is strictly adhered to. All reasonable measures must be taken to ensure the safety of all site staff and the surrounding community is not compromised. No weapons may be brought onto the property by any person. Where fencing is temporarily affected, temporary security must be provided at all times until the fence is reinstated.

The Holder and Contractor/s must ensure that all vehicles using public roads are in a roadworthy condition, that drivers adhere to the speed limits and that their loads are secured and that all local, provincial and national regulations are adhered to. Provision shall be made for flagmen to regulate traffic and construction vehicles when necessary.

The Holder and Contractor must ensure that all accidents and incidents are recorded and, where appropriate, reported to the ECO. The Holder/ contractor must have easy access to all relevant emergency numbers for example, spill response teams, fire authorities, fire protection associations, medical emergency, nearest

emergency rooms (hospitals) to the site, of both private and public hospitals. The Holder and Contractor/s must take all reasonable measures to ensure the health and safety of all employees, visitors and the public.

#### **9.4. SPILL RESPONSE PROCEDURE**

All employees, staff and labourers must be instructed regarding implementation of spill prevention measures and spill response procedures. In the event of a spill, the following general requirements shall apply and the detailed spill procedure must cater for these requirements;

- Immediately reporting of spills by all employees and/or visitors to the relevant supervisor and EO (this requirement must be including in induction training);
- Take immediate action to contain or stop the spill where it is safe to do so;
- Contain the spill and prevent its further spread (e.g. earth berm or oil absorbent materials for spill to land or by deploying booms and/or absorbent material for a spill to water);
- Dispose of any contaminated soil or materials according to appropriate waste disposal procedure. Note: Waste from spills of hazardous materials shall be disposed of as hazardous waste at a suitably licensed waste disposal facility;
- The Contractor's EO and holder EO shall record details of the spill in their respective incident registers;
- Photographic evidence shall be obtained of the spill cleanup.

In the case of large spills, the services of a specialist spill response agency shall be required, who shall advise on appropriate cleanup procedures and follow-up monitoring (if required).

In the event of any spills which are classified as medium or major incidents, the EO shall immediately inform the ECO. The ECO shall record the incident in the ECO's non-conformance and incident register and advise on the appropriate measures and timeframes for corrective action. Environmental incident reports shall be completed and submitted to the Production Manager and ECO within 5 working days for all medium and major incidents. If there is a requirement to report the incident to the authorities, this shall be done by the Applicant in consultation with the ECO.

The Applicant must also, (as per Section 30 of the NEMA) notify the Director-General (DWA, DEA and DMR), South African Police Services, Free State Environmental Authority and Local Municipality and any persons whose health may be affected of the nature of an incident including:

- Any risks posed to public health, safety and property,
- Toxicity of the substance or by products released by the incident and
- Any step taken to avoid or minimise the effects of the incident on public health and the environment

The Applicant and Contractor must ensure that lists of all emergency telephone numbers/contact persons (including fire control) are kept up to date and that all numbers and names are posted at relevant locations throughout the lifespan of the project.

## 9.5. MEASURES TO CONTROL OR REMEDY ANY CAUSES OF POLLUTION OR DEGRADATION

The broad measures to control or remedy any causes of pollution or environmental degradation as a result of the proposed activities are provided below:

- ✎ Limit the size of the area to be disturbed as far as is practically possible;
- ✎ Design and construct infrastructure with necessary clean and dirty water separation, containment, and stormwater management plans;
- ✎ Conduct regular inspections in line with the regulatory requirements;
- ✎ Establish and maintain dirty and clean water systems in line with the regulatory requirements;
- ✎ Treat all contaminated water prior to discharge;
- ✎ Contain potential pollutants and contaminants (where possible) at source;
- ✎ Handling of potential pollutants and contaminants (where possible) must be conducted in bunded areas and on impermeable substrates;
- ✎ Ensure the timeous clean-up of any spills;
- ✎ Implement a waste management system for all waste stream present on site;
- ✎ Investigate any I&AP claims of pollution or contamination as a result of Production activities;
- ✎ Continue with concurrent rehabilitation;
- ✎ Operate the Production in line with the proposed closure goals and objectives;
- ✎ Rehabilitate the affected areas in line with the requirements of the detailed rehabilitation and closure plan; and
- ✎ Implement the action plans and technical management options described in this EMPR.

It is of critical importance that the broad measures to control or remedy any causes of pollution or environmental degradation are applied during all phases of the proposed Production. This is essential and allows for the operation to be conducted in a manner that will allow for the post Production closure goals and objectives to be met.

## 10. ENVIRONMENTAL AWARENESS PLAN

The aim of an environmental awareness programme is to create awareness between the employees of the implications which certain actions might have on the environment. The awareness programme should be implemented before any activity is commenced, and all staff should be made aware of the requirement of the EMPR and EMP.

The environmental awareness programme can be carried out by:

- ✎ Incorporating it as part of the induction process;
- ✎ Ensure that compliance with the relevant provisions of the EMPR are included in the contractual arrangements with sub-contractors;

- ✎ Initial Environmental Awareness Training will be carried out for all relevant senior production staff members in order to educate the staff on general environmental awareness as well as relevant aspects of the EMPR relating to the correct management and undertaking of their specific jobs;
- ✎ Regular toolbox talks during which certain environmental topics are discussed;
- ✎ On the job training of the potential impacts that certain of the activities might have; and
- ✎ Training in executing emergency procedures in the event of spills or fires.

A copy of the EMPR should be kept on site and records should be kept of the environmental awareness undertaken. Also in accordance with the provision of Regulation 13 of the NEMA Financial Provisions Regulation (2015), Tetra 4 must make this EMPR (and any amendments), available on their publicly accessible website (if available), and at the relevant site office/s, and available to the public on request.

## 11. REHABILITATION AND CLOSURE

The vision, and consequent objective and targets for rehabilitation, decommissioning and closure, aim to reflect the local environmental and socio-economic context of the project, and to represent both the corporate requirements and the stakeholder expectations as well as the legislative framework and regulations.

The receiving environment within which the exploration activities will be undertaken include the following key land-uses:

- ✎ Agriculture- cultivated fields;
- ✎ Natural and degraded veld primarily utilised or livestock grazing;
- ✎ Mining areas; and
- ✎ Low density rural residential.

With reference to the Issues and Responses Report (IRR) presented in the EIA Report, the stakeholders consulted during the public participation process for the EIA raised concerns regarding closure and rehabilitation, amongst others, the following:

- ✎ Impacts on ground water quality and availability;
- ✎ Impacts on surface water quality;
- ✎ The proposed pipeline alignment;
- ✎ Disruption of current land use and capability;
- ✎ Sense of place;
- ✎ The quantum for rehabilitation; and
- ✎ Security and access to individual farms.

With reference to both the environmental context of the project and the feedback from the consultation process the vision for closure is to: Ensure that the landscape is safe, stable and non-polluting over the long term, and that the post closure land use aligns with the surrounding land-use and does not affect the sustained utilisation thereof.

Driven by the closure vision and with due consideration of the project context the following closure objectives are presented:

- ✎ Set the course for eventual ecosystem restoration, including the restoration of the natural vegetation community, hydrology, and wildlife habitats.
- ✎ Prevent future environmental issues related to long term fluid or gas leakage or lateral movement through the well.
- ✎ Protection of water resources.
- ✎ Ensure that land is usable, in alignment with surrounding land uses.

Please refer to the detailed Final Rehabilitation, Decommissioning and Closure Plan, Incorporating an Annual Rehabilitation Plan and Environmental Risk Assessment as presented in an appendix to the EIA Report. Please note that during the life of Production this closure planning and consequent financial provisioning will undergo annual review and adjustment.

## 12. ENVIRONMENTAL MONITORING AND ACTION PLANS

This section provides a more detailed description of the intent, objectives and actions applicable to key environmental aspects associated with the Production. This section is supplementary to the specific impact management actions presented in Section 7.3, and should not be considered in isolation to the management objectives, outcomes and actions.

### 12.1. COMPLIANCE MONITORING

The appointed Independent ECO, EO as well as Tetra 4 are responsible for ensuring compliance with the EMPR. The following monitoring and auditing is specifically required:

- ✎ Daily Environmental Checklists and Diary (Construction/Decommissioning Phase): These checklists should be specific to the applicable activity being undertaken and should aim to provide a daily check and record of site environmental compliance;
- ✎ Monthly Compliance Reports (All Phases excl. post closure): These reports must be compiled by the EO and must aim to monitor and report on compliance with the requirements of the EA and EMPR and general environmental performance. This report must include the results of all environmental monitoring, including but not limited to:
  - Records of waste volumes and associated disposal records; and
  - Monitoring and detection results of all leakage or spillage of hazardous substances (incl. transport, handling, installation and storage).
- ✎ Monthly ECO Audits (Construction/decommissioning Phase): Monthly inspections and audits to be undertaken by an Independent ECO. Monthly Audit reports to be submitted to PASA. These audits will focus on monitoring EMPR compliance on active construction sites.
- ✎ Annual ECO Audits (All Phases excl post closure): This audit will be undertaken by the Independent ECO and will aim to meet the requirements of Regulation 34 as well as Appendix 7 of GNR 982. Reports will be compiled and submitted to the PASA.
- ✎ Post Construction/ Rehabilitation Independent Audit: A final close-out audit will be carried out by the Independent ECO at completion of closure and rehabilitation activities.
- ✎ Bi-annual (every 2 years) EMPR performance assessment reports (All Phases): These reports will be compiled and submitted to PASA as required in accordance with regulation 55(1).

All monitoring and auditing must be accompanied by applicable records and evidence (e.g. delivery slips, photographic records, etc.). All reports must be retained and made available for inspection by the ECO, the Applicant and /or the Relevant Competent Authorities. Copies of all documentation, permits, licences, and authorisations (incl. copy of EA and relevant amendments to the EMPR and EA, waste disposal certificates, disposal licences, water use licences, etc.) must be obtained and kept in a site environmental file.

An environmental compliance register must be prepared and maintained throughout construction, operation and decommissioning in order to monitor environmental concerns, incidents, and non-conformances. This register should be utilised to measure overall environmental performance.

The applicant must use the audit report findings to continually ensure that environmental protection measures are working effectively on site through a system of self-checking. The EMPR should be viewed as a dynamic document aimed at continual environmental performance improvement. In this regard the provisions of Regulation 34-37 of GNR 982 apply to the process of amending the EMPR.

## 12.2. GROUNDWATER MONITORING AND ACTION PLANS

Groundwater monitoring for the project should be undertaken to meet the following objectives:

- ✎ To measure the impacts of gas production on groundwater levels and quality;
- ✎ To detect short- and long-term water level and quality trends;
- ✎ To calculate aquifer parameters, like the rate of recharge and storage coefficients;
- ✎ To recognise changes in groundwater characteristics, to enable analysis of their causes and to trigger the appropriate groundwater management response;
- ✎ To check the accuracy of predicted impacts;
- ✎ To use the information gathered for model calibration and/or verification and
- ✎ To develop improved practices and procedures for groundwater protection.

The groundwater monitoring programme should include the following activities to ensure consistent results. It is noted that an external contractor (EIMS) is already undertaking a groundwater monitoring programme on behalf of Tetra4. The procedures implemented as part of the existing monitoring programme must be integrated into groundwater monitoring programme proposed here:

- ✎ Purging of the borehole prior to sampling to remove any stagnant water (where relevant depending on sample method). Stagnant water is likely to have degassed and would not provide representative dissolved methane and ethane results. Usually purging should involve removing at least 1 casing volume of standing water, if possible. Measuring field parameters like pH, temperature and EC can assist in determining when the borehole has been purged as stabilisation of these parameters usually indicates when sampling can begin;
- ✎ Sampling bottles must be rinsed with the water removed from the borehole to reduce the risk of incidental contamination;
- ✎ One sampling procedure that can be considered is the inverted bottle method based on the United States Geological Survey (USGS) approach (Walker and Mallants, 2014). This method involves the discharge of water into the bottom of a serum bottle until it is full. The bottle is then submerged into a bucket of water and groundwater is continued to be discharged into the bottle until it has been purged by two volumes of groundwater. This needs to be done without having bubbles adhering to the side of the bottle. A stopper is placed in the bottle and then crimp sealed with aluminium crimp caps;
- ✎ Samples should be transported in a cooler box, preferably at a temperature of 4°C, to the laboratory for analysis; and
- ✎ Analysis should preferably take place within 24 hours of sampling.



The baseline water quality presented in the EIA Report represents the benchmark against which monitoring results will be evaluated. It is recommended that routine monitoring of the hydrocensus boreholes include indicator elements. These are chosen as those elements that exceeded the SANS241:2015 Drinking Water Standards as well as dissolved methane and ethane, and are derived from the baseline monitoring results. In the event that daily pressure measurements or evaluation of the integrity of casing and cementation indicate a failure, the monitoring frequency and list of parameters analysed for must be increased, as indicated below.

Gas producing well integrity should be tested on a monthly basis during the life of the operations in order to detect failure and/or leaks as early as possible. Well monitoring should include:

- ✎ Pressure testing on surface for well casing/cementation or integrity failure (referred to as sustained casing pressure). If the results indicate a possible failure, the following tests must be undertaken immediately:
  - Running detection equipment down each well to detect leaks;
  - Migration of gas outside the well can be established by inserting a probe into the soil immediately surrounding the well; and
  - Sampling groundwater boreholes within the 250m radius delineated as part of this investigation.

The latter three tests should be undertaken annually even if no leaks are detected through pressure testing, as a precautionary measure.

Based on the boreholes identified during the 2016 hydrocensus, the existing monitoring database, the results of the hydrogeology (groundwater) impact assessment and the monitoring requirements discussed above, the following groundwater monitoring programme is recommended for the Cluster 1. It is recommended that the following additional monitoring boreholes are drilled for the project:

- ✎ A new dedicated monitoring borehole at each future gas production well that does not yet have a monitoring borehole (preferably within the defined zone of impact as per the specialist hydrogeological report).
- ✎ The following monitoring response triggers are proposed for the project.
  - The primary proof of connectivity between the deep-seated production zone and the shallow potable Karoo aquifer is water level drawdown and groundwater quality changes;
  - A lowering in groundwater level by more than 10m will trigger a response from Tetra4;
  - An increase in any of the indicator elements by more than 25% from baseline conditions will trigger a response from Tetra4;
- ✎ Once a response has been triggered, Tetra4 will launch an investigation and the management response will involve:
  - A check of nearby borehole use;
  - A check of nearby and recent water borehole and gas well drilling activities;
  - A check of climatic conditions and expected trends;

- If the outcome of these actions and the Tetra4 monitoring results indicate that the decline in groundwater level and/or in groundwater quality in a private borehole may be as a result of the impacts of Tetra4's activities, Tetra4 will enter into discussions with the affected borehole user to develop the correct course of action.

TABLE 8 provides the detail for the Groundwater Monitoring Programme. The groundwater monitoring programme must be reviewed on an annual basis. The monitoring positions, frequency and elements for analysis must be re-assessed at the hand of the monitoring results as well as against any incidents or exceedances that have occurred during the year.

TABLE 8: GROUNDWATER MONITORING PROGRAMME

| Activity/Phase  | Functional Requirements   | Performance Indicator/ Target  | Roles and Responsibilities | Frequency                          | Reporting Mechanism                |
|---|---|--|----------------------------|------------------------------------|------------------------------------|
| <b>Production Boreholes/ Production Phase</b>                 | <ul style="list-style-type: none"> <li>Pressure testing on surface for well casing/cementation or integrity failure- according to Tetra 4 Internal Procedures.</li> </ul>   | <ul style="list-style-type: none"> <li>Sustained well integrity</li> </ul>   | Tetra 4                    | As per well design report          | Pressure test logs                 |
| <b>Exploration and Production Boreholes (High Risk Zone).</b> | <ul style="list-style-type: none"> <li><u>Standards:</u> Guidance on Sampling Techniques (SABS ISO 5667:2:1991), Guidance on Sampling of Groundwater (SABS ISO 5667:11:2009) and Guidance on the Preservation and Handling of Samples (SABS ISO 5667:3:1994). Laboratory analysis undertaken at a SANAS Accredited Laboratory.</li> <li><u>Locations:</u> Hydrocensus boreholes within the zone of impact. Both equipped and unequipped boreholes must be included in the monitoring programme. In the event that monitoring of gas production wells indicates gas leaks, casing or cementation failure, all hydrocensus boreholes within a 3km radius of the affected gas production well must be included in the monitoring programme.</li> <li><u>Monitoring parameters (minimum):</u> Physio-chemical analysis: Dissolved methane, Dissolved ethane, Electrical Conductivity, pH, Total Dissolved Solids, Sodium, Chloride, manganese, barium, molybdenum and nitrate. Physical parameters: Groundwater level.</li> </ul> | <ul style="list-style-type: none"> <li>Alignment with background and baseline values. An increase in any of the indicator elements by more than 25% from baseline conditions will trigger a response from Tetra4. The lowering in groundwater level by more than 10m will trigger a response from Tetra4.</li> <li>No water supply (quality and quantity) complaints.</li> </ul> | Tetra 4                    | Bi-annually (March and September). | Annual Monitoring Report (January) |

| Activity/Phase  | Functional Requirements   | Performance Indicator/ Target  | Roles and Responsibilities | Frequency            | Reporting Mechanism                 |
|---|---|--|----------------------------|----------------------|-------------------------------------|
| <b>Exploration and Production Boreholes (Routine).</b>  | <ul style="list-style-type: none"> <li><u>Standards:</u> Guidance on Sampling Techniques (SABS ISO 5667:2:1991), Guidance on Sampling of Groundwater (SABS ISO 5667:11:2009) and Guidance on the Preservation and Handling of Samples (SABS ISO 5667:3:1994). Laboratory analysis undertaken at a SANAS Accredited Laboratory.</li> <li><u>Locations:</u> Existing Tetra4 monitoring points (BH01, BH02, BH03, BH04, BH05, BH07, BH08, BH09) and New Tetra4 monitoring points (Mon-2057, Mon-DHR1, Mon-F3, Mon-F4, new borehole at Helium Plant, new dedicated monitoring boreholes at wells).</li> <li><u>Monitoring parameters (minimum):</u> Full monitoring set<sup>4</sup>. Physical parameters: Groundwater level.</li> </ul> | <ul style="list-style-type: none"> <li>Alignment with background and baseline values. An increase in any of the indicator elements by more than 25% from baseline conditions will trigger a response from Tetra4. The lowering in groundwater level by more than 10m will trigger a response from Tetra4.</li> <li>No water supply (quality and quantity) complaints.</li> </ul> | Tetra 4.                   | Bi-Monthly.          | Bi-Monthly Monitoring Report.       |
| <b>Exploration and Production Boreholes (Baseline).</b> | <ul style="list-style-type: none"> <li><u>Standards:</u> Guidance on Sampling Techniques (SABS ISO 5667:2:1991), Guidance on Sampling of Groundwater (SABS ISO 5667:11:2009) and Guidance on the Preservation and Handling of Samples (SABS ISO 5667:3:1994). Laboratory analysis undertaken at a SANAS Accredited Laboratory.</li> <li><u>Locations:</u> All hydrocensus boreholes listed in TABLE 9.</li> </ul>   | <ul style="list-style-type: none"> <li>Alignment with background and baseline values. An increase in any of the indicator elements by more than 25% from baseline conditions will trigger a response from Tetra4. The lowering in groundwater level by more</li> </ul>   | Tetra 4.                   | Annually (December). | Annual Monitoring Report (January). |

<sup>4</sup> Parameter in the full monitoring set include: pH, Electrical conductivity (EC), Total Hardness, Total Dissolved Solids (TDS), Alkalinity, Ammonia (NH<sub>3</sub>), Bromide (Br), Nitrite (NO<sub>2</sub>), Total Nitrogen, Bicarbonate (HCO<sub>3</sub>), Fluoride, Chloride, Nitrate (NO<sub>3</sub>), Sulphate (SO<sub>4</sub>), Calcium (Ca), Potassium (K), Magnesium (Mg), Sodium (Na), Silver (Ag), Aluminium (Al), Arsenic (As), Boron (B), Barium (Ba), Beryllium (Be), Cadmium (Cd), Cobalt (Co), Chromium (Cr), Copper (Cu), Iron (Fe), Lithium (Li), Manganese (Mn), Molybdenum (Mo), Nickel (Ni), Lead (Pb), Antimony (Sb), Selenium (Se), Silicon (Si), Strontium (Sr), Thallium (Tl), Titanium (Ti), Vanadium (V), Zinc (Zn), MTBE, Benzene, TAME, Toluene, Ethyl Benzene, m+p-Xylene, o-Xylene, 1, 3, 5 Trimethyl benzene, 1, 2, 4 Trimethyl benzene, Naphthalene, Dissolved methane, Dissolved ethane, TPH GRO C6-C10, TPH GRO C10-C40, Polycyclic aromatic compounds, Total oil and grease.

| Activity/Phase                                  | Functional Requirements   | Performance Indicator/ Target   | Roles and Responsibilities | Frequency | Reporting Mechanism      |
|---|---|---|----------------------------|-----------|--------------------------|
|   | <ul style="list-style-type: none"> <li>Monitoring parameters (minimum): Full monitoring set<sup>5</sup>.<br/>Physical parameters: Groundwater level.</li> </ul>   | <p>than 10m will trigger a response from Tetra4.</p> <ul style="list-style-type: none"> <li>No water supply (quality and quantity) complaints.</li> </ul> |                            |           |                          |
| <b>Production Boreholes/ Production Phase</b>   | <ul style="list-style-type: none"> <li>Running detection equipment down each well to detect leaks.</li> <li>Migration of gas outside the well can be established by inserting a probe into the soil immediately surrounding the well.</li> <li>Internal Tetra 4 Procedures.</li> </ul>                | Sustained well integrity  | Tetra 4                    | Annually  | Well integrity reports.  |
| <b>Production boreholes/ Post Closure Phase</b> | <ul style="list-style-type: none"> <li>Groundwater Water quality monitoring: Alignment with functional requirements for Routine groundwater monitoring)</li> <li>Pressure testing of the seal;</li> <li>Measuring soil gas content using a probe; and</li> <li>Internal Tetra 4 Procedures</li> </ul> | Sustained well plug/abandonment integrity   | Tetra 4                    | Annually  | Well monitoring reports. |

<sup>5</sup> Parameter in the full Groundwater monitoring set include: pH, Electrical conductivity (EC), Total Hardness, Total Dissolved Solids (TDS), Alkalinity, Ammonia (NH<sub>3</sub>), Bromide (Br), Nitrite (NO<sub>2</sub>), Total Nitrogen, Bicarbonate (HCO<sub>3</sub>), Fluoride, Chloride, Nitrate (NO<sub>3</sub>), Sulphate (SO<sub>4</sub>), Calcium (Ca), Potassium (K), Magnesium (Mg), Sodium (Na), Silver (Ag), Aluminium (Al), Arsenic (As), Boron (B), Barium (Ba), Beryllium (Be), Cadmium (Cd), Cobalt (Co), Chromium (Cr), Copper (Cu), Iron (Fe), Lithium (Li), Manganese (Mn), Molybdenum (Mo), Nickel (Ni), Lead (Pb), Antimony (Sb), Selenium (Se), Silicon (Si), Strontium (Sr), Thallium (Tl), Titanium (Ti), Vanadium (V), Zinc (Zn), MTBE, Benzene, TAME, Toluene, Ethyl Benzene, m+p-Xylene, 1, 3, 5 Trimethyl benzene, 1, 2, 4 Trimethyl benzene, Naphthalene, Dissolved methane, Dissolved ethane, TPH GRO C6-C10, TPH GRO C10-C40, Polycyclic aromatic compounds, Total oil and grease.

TABLE 9: HYDROCENSUS BOREHOLE INFORMATION

| BH ID | Latitude (south) |     |       | Longitude (east) |     |       | Elevation (mamsl) | SWL (mbgl) | Owner                    | Farm                     | Equipment   | Use              | Sampled | Date monitored |
|-------|------------------|-----|-------|------------------|-----|-------|-------------------|------------|--------------------------|--------------------------|-------------|------------------|---------|----------------|
|       | Deg              | Min | Sec   | Deg              | Min | Sec   |                   |            |                          |                          |             |                  |         |                |
| 2A    | 28               | 14  | 30,8  | 26               | 43  | 53,70 | 1366              | 0          | Mr WJ Janse van Rensburg | Boschuis Spruit Ptn RE 0 | Windmill    | Livestock        |         | 17/03/2016     |
| 2B    | 28               | 14  | 17,5  | 26               | 43  | 5,80  | 1354              | 5,83       | Mr WJ Janse van Rensburg | Boschuis Spruit Ptn RE 0 | Windmill    | Livestock        |         | 17/03/2016     |
| 4A    | 28               | 14  | 55,8  | 26               | 44  | 1,10  | 1369              | 7,9        | Mr F Jacobs              | Nortier Ptn 1            | None        | None             |         | 17/03/2016     |
| 5A    | 28               | 16  | 10,2  | 26               | 42  | 2,00  | 1386              | 10,95      | Mr JA Smith              | Kleinpan Ptn 0           | Windmill    | Livestock        |         | 16/03/2016     |
| 5B    | 28               | 16  | 4,3   | 26               | 42  | 1,00  | 1384              | 8,67       | Mr JA Smith              | Kleinpan Ptn 0           | Windmill    | None             |         | 16/03/2016     |
| 5C    | 28               | 16  | 4,1   | 26               | 42  | 7,70  | 1378              | 11,54      | Mr JA Smith              | Kleinpan Ptn 0           | Submersible | Domestic         | Yes     | 16/03/2016     |
| 5D    | 28               | 16  | 4,1   | 26               | 42  | 5,90  | 1389              | N/A        | Mr JA Smith              | Kleinpan Ptn 0           | Windmill    | Livestock        |         | 16/03/2016     |
| 5E    | 28               | 16  | 2,20  | 26               | 42  | 0,30  | 1384              | 5,56       | Mr JA Smith              | Kleinpan Ptn 0           | Submersible | Domestic         |         | 16/03/2016     |
| 5F    | 28               | 16  | 23,50 | 26               | 41  | 43,40 | 1384              | 19,85      | Mr JA Smith              | Deeldam Ptn 4            | Submersible | Livestock        |         | 16/03/2016     |
| 5G    | 28               | 16  | 22,70 | 26               | 41  | 41,00 | 1385              | 17         | Mr JA Smith              | Deeldam Ptn 4            | Submersible | Game + livestock |         | 16/03/2016     |
| 5H    | 28               | 16  | 5,00  | 26               | 40  | 24,50 | 1399              | N/A        | Mr JA Smith              | Frisgewaag Ptn 2         | Windmill    | Livestock        |         | 16/03/2016     |
| 5I    | 28               | 16  | 16,40 | 26               | 40  | 20,30 | 1400              | 5,85       | Mr JA Smith              | Frisgewaag Ptn 2         | Submersible | None             |         | 16/03/2016     |
| 5J    | 28               | 15  | 19,10 | 26               | 40  | 47,50 | 1400              | N/A        | Mr JA Smith              | Frisgewaag Ptn 2         | Windmill    | Livestock        |         | 16/03/2016     |
| 5K    | 28               | 15  | 45,20 | 26               | 41  | 34,60 | 1384              | N/A        | Mr JA Smith              | Frisgewaag Ptn RE 0      | Windmill    | Livestock        |         | 16/03/2016     |
| 5L    | 28               | 16  | 38,30 | 26               | 41  | 13,70 | 1386              | 10,42      | Mr JA Smith              | Frisgewaag Ptn RE 0      | Submersible | Livestock        |         | 16/03/2016     |
| 5M    | 28               | 16  | 44,50 | 26               | 41  | 33,30 | 1387              | 9,82       | Mr JA Smith              | Frisgewaag Ptn RE 0      | Submersible | Livestock        |         | 16/03/2016     |
| 7A    | 28               | 9   | 1,30  | 26               | 43  | 28,20 | 1323              | N/A        | Mr L Lourens             | Glen Ross Ptn 8          | Submersible | Domestic         |         | 14/03/2016     |
| 7B    | 28               | 8   | 51,20 | 26               | 43  | 27,00 | 1314              | N/A        | Mr L Lourens             | Glen Ross Ptn 8          | Submersible | Domestic         |         | 14/03/2016     |
| 7C    | 28               | 9   | 22,70 | 26               | 43  | 25,60 | 1325              | 13,98      | Mr L Lourens             | Glen Ross Ptn 6          | Submersible | None             |         | 14/03/2016     |
| 8A    | 28               | 11  | 1,40  | 26               | 44  | 48,60 | 1342              | N/A        | Mr WP du Plessis         | Kalkoenkrans Ptn 2       | Submersible | Domestic         |         | 15/03/2016     |
| 8B    | 28               | 10  | 39,90 | 26               | 44  | 49,50 | 1331              | N/A        | Mr WP du Plessis         | Kalkoenkrans Ptn 2       | Submersible | Domestic         | Yes     | 15/03/2016     |
| 8C    | 28               | 13  | 30,90 | 26               | 43  | 18,20 | 1354              | N/A        | Mr WP du Plessis         | Palmietkuil Ptn 5        | Windmill    | Livestock        |         | 15/03/2016     |
| 8D    | 28               | 13  | 38,10 | 26               | 43  | 17,50 | 1341              | N/A        | Mr WP du Plessis         | Palmietkuil Ptn 5        | Submersible | Domestic         |         | 15/03/2016     |
| 8E    | 28               | 12  | 40,50 | 26               | 43  | 53,10 | 1350              | 2,18       | Mr WP du Plessis         | Palmietkuil Ptn 5        | Windmill    | Livestock        |         | 15/03/2016     |
| 8F    | 28               | 13  | 47,60 | 26               | 43  | 49,20 | 1357              | 5,42       | Mr WP du Plessis         | Palmietkuil Ptn 5        | Windmill    | Livestock        |         | 15/03/2016     |
| 8G    | 28               | 9   | 0,40  | 26               | 46  | 9,00  | 1304              | 11,83      | Mr WP du Plessis         | Kalkoenkrans Ptn RE      | Windmill    | Livestock        |         | 15/03/2016     |
| 11A   | 28               | 11  | 35,10 | 26               | 44  | 22,30 | 1344              | N/A        | Mr JK Oosthuizen         | Palmietkuil Ptn 4        | Submersible | Domestic         | Yes     | 17/03/2016     |
| 11B   | 28               | 11  | 31,40 | 26               | 44  | 25,50 | 1344              | N/A        | Mr JK Oosthuizen         | Palmietkuil Ptn 4        | Submersible | Domestic         |         | 17/03/2016     |
| 11C   | 28               | 11  | 39,20 | 26               | 44  | 20,90 | 1342              | N/A        | Mr JK Oosthuizen         | Palmietkuil Ptn 4        | None        | None             |         | 17/03/2016     |
| 11D   | 28               | 11  | 43,70 | 26               | 44  | 27,10 | 1353              | N/A        | Mr JK Oosthuizen         | Palmietkuil Ptn 4        | Hand Pump   | None             |         | 17/03/2016     |
| 11E   | 28               | 11  | 42,20 | 26               | 44  | 29,70 | 1342              | N/A        | Mr JK Oosthuizen         | Palmietkuil Ptn 4        | Windmill    | Domestic         |         | 17/03/2016     |
| 11F   | 28               | 12  | 39,60 | 26               | 44  | 32,40 | 1351              | 1,86       | Mr JK Oosthuizen         | Palmietkuil Ptn 4        | Windmill    | Domestic         |         | 17/03/2016     |
| 11G   | 28               | 13  | 24,50 | 26               | 45  | 8,90  | 1356              | 4,82       | Mr JK Oosthuizen         | Doornrivier Ptn 1        | Hand Pump   | None             |         | 17/03/2016     |
| 11H   | 28               | 13  | 43,50 | 26               | 44  | 27,40 | 1365              | N/A        | Mr JK Oosthuizen         | Doornrivier Ptn 1        | Windmill    | Domestic         |         | 17/03/2016     |
| 11I   | 28               | 13  | 24,10 | 26               | 44  | 51,90 | 1351              | N/A        | Mr JK Oosthuizen         | Doornrivier Ptn 1        | Submersible | Domestic         |         | 17/03/2016     |
| 11J   | 28               | 13  | 27,80 | 26               | 45  | 15,20 | 1358              | 4,23       | Mr JK Oosthuizen         | Doornrivier Ptn 1        | Windmill    | Domestic         |         | 17/03/2016     |
| 12A   | 28               | 16  | 21,00 | 26               | 44  | 31,10 | 1386              | 10,67      | Mrs L Kotze/Mrs Viljoen  | Exelsior Ptn RE 0        | Submersible | Domestic         | Yes     | 17/03/2016     |
| 12B   | 28               | 16  | 20,50 | 26               | 44  | 32,10 | 1383              | N/A        | Mrs L Kotze/Mrs Viljoen  | Exelsior Ptn RE 0        | Submersible | Domestic         |         | 17/03/2016     |
| 12C   | 28               | 16  | 10,60 | 26               | 44  | 28,30 | 1382              | 11,54      | Mrs L Kotze/Mrs Viljoen  | Exelsior Ptn RE 0        | Windmill    | Domestic         |         | 17/03/2016     |
| 15A   | 28               | 16  | 25,10 | 26               | 38  | 39,20 | 1377              | 12,24      | Mr F Schoeman            | De Wilger Ptn RE 0       | Submersible | Domestic         | Yes     | 16/03/2016     |
| 15B   | 28               | 16  | 24,40 | 26               | 38  | 40,10 | 1373              | 12,44      | Mr F Schoeman            | De Wilger Ptn RE 0       | Windmill    | Livestock        |         | 16/03/2016     |
| 15C   | 28               | 16  | 34,10 | 26               | 38  | 34,10 | 1371              | 7,93       | Mr F Schoeman            | De Wilger Ptn RE 0       | Submersible | Domestic         |         | 16/03/2016     |
| 15D   | 28               | 16  | 38,60 | 26               | 38  | 30,10 | 1371              | 6,27       | Mr F Schoeman            | De Wilger Ptn RE 0       | Submersible | Domestic         |         | 16/03/2016     |

| BH ID | Latitude (south) |     |       | Longitude (east) |     |       | Elevation (mamsl) | SWL (mbgl) | Owner                    | Farm                        | Equipment   | Use                   | Sampled | Date monitored |
|-------|------------------|-----|-------|------------------|-----|-------|-------------------|------------|--------------------------|-----------------------------|-------------|-----------------------|---------|----------------|
|       | Deg              | Min | Sec   | Deg              | Min | Sec   |                   |            |                          |                             |             |                       |         |                |
| 15E   | 28               | 16  | 38,50 | 26               | 38  | 29,60 | 1370              | 6,1        | Mr F Schoeman            | De Wilger Ptn RE 0          | None        | None                  |         | 16/03/2016     |
| 16A   | 28               | 8   | 51,60 | 26               | 43  | 22,50 | 1316              | N/A        | Mr A Jacobs              | Glen Ross Ptn 10            | Submersible | Domestic              | Yes     | 14/03/2016     |
| 16B   | 28               | 8   | 53,50 | 26               | 43  | 18,70 | 1316              | N/A        | Mr G Prinsloo            | Glen Ross Ptn 7             | Submersible | Domestic              |         | 14/03/2016     |
| 17A   | 28               | 9   | 12,10 | 26               | 42  | 44,70 | 1320              | N/A        | Mrs A van der Merwe      | Helpmekaar Ptn 1            | Hand Pump   | Domestic              | Yes     | 14/03/2016     |
| 17B   | 28               | 8   | 44,90 | 26               | 42  | 55,10 | 1304              | N/A        | Mrs A van der Merwe      | Helpmekaar Ptn 1            | Submersible | Irrigation + Domestic |         | 14/03/2016     |
| 17C   | 28               | 8   | 51,10 | 26               | 42  | 50,90 | 1305              | N/A        | Mrs A van der Merwe      | Helpmekaar Ptn 1            | Submersible | Domestic              |         | 14/03/2016     |
| 17D   | 28               | 8   | 5,20  | 26               | 42  | 49,60 | 1303              | N/A        | Mrs A van der Merwe      | Helpmekaar Ptn 1            | Submersible | Domestic              |         | 14/03/2016     |
| 17E   | 28               | 7   | 23,20 | 26               | 42  | 45,60 | 1285              | 10,98      | Mrs A van der Merwe      | Helpmekaar Ptn 1            | None        | None                  |         | 14/03/2016     |
| 21A   | 28               | 7   | 10,40 | 26               | 43  | 22,10 | 1287              | 13,69      | Mr A Jacobs              | Mond van Doornrivier Ptn RE | None        | None                  |         | 14/03/2016     |
| 21B   | 28               | 7   | 9,80  | 26               | 43  | 20,40 | 1288              | 15,56      | Mr A Jacobs              | Mond van Doornrivier Ptn RE | None        | None                  |         | 14/03/2016     |
| 21C   | 28               | 7   | 10,50 | 26               | 43  | 19,70 | 1282              | 16,1       | Mr A Jacobs              | Mond van Doornrivier Ptn RE | Submersible | Domestic              | Yes     | 14/03/2016     |
| 21D   | 28               | 7   | 13,00 | 26               | 43  | 22,90 | 1289              | 16,5       | Mr A Jacobs              | Mond van Doornrivier Ptn RE | None        | None                  |         | 14/03/2016     |
| 22A   | 28               | 7   | 9,10  | 26               | 43  | 13,10 | 1288              | N/A        | Mrs H van der Westhuizen | Mond van Doornrivier Ptn 2  | None        | None                  |         | 14/03/2016     |
| 22B   | 28               | 7   | 6,30  | 26               | 43  | 15,90 | 1288              | 13         | Mrs H van der Westhuizen | Mond van Doornrivier Ptn 2  | None        | None                  |         | 14/03/2016     |
| 22C   | 28               | 7   | 6,30  | 26               | 43  | 15,90 | 1288              | N/A        | Mrs H van der Westhuizen | Mond van Doornrivier Ptn 2  | Submersible | Domestic              | Yes     | 14/03/2016     |
| 22D   | 28               | 7   | 2,30  | 26               | 43  | 18,20 | 1290              | 11,06      | Mrs H van der Westhuizen | Mond van Doornrivier Ptn 2  | None        | None                  |         | 14/03/2016     |
| 23A   | 28               | 14  | 59,30 | 26               | 44  | 36,90 | 1377              | 14,66      | Mr K du Plooy            | Middelplaas Ptn 0           | Submersible | Domestic              |         | 17/03/2016     |
| 23B   | 28               | 14  | 59,00 | 26               | 44  | 35,40 | 1371              | 14,74      | Mr K du Plooy            | Middelplaas Ptn 0           | Submersible | Domestic              |         | 17/03/2016     |
| 23C   | 28               | 15  | 4,50  | 26               | 44  | 37,60 | 1374              | 15,59      | Mr K du Plooy            | Middelplaas Ptn 0           | Submersible | Domestic              |         | 17/03/2016     |
| 23D   | 28               | 15  | 15,00 | 26               | 44  | 34,60 | 1372              | N/A        | Mr K du Plooy            | Middelplaas Ptn 0           | None        | None                  |         | 17/03/2016     |
| 23E   | 28               | 14  | 28,30 | 26               | 44  | 56,60 | 1369              | N/A        | Mr K du Plooy            | Middelplaas Ptn 0           | Windmill    | None                  |         | 17/03/2016     |
| 24A   | 28               | 9   | 12,70 | 26               | 43  | 57,00 | 1318              | 10,92      | Mr T Strauss             | Glen Ross Ptn RE 0 and 1    | Submersible | Domestic              |         | 14/03/2016     |
| 24B   | 28               | 9   | 6,10  | 26               | 44  | 13,00 | 1313              | 10,25      | Mr T Strauss             | Glen Ross Ptn RE 0 and 1    | Submersible | Domestic              |         | 14/03/2016     |
| 24C   | 28               | 9   | 6,30  | 26               | 44  | 13,30 | 1313              | 9,9        | Mr T Strauss             | Glen Ross Ptn RE 0 and 1    | Windmill    | Livestock             |         | 14/03/2016     |
| 24D   | 28               | 8   | 41,90 | 26               | 44  | 29,20 | 1299              | 13,94      | Mr T Strauss             | Glen Ross Ptn RE 0 and 1    | None        | None                  |         | 14/03/2016     |
| 25A   | 28               | 17  | 13,30 | 26               | 44  | 31,40 | 1389              | 10,77      | Mr T Muller              | Grottkrav Ptn RE 0          | None        | None                  | Yes     | 18/03/2016     |
| 25B   | 28               | 18  | 7,80  | 26               | 44  | 35,10 | 1401              | N/A        | Mr T Muller              | Grottkrav Ptn RE 0          | None        | None                  |         | 18/03/2016     |
| 25C   | 28               | 18  | 6,30  | 26               | 44  | 35,20 | 1402              | N/A        | Mr T Muller              | Grottkrav Ptn RE 0          | Windmill    | Livestock             |         | 18/03/2016     |
| 25D   | 28               | 18  | 8,70  | 26               | 44  | 35,30 | 1403              | 8,76       | Mr T Muller              | Grottkrav Ptn RE 0          | None        | None                  |         | 18/03/2016     |
| OA    | 28               | 13  | 27,80 | 26               | 45  | 15,10 | 1361              | 5,39       | Mr JH Oosthuizen         | Doornrivier Ptn 2           | Windmill    | Domestic              |         | 17/03/2016     |
| OB    | 28               | 13  | 45,50 | 26               | 45  | 26,80 | 1367              | 3,41       | Mr JH Oosthuizen         | Doornrivier Ptn 2           | None        | None                  |         | 17/03/2016     |
| OC    | 28               | 13  | 7,00  | 26               | 45  | 17,20 | 1357              | 2,34       | Mr JH Oosthuizen         | Doornrivier Ptn 2           | None        | None                  |         | 17/03/2016     |
| ZA    | 28               | 5   | 54,10 | 26               | 45  | 6,60  | 1320              | 11,48      | Mr NJ van Dyk            | Jonkers Rust Ptn 0          | None        | None                  |         | 18/03/2016     |
| ZB    | 28               | 5   | 59,70 | 26               | 45  | 7,10  | 1305              | 15,82      | Mr NJ van Dyk            | Jonkers Rust Ptn 0          | Submersible | Domestic              |         | 18/03/2016     |
| ZC    | 28               | 5   | 9,00  | 26               | 45  | 14,60 | 1344              | 13,89      | Mr NJ van Dyk            | Jonkers Rust Ptn 0          | Submersible | Game + livestock      |         | 18/03/2016     |

### 12.3. SURFACE WATER MONITORING

A surface water management plan was developed for the mitigation measures suggested for the surface water risks identified.

- A surface water quality monitoring plan needs to be produced and implemented to determine any changes in the water quality (i.e. organics, inorganics, and dissolved gas); and
- Any water (this makes it relevant to condensate) generated at the conventional and unconventional well heads need to be captured in some form of dirty water storage facility. This water can be tested and treated (if needed) and used for irrigation or discharge into the environment if found to be suitable. Should the water be found to be unsuitable for irrigation or discharge into the environment, the contaminated water will be disposed of at a suitable licenced facility.

TABLE 10 provides the detail for the Surface Monitoring Programme.



TABLE 10: SURFACE WATER RESOURCES MONITORING PROGRAMME

| Activity/Phase   | Functional Requirements  | Performance Indicator/ Target   | Roles and Responsibilities | Frequency  | Reporting Mechanism       |
|--|--|---|----------------------------|--|---------------------------|
| <b>Exploration and Production (Construction phase) (Baseline).</b> | <ul style="list-style-type: none"> <li><u>Standards:</u> Aquatic Water Quality Standards as published in the Department of Environmental Affairs (DEA) (2014): Framework for the Management of Contaminated Land; and South African National Standards (SANS) 241-1:2011 drinking water standards (SABS, 2015) which sets numerical limits for specific determinants to provide the minimum assurance necessary that the drinking water is deemed to present an acceptable health risk for lifetime consumption.</li> <li><u>Locations:</u> Downstream of proposed pipeline river crossings (Doring River, Sand River, Bosluisspruit).</li> <li><u>Parameters:</u> Full monitoring set<sup>6</sup>.</li> </ul> | <ul style="list-style-type: none"> <li><u>Target:</u> None-establish baseline</li> </ul>  | Tetra 4                    | Prior to construction-preferably dry and wet season samples. | Annual Monitoring report. |
| <b>Exploration and Production (Construction phase) (Routine).</b>  | <ul style="list-style-type: none"> <li><u>Standards:</u> Aquatic Water Quality Standards as published in the Department of Environmental Affairs (DEA) (2014): Framework for the Management of Contaminated Land; and South African National Standards (SANS) 241-1:2011 drinking water standards (SABS, 2015) which sets numerical limits for specific determinants to provide the minimum assurance necessary that the drinking water is deemed to present an acceptable health risk for lifetime consumption. Baseline Water Quality Values.</li> </ul>   | <ul style="list-style-type: none"> <li><u>Target:</u> &lt;10% variation in upstream and downstream- if exceeded then review and institute additional</li> </ul> | Tetra 4                    | During active construction in watercourses                   | Annual Monitoring report. |

<sup>6</sup> pH, Electrical conductivity (EC), Total Hardness, Total Dissolved Solids (TDS), Alkalinity, Ammonia (NH<sub>3</sub>), Bromide (Br), Nitrite (NO<sub>2</sub>), Total Nitrogen, Bicarbonate (HCO<sub>3</sub>), Fluoride, Chloride, Nitrate (NO<sub>3</sub>), Sulphate (SO<sub>4</sub>), Calcium (Ca), Potassium (K), Magnesium (Mg), Sodium (Na), Silver (Ag), Aluminium (Al), Arsenic (As), Boron (B), Barium (Ba), Beryllium (Be), Cadmium (Cd), Cobalt (Co), Chromium (Cr), Copper (Cu), Iron (Fe), Lithium (Li), Manganese (Mn), Molybdenum (Mo), Nickel (Ni), Lead (Pb), Antimony (Sb), Selenium (Se), Silicon (Si), Strontium (Sr), Thallium (Tl), Titanium (Ti), Vanadium (V), Zinc (Zn), MTBE, Benzene, TAME, Toluene, Ethyl Benzene, m+p-Xylene, o-Xylene, 1, 3, 5 Trimethyl benzene, 1, 2, 4 Trimethyl benzene, Naphthalene, TPH GRO C6-C10, TPH GRO C10-C40, Polycyclic aromatic compounds, Total oil and grease

| Activity/Phase   | Functional Requirements  | Performance Indicator/ Target  | Roles and Responsibilities | Frequency                           | Reporting Mechanism |
|--|--|--|----------------------------|-------------------------------------|---------------------|
|  | <ul style="list-style-type: none"> <li><u>Locations:</u> Upstream and downstream of active construction areas in pipeline crossings.</li> <li><u>Parameters:</u> Temp (C), Baro (mb), pH pHmV, ORP (REDOX), DO (% Sat), EC (uS/cm @25C), RES (Ohms.cm), TDS (mg/L), SAL (ppt), SSG (st), Turbidity.</li> </ul> | monitoring and investigation.  |                            |                                     |                     |
| <b>Exploration and Production (All Phases)(Adhoc).</b> | <ul style="list-style-type: none"> <li><u>Standards:</u> DWS Discharge Limits</li> <li><u>Locations:</u> Dirty water containment features; localised dirty water collections and temporary storage (as applicable).</li> <li><u>Parameters:</u> DWS Discharge parameters.</li> </ul>                           | <ul style="list-style-type: none"> <li>Compliance with DWS Discharge Limits</li> </ul> | Tetra 4                    | Ad hoc- prior to planned discharge. | Monthly ECO Report. |

## 12.4. AIR QUALITY MONITORING

Air quality monitoring can be split into two main types namely, emissions monitoring at source, and ambient monitoring. The functional requirements for these are discussed in this section and summarised in TABLE 11.

### 12.4.1. EMISSIONS MONITORING

Regular monitoring of air emissions from the Helium and CNG plant is recommended. Particular attention to start-up and upset conditions should be included for monitoring purposes in order to adequately delineate emission and process metrics during these conditions, as well as routine conditions. Furthermore, the following are recommended for adequate emissions monitoring and air quality management at the Helium and CNG plant:

- Monitoring data should be analysed and reviewed at regular intervals (quarterly or annually), and also compared with the operating standards so that any necessary corrective actions can be taken;
- Records of monitoring results should be kept in an acceptable format and reported to the responsible authorities and relevant parties, if required; and
- A record of accidental releases of pollutants to the environment should be maintained and appropriate corrective measures should be implemented in order to be better prepared for future occurrences.

### 12.4.2. AMBIENT AIR QUALITY MONITORING

Ambient air quality monitoring can serve to meet various objectives, such as:

- Compliance monitoring;
- Validate dispersion model results;
- Use as input for health risk assessment;
- Assist in source apportionment and source quantification;
- Temporal and spatial trend analysis; and
- Tracking progress made by control measures.

In order to determine and assess cumulative impacts of pollutants at AQSRs and define air quality trends in the Project region, it is recommended that ambient air quality measurement be included as part of the Project's air quality management plan. Pollutants such as SO<sub>2</sub>, NO<sub>2</sub>, PM<sub>2.5</sub> and PM<sub>10</sub> may be included in the monitoring campaign to be conducted at regular intervals over the life of the project. Due to the extent of the project site, monitoring locations may be varied over time within the project boundary and at various project sections, taking into account the locations of unpaved roads, production wells, CCF, Helium and CNG plant.

### **Impact Zones and Site Alternatives**

A conservative impact zone of 200 m around production well sites, the CCF as well as the Helium and CNG plant site is recommended; while a 100 m impact zone should be stipulated for pipeline routes. This conservative buffer zone is in consideration of cumulative air quality impacts in the Project region.

**TABLE 11: AIR QUALITY MONITORING PROGRAMME**

| Activity/Phase   | Functional Requirements   | Performance Indicator/ Target  | Roles and Responsibilities | Frequency  | Reporting Mechanism                  |
|--|---|--|----------------------------|--|--------------------------------------|
| <p><b>Exploration and Production Activities/ Construction, decommissioning, and rehabilitation phases (Dust and Particulate Matter).</b></p> | <ul style="list-style-type: none"> <li><u>Standards:</u> ASTM D1739:1998; SANS 1929; National Dust Control Regulations (GN827/2013), National Ambient Air Quality Standards (GN1210/2009).</li> <li><u>Locations:</u> All dust sensitive receptors within the designated impact zones (200m) of the Processing Plants and Regional Compressor sites.</li> <li><u>Parameters:</u> Dust fallout. PM10 and PM2.5, and additional Dust fallout sites as required by the ECO<sup>7</sup>.</li> </ul> | <ul style="list-style-type: none"> <li>Alignment with baseline dust fallout.</li> <li>Dust Fallout:                             <ul style="list-style-type: none"> <li>&lt;600mg/m<sup>2</sup>/day.</li> <li>&lt;400 mg/m<sup>2</sup>/day (where agricultural activities take place).</li> <li>National Dust Control Regulations.</li> </ul> </li> <li>PM10 and PM2.5: ambient concentrations should comply with baseline and NAAQS.</li> <li>No dust complaints from landowners.</li> </ul> | <p>Tetra 4</p>             | <p><u>Monthly dust fallout</u> during construction of the Combined helium and CNG plant and regional compressor sites.</p> | <p>Bi-monthly Monitoring Report.</p> |
| <p><b>Production Activities (key emissions).</b></p>   | <ul style="list-style-type: none"> <li><u>Standards:</u> Passive diffusive sampling, National Ambient Air Quality Standards (GN1210/2009).</li> </ul>   | <ul style="list-style-type: none"> <li>Comply with emissions limits or industry guidelines.</li> <li>Limit fugitive/ unintended GHG emissions (incl. Methane).</li> </ul>  | <p>Tetra 4</p>             | <ul style="list-style-type: none"> <li><u>PM10, PM2.5, SO2, VOC's, and NO2 GLCs:</u> Annually.</li> </ul>                  | <p>Annual monitoring report</p>      |

<sup>7</sup> Ongoing local meteorological data should be collected to compare and inform the interpretation of air quality monitoring data.

| Activity/Phase            | Functional Requirements  | Performance Indicator/ Target  | Roles and Responsibilities | Frequency  | Reporting Mechanism       |
|---------------------------|--|--|----------------------------|--|---------------------------|
|                           | <ul style="list-style-type: none"> <li>• <u>Locations:</u> <ul style="list-style-type: none"> <li>○ Well heads and pipelines.</li> <li>○ Combined Helium and CNG Plant.</li> </ul> </li> <li>• <u>Parameters:</u> <ul style="list-style-type: none"> <li>○ Well heads and pipelines: GHG and odour emissions (leakages).</li> <li>○ Combined Helium and CNG Plant: PM10, PM2.5, SO2, NO2 and CO emissions</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• PM10, PM2.5, SO2, and NO2 GLCs should comply with their various NAAQS.</li> <li>• VOCs GLCs should comply with the TCEQ guideline.</li> </ul>       |                            | <ul style="list-style-type: none"> <li>• <u>GHG:</u> Monthly inspections of all facilities.</li> </ul> |                           |
| <b>Post Closure Phase</b> | <ul style="list-style-type: none"> <li>• <u>Standards:</u> Passive diffusive sampling, National Ambient Air Quality Standards (GN1210/2009).</li> <li>• <u>Locations:</u> At all closed production wells.</li> </ul>   | <ul style="list-style-type: none"> <li>• VOCs GLCs should comply with the TCEQ guideline.</li> <li>• No localised increases in Methane emissions- indicating leaks from plugging.</li> </ul> | Tetra 4                    | Every 5 years  | Annual Monitoring Report. |

| Activity/Phase | Functional Requirements   | Performance Indicator/ Target | Roles and Responsibilities | Frequency | Reporting Mechanism |
|----------------|---|-------------------------------|----------------------------|-----------|---------------------|
|                | <ul style="list-style-type: none"> <li>Parameters: Methane, soil vapour testing and/or surface methanometer.</li> </ul> |                               |                            |           |                     |

## 12.5. BIODIVERSITY MONITORING PLAN

The following TABLE 12 provides details of the monitoring activities that are required for Cluster 1 in order to ensure that the biodiversity and specifically the invasive species are properly managed and that rehabilitation is successful post-closure.



**TABLE 12: BIODIVERSITY MONITORING PLAN**

| Activity/Phase   | Functional Requirements  | Performance Indicator/ Target  | Roles and Responsibilities | Frequency   | Reporting Mechanism                          |
|--|--|--|----------------------------|---|--|
| <b>Exploration and Production Surface Activities (All Phases).</b>   | <ul style="list-style-type: none"> <li><u>Standards:</u> Conservation of Agricultural Resources Act, Act No. 43 of 1983; National Environmental Management: Biodiversity Act, Act No. 10 of 2004-alien and invasive species list (2014).</li> <li><u>Locations:</u> All production areas and adjacent area (~20m).</li> <li><u>Parameters:</u> Plant community composition. Alien and invasive plant abundance (numbers, density, cover, frequency); Condition (measures of vigour, performance, fecundity); Structure (size or age class information).</li> </ul> | <ul style="list-style-type: none"> <li><u>Target:</u> All alien invasive plant species effectively controlled.</li> <li><u>Indicators:</u> New floral species appearing on site, alien species list (including density information), change in composition/structure of native plant communities, extent of invasive species populations, record of clearing activities, decline in abundance of alien plant species over time.</li> </ul> | Tetra 4                    | Annual Survey.  | Annual survey report<br><br>Clearing records |
| <b>Exploration and Production Surface Activities (Construction).</b> | <ul style="list-style-type: none"> <li><u>Standards:</u> None</li> <li><u>Locations:</u> All identified Watercourses (refer to Wetland and aquatic specialist study).</li> <li><u>Parameters:</u> Watercourse monitoring datasheet (refer to wetland and aquatic specialist study).</li> </ul>   | <ul style="list-style-type: none"> <li><u>Target:</u> no construction related erosion and /or watercourse degradation.</li> </ul>  | Tetra 4                    | Bi-monthly during construction in vicinity to watercourses and 1 year thereafter. | Annual monitoring report                     |

| Activity/Phase   | Functional Requirements   | Performance Indicator/ Target  | Roles and Responsibilities | Frequency                                | Reporting Mechanism                              |
|--|---|--|----------------------------|--|--|
| <b>Exploration and Production Surface Activities (Post closure).</b> | <ul style="list-style-type: none"> <li>• <u>Standards:</u> Conservation of Agricultural Resources Act, Act No. 43 of 1983; National Environmental Management: Biodiversity Act, Act No. 10 of 2004-alien and invasive species list (2014).</li> <li>• <u>Locations:</u> All production areas and adjacent area (~20m).</li> <li>• <u>Parameters:</u> Plant community composition. Alien and invasive plant abundance (numbers, density, cover, frequency); Condition (measures of vigour, performance, fecundity); Structure (size or age class information); erosion;</li> </ul> | <ul style="list-style-type: none"> <li>• <u>Target:</u> Confirmation that acceptable cover has been achieved in areas where natural vegetation is being re-established. 'Acceptable cover' means re-establishment of pioneer grass communities over the disturbed areas at a density similar to surrounding undisturbed areas, non-eroding and free of invasive alien plants.</li> <li>• <u>Indicators:</u> New species appearing on site, alien species list (including density information), change in composition/structure of native plant communities, extent of invasive species populations, record of clearing activities, decline in abundance of alien plant species over time.</li> </ul> | Tetra 4                    | Bi-annual Survey (3 years post closure). | Annual survey report<br><br>Photographic record. |

## 12.6. HERITAGE MONITORING

The action plan to mitigate identified Cluster 1 impacts is based on the following overriding principle:

- The minimisation of the disturbance of the proposed development activities on the identified heritage constraints and sensitivities.

The individual monitoring actions required towards managing the impact of Cluster 1 on identified heritage sensitivities and constraints, are outlined in TABLE 13.

**TABLE 13: HERITAGE AND PALAEOLOGY MONITORING PLAN**

| Activity/Phase  | Functional Requirements  | Performance Indicator/ Target  | Roles and Responsibilities | Frequency      | Reporting Mechanism  |
|---|--|--|----------------------------|----------------|--|
| <p><b>Exploration and Production Surface Activities (Construction Phase).</b></p> | <ul style="list-style-type: none"> <li>Standards: National Heritage Resources Act (NHRA), Act 25 of 1999.</li> <li>Location: All production areas (within ~200m from cemeteries and 50 m from graves).</li> <li>Parameters: Inventory of cultural and heritage identified within Cluster 1.</li> </ul> | <ul style="list-style-type: none"> <li>Target: All cultural and heritage features (e.g. cemeteries graves, historic structures (older than 60 years), Stone Age artefacts. etc.) undisturbed.</li> <li>Indicators: Undisturbed graves, cemeteries, historic structures and artefacts. Photographs of undisturbed cultural and heritage sites.</li> </ul> | <p>Tetra 4<br/>ECO</p>     | <p>Monthly</p> | <p>ECO Monthly Checklist/Report<br/>Photographic record of cultural and heritage sites</p> |

## 12.7. NOISE MONITORING PROGRAMME

Environmental Noise Monitoring can be divided into two distinct categories, namely:

- Passive monitoring – the registering of any complaints (reasonable and valid) regarding noise; and
- Active monitoring – the measurement of noise levels at identified locations; generally after a noise complaint was received.

No active environmental noise monitoring is recommended due to the low significance for a noise impact to develop. However, should a reasonable and valid complaint about noise be registered, it is the responsibility of Tetra 4 to investigate this complaint as per the specifications in TABLE 14.

While this section recommends a noise monitoring programme, it should be used as a guideline as site specific conditions may require that the monitoring locations, frequency or procedure be adapted.

**TABLE 14: NOISE MONITORING PROGRAMME**

| Activity/Phase                                  | Functional Requirements  | Performance Target   | Indicator/ Roles and Responsibilities | Frequency | Reporting Mechanism       |
|---|--|--|---------------------------------------|-----------|---------------------------|
| <b>Exploration and Production (All Phases).</b> | <ul style="list-style-type: none"> <li>• <u>Standards:</u> National Noise Control Regulations (GN R154 of 1992) and SANS 10103:2008.</li> <li>• <u>Locations:</u> No pre-identified and/or routine site identified during EIA. Site locations to be identified in response to valid noise complaints.</li> <li>• <u>Parameters:</u> 10-minute bins defining the 10-minute descriptors such as LAeq,l (National Noise Control Regulation requirement), LA90,f (background noise level as used internationally), and LAeq,f (Noise level used to compare with IFC noise limit). Noise levels should be co-ordinated with the 10-m wind speed. Spectral frequencies should also be measured to define the potential origin of noise.</li> </ul> | <ul style="list-style-type: none"> <li>• <u>Target:</u> Compliance with National Noise Control Regulations (GN R154 of 1992) and SANS 10103:2008.</li> </ul> | Tetra 4                               | Ad-hoc    | Annual Monitoring report. |

## 13. STAKEHOLDER ENGAGEMENT

Social impacts occur immediately in the planning phase of a project and as such it is imperative to start with stakeholder engagement as early in the process as possible. Stakeholder Engagement commenced during the EIA Phase of the project (both for the overall Production area and the site specific areas), in accordance with the relevant legislation. Stakeholder Engagement is however required on an ongoing basis throughout the execution of the Production. As such, it is recommended that the Holder develop and implement a detailed Stakeholder Engagement Plan (SEP), designed to work as a living document for implementation over the entire production period.

### 13.1. STAKEHOLDER ENGAGEMENT PLAN

The following stakeholder engagement framework outlines the principles and objectives for stakeholder engagement during all phases of the mining operation.

- To identify and assess the processes and/or mechanisms that will improve the communication between local communities, the wider community and the Holder;
- To improve relations between the Holder's staff and the people living in the local communities;
- To provide a guideline for the dissemination of information crucial to the local communities in a timely, respectful and efficient manner; and
- To provide a format for the timely recollection of information from the local communities in such a way that the communities are included in the decision making process.

This SEP plan will assist the Holder to outline their approach towards communicating in the most efficient way possible with stakeholders throughout the life of the production. Such a plan cannot be considered a once off activity and should be regularly updated to ensure that it stays relevant and to capture new information. The SEP should be compiled in line with IFC Guidelines (IFC) and should consist of the following components:

- Stakeholder Identification and Analysis – time should be invested in identifying and prioritising stakeholders and assessing their interests and concerns.
- Information Disclosure – information must be communicated to stakeholders early in the decision-making process in ways that are meaningful and accessible, and this communication should be continued throughout the life of the project.
- Stakeholder Consultation – each consultation process should be planned out, consultation should be inclusive, the process should be documented and follow-up should be communicated.
- Negotiation and Partnerships – add value to mitigation or project benefits by forming strategic partnerships and for controversial and complex issues, enter into good faith negotiations that satisfy the interest of all parties.
- Grievance Management – accessible and responsive means for stakeholders to raise concerns and grievances about the project must be established throughout the life of the project.

- ✎ Stakeholder Involvement in Project Monitoring – directly affected stakeholders must be involved in monitoring project impacts, mitigation and benefits. External monitors must be involved where they can enhance transparency and credibility.
- ✎ Reporting to Stakeholders – report back to stakeholders on environmental, social and economic performance, both those consulted and those with more general interests in the project and parent company.
- ✎ Management Functions – sufficient capacity within the company must be built and maintained to manage processes of stakeholder engagement, track commitments and report on progress.

It is of critical importance that stakeholder engagement takes place in each phase of the project cycle and it must be noted that the approach will differ according to each phase.

## 13.2. GRIEVANCE MECHANISM

In accordance with international good practice the Holder shall establish a specific mechanism for dealing with grievances. A grievance is a complaint or concern raised by an individual or organisation that judges that they have been adversely affected by the project during any stage of its development. Grievances may take the form of specific complaints for actual damages or injury, general concerns about project activities, incidents and impacts, or perceived impacts. The IFC standards require Grievance Mechanisms to provide a structured way of receiving and resolving grievances. Complaints should be addressed promptly using an understandable and transparent process that is culturally appropriate and readily acceptable to all segments of affected communities, and is at no cost and without retribution. The mechanism should be appropriate to the scale of impacts and risks presented by a project and beneficial for both the company and stakeholders. The mechanism must not impede access to other judicial or administrative remedies.

The proposed grievance mechanism shall be based on the following principles:

- ✎ Transparency and fairness;
- ✎ Accessibility and cultural appropriateness;
- ✎ Openness and communication regularity;
- ✎ Written records;
- ✎ Dialogue and site visits; and
- ✎ Timely resolution.

Based on the principles described above, the grievance mechanism process involves four stages:

- ✎ Receiving and recording the grievance;
- ✎ Acknowledgement and registration;
- ✎ Site inspection and investigation; and
- ✎ Response.



## 14. FAILURE TO COMPLY WITH ENVIRONMENTAL CONSIDERATIONS

Within the provisions of the relevant environmental legislation, there are a number of penalties for non-compliance or offences. Below a few extracts are presented for information purposes, however these must not be read in isolation and the reader is reminded that there are other acts that may be applicable to the relevant project:

- ✎ NEMA Section 49A(c): It is an offence for any person to fail to comply with or to contravene the conditions of an environmental authorisation granted for a listed activity or specified activity or an approved environmental management programme; 49B(1) states that a person convicted for an offence under 49A(c) is liable to a fine not exceeding R10 million or to imprisonment for a period not exceeding 10 years, or to both such fine or such imprisonment.
- ✎ NEMA Section 34(6): Whenever any manager, agent or employee does or omits to do an act which it had been his or her task to do, or to refrain from doing on behalf of the employer and which would be an offence under any provision listed in Schedule 3 (relates to all environmental related acts) for the employer to do or omit to do, he or she shall be liable to be convicted and sentenced in respect thereof as if he or she were the employer;
- ✎ NWA Section 151 (1): “No person may fail to comply with any condition attached to a permitted water use (Water Use License)”;
- ✎ NWA Section 151 (2): “Any person who contravenes any provision of subsection 1 is guilty of an offence and liable, on the first conviction, to a fine or imprisonment for a period not exceeding 5 years or to both a fine and such imprisonment (10 years for second conviction)”;
- ✎ NEMA: If anyone is convicted of an offence under the act which has resulted in harm, loss or damage to any other person, the court may award damages to be paid by the accused or convicted;
- ✎ NWA Section 154: Makes provision that it’s not only the applicant that may be liable but also an employee or agent acting on their behalf;

It is recommended that a procedure for non-compliances (i.e. incentives or disincentives for conformance and non-conformance with the EMPR requirements) must be employed to ensure that the EMPR is adequately implemented. The system to be used must be determined before production commences, included in the tender documents and contracts, and made clear to all project workers.

## 15. OTHER INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

To date, no additional information has been requested from the competent authority other than the following requests received with the acceptance of the scoping report for the Cluster 1 EIA Process:

| PASA Comments  | How / Where in EIA Report Comment was Addressed  |
|--|--|
| <p>☞ Please ensure that various state Departments are consulted during the EIA process and their comments incorporated in the Environmental Impact Assessment Report (EIR) before submission to the Agency. State Departments/Agencies to be consulted include amongst others:</p> <ul style="list-style-type: none"> <li>○ The Provincial Heritage Resources Authority/South African Heritage Resources Agency;</li> <li>○ Provincial Environmental Department;</li> <li>○ Department of Agriculture, Forestry and Fisheries (DAFF);</li> <li>○ Department of Water and Sanitation (DWS);</li> <li>○ Department of Land Affairs (DLA), district and local municipalities; and</li> <li>○ Department of Rural Development and Land Affairs regarding the land claims status of the area in question.</li> </ul> <p>Should you be unable to obtain comments, proof of attempts made to obtain comments should be submitted to the Agency.</p> | <p>The EIA Report has been made available on the project website and notification regarding its availability and duration of the comment period distributed to the all registered Interested and Affected Parties including landowners, as well as all relevant national, provincial and local Departments (including but not limited to the entities listed in the letter from the competent authority).</p> <p>The Provincial Environment Department, Department of Water and Sanitation have been furnished with hard and/or electronic copies of the report to facilitate their review and comments. The EIA Report has been loaded on the SAHRIS website as per the requirement by the Provincial Heritage Resources Authority/South African Heritage Resources Agency.</p> <p>Follow up has been made with the Department of Rural Development and Land Affairs regarding the land claims status of the area, and to date no response in regard has been received.</p> |

☞ The implementation of the Plan of Study for EIA must take into consideration of the following:

- Dust suppression: It is noted that saline water will be used for dust suppression. Please outline the process to be undertaken for the extraction and storage of the saline water including a detailed assessment of the use of saline groundwater for dust suppression. The latter is anticipated to trigger section 21 of National Water Act, as such the Department of Water and Sanitation must be consulted to assist in identifying all the listed activities to be triggered.

Dust suppression utilising saline water was raised as an option in the hydrogeology report and impacts thereof highlighted to be further assessed in the EIA phase. The EIA Report and relevant specialist reports have thus since been updated to reflect that dust suppression will be undertaken utilising water brought on site by the contractors from licensed sources, and the dust suppression will be take place during construction and decommissioning. Therefore, there will be no extraction and/ or storage of saline groundwater for the Cluster 1 gas production activities.

- Financial Provision for environmental rehabilitation: Section 24P of the NEMA requires that an applicant for an environmental authorisation relating to prospecting, exploration, mining or production must, before the Minister responsible for mineral resources issues the environmental authorisation, comply with the prescribed financial provision for the rehabilitation, closure and ongoing post decommissioning management of negative environmental impacts. You are therefore reminded to quantify the potential environmental liability associated with the proposed activities and indicate the method of financial provision in line with the requirements of the National Environmental Management Act: Regulations Pertaining to the Financial Provision Prospecting, Exploration, Mining or Production Operation, 2015. The said must be carried out by a specialist.

Financial provisions for the Cluster 1 gas production activities are presented in the EIA Report.

☞ Please ensure that the EIR includes the A3 size locality and layout maps of the application area.

Please refer to the EIA Report for the locality and layout maps in A3 size as well as the project preferred pipeline route alternative and combined sensitivity map.

| PASA Comments  | How / Where in EIA Report Comment was Addressed                 |
|--|---|
| <p>☞ You are requested to submit two (2) hard copies of the EIR and EMPr and at least one electronic copy (USB/CD) of the complete EIR and EMPr to the Agency on or before the 06 June 2017.</p> | <p>This has been undertaken upon submission of this report.</p> |

## 16. UNDERTAKING

I, \_\_\_\_\_ the undersigned and duly authorised thereto by Tetra 4 (Pty) Ltd undertake to adhere to the requirements and conditions as set out in this approved EMPR with the exception of lawful and formally executed exemption(s) and amendment(s) agreed to by the relevant Director: Petroleum Agency of South Africa and approved on.....

Signed at \_\_\_\_\_ on the \_\_\_\_\_ 2017.

**TO BE SIGNED WITH FINAL EMPR TO BE SUBMITTED POST PUBLIC REVIEW**

\_\_\_\_\_

**APPENDIX 1: LIST OF IDENTIFIED IMPACTS**

**APPENDIX 2: SENSITIVITY MAP**

**APPENDIX 3: ENVIRONMENTAL MANAGEMENT OBJECTIVES, ACTIONS, AND TARGETS**