

Client:

City of Cape Town

**BASELINE ASSESSMENT OF ADDITIONAL PRODUCTION
BOREHOLES
IN THE STEEBRAS WELLFIELD (H1A2 & H1A5),
FRESHWATER SPECIALIST INPUT**

Submitted to

Aurecon South Africa (Pty) Ltd



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1 INTRODUCTION

1.1 Background

In terms of the NEMA Section 30A directive issued by DEAD&P for undertaking emergency drilling operations in the western Cape, the City of Cape Town is required to identify potentially affected habitats, mitigation methods and remediation activities to minimize potential impacts associated with borehole drilling activities.

In May 2018, a total of 16 production boreholes within the Steenbras Catchment were earmarked for drilling and pump testing as a basis for establishing a wellfield in the area. Although these sites were not subject to baseline assessments prior to the commencement of drilling, the sites were screened for sensitivity and their sensitivity confirmed through a number of site visits, with subsequent input to Method Statements in an attempt to minimize impacts.

In April 2019, an additional two production boreholes (i.e. H1A2 and H1A5) were proposed by the City of Cape Town following feedback on production yields obtained from those boreholes already drilled and tested. Both new boreholes will be percussion drilled and will target the Peninsula formation. One of the proposed new boreholes includes two alternatives for consideration (i.e. H1A5_original and H1A5_alternative). These three sites (Figure 1) were assessed in terms of their ecological importance and sensitivity to drilling operations and associated risks to freshwater ecosystems.

The purpose of this report is to provide an account of freshwater ecosystems potentially impacted by the footprint of these additional boreholes within the Steenbras Wellfield, with recommendations for the alternatives at H1A5, together with input and recommendations to minimize impacts and risk at the preferred site (Figure 1).

1.2 Terms of Reference

The Terms of Reference for this assessment were as follows:

- Undertake a site visit to identify freshwater ecosystems (rivers or wetlands) within close proximity of the proposed sites;
- Evaluate the sensitivity of these habitats to the layout and drilling operations proposed at each site;
- Provide recommendations for the layout and operation of drilling activities, if necessary, to minimise the risk of potential impacts to freshwater ecosystems.

1.3 Use of this Report

This report reflects the professional judgement of its author. It is FCG's policy that the full and unedited contents thereof should be presented to the client and included in any application to relevant authorities. Any summary of the findings should only be produced with the approval of the author.

1.4 Wetland definition

According to the National Water Act (36 of 1998) wetlands are areas: "...where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted for life in saturated soil." Essentially, this means that wetlands are areas where water is the primary driving force. Therefore wetlands develop in areas where water is present for

prolonged periods of time but soils are saturated or inundated with water for varying lengths of time and at different frequencies.

For a wetland to be classified as such, it must have one or more of the following features (after DWAF 2005):

- Hydromorphic soils that display characteristics resulting from prolonged saturation such as mottles¹, organic streaking or gleying².
- The presence, at least occasionally of vegetation indicators i.e. the presence of obligate or facultative wetland plants (Corry 2012) which means they are found most often in wetlands.
- A high water table that results in saturation at or near the surface, leading to anaerobic conditions developing in the top 50 cm of the soil.



Figure 1 The location of the two additional production boreholes proposed in the Steenbras Wellfield.

2 THE STUDY AREA

Both sites are situated within vegetation described by Mucina and Rutherford (2006) as Kogelberg Sandstone Fynbos, identified as a critically endangered vegetation type. Rivers and wetlands within this vegetation type are typically nutrient poor (oligotrophic) with low pH (acidic) and a low mineral content as indicated by low Electrical Conductivity of either standing or flowing waters. These ecosystems typically support threatened biota with high levels of endemism and are generally sensitive to anthropogenic disturbance, particularly with regards to change in water chemistry (including sediments), habitat loss and erosion.

¹ These are orange, yellow or reddish-brown splotches that appear in mineral soils that are alternately wet and dry and therefore indicative of seasonal wetland habitat.

² Gleying occurs when iron deposits in the soil are converted from an oxidized to a reduced state due to extended periods of saturation and low oxygen conditions.

3 ASSESSEMENT OF SENSITIVITY AND RISK WITH RECOMMENDED MITIGATION

3.1 H1A2

This production borehole falls within quaternary catchment G40A adjacent to an existing access road within a recently felled pine plantation in Steenbras (Figure 2). The site slopes northwards with a channelled seep draining towards the Steenbras Dam. Although the seep and channel have been impacted by the mature pine plantation, the habitat supports remnant stands of *Berzelia lanuginosa* with *Bechnum* sp. ferns (Figure 3). Some vegetation within the footprint of the borehole is indicative of temporary wetland along the margins of the permanently saturated and seasonally inundated seep wetland, including *Syncarpha* sp and *Cliffortia atrata*. Major existing impacts to this wetland habitat include the dominance of a mature pine plantation that has affected the integrity of natural vegetation cover and resulted in some erosion of the channel. Also, the integrity of the system has been affected by hydrological alterations associated with diversion of flows away from the seep habitat to accommodate the road. The system is therefore not pristine but it supports wetland habitat with a high potential for rehabilitation now that the pine trees have been removed and efforts are planned to reinstate flows to this system from upstream (Ewart-Smith and Boucher 2019). Thus, this wetland represents a system that is likely to recover such that it provides intact habitat within a threatened ecosystem type and is thus considered *of Moderate to High Ecological Importance and Sensitivity*.

A portion of the temporary wetland habitat will be lost to accommodate the footprint of the drilling rig and associated vehicles during drilling activities. This habitat is currently disturbed by the presence of pines and thus its sensitivity to disturbance and thus the impact is considered low to moderate prior to consideration of any rehabilitation intervention. With efforts to rehabilitate this habitat following drilling, it is likely that residual impacts and thus risk would be low (Table 1). Spillage of drilling effluent however, if not contained effectively, poses a moderate to high risk to the channelled seep habitat immediately west and south of the site. Also, this area is vulnerable to erosion if used as a recipient of pump test discharge water and the risk is considered high without the consideration of mitigation (Table 1).



Figure 2 Position of H1A2 adjacent to the road showing the proximity of wetland seep immediately west.



Figure 3 H1A2 in the foreground with the wetland habitat in the background. This picture was taken during the felling operations.

Recommendations: It is recommended that topsoil from the site be removed and appropriately stored prior to preparation for drilling such that these materials can be replaced and used in efforts to rehabilitate the disturbance footprint. Effluent runoff needs to be controlled and contained within sufficiently sized sumps placed adjacent to the road. Sandbags should be placed along the western edge of the sandbags such that any uncontrolled overflow is directed towards the road and away from the wetland. The potential of spillage from the drilling site should be closely monitored by an ECO. Drilling effluent and pump test water should be discharged directly to the Steenbras Dam via a temporary pipe system that avoids the wetland habitat as far as possible. Assuming all mitigation is effectively implemented, the risk to freshwater ecosystems associated with the percussion drilling of H1A2 is considered low to moderate, due to the close proximity of the site to wetland habitat. In the unlikely event that

drilling effluent does enter the wetland habitat, the need for remediation measures should be assessed by a suitably qualified ecologist and implemented if necessary.

Table 1 Summary of the risks to freshwater ecosystems associated with different activities associated with percussion drilling at H1A2 both with and without consideration of mitigation.

Development component	Risk	
	<i>Without mitigation</i>	<i>With mitigation</i>
Borehole Footprint	Low-Moderate	Low
Effluent spillage	Moderate-High	Low-Moderate
Test pumping	High	Low

3.2 H1A5

Two alternative sites for H1A5 were considered as an additional production borehole in Steenbras (Figure 4), both within quaternary catchment G40A. H1A5_original is situated within a firebreak adjacent to the N2 Highway immediately upslope of a seasonal channel draining through seep habitat. The Alternative H1A5 site is situated further west on a disused track within seasonal wetland habitat in an area previously under pine plantations.

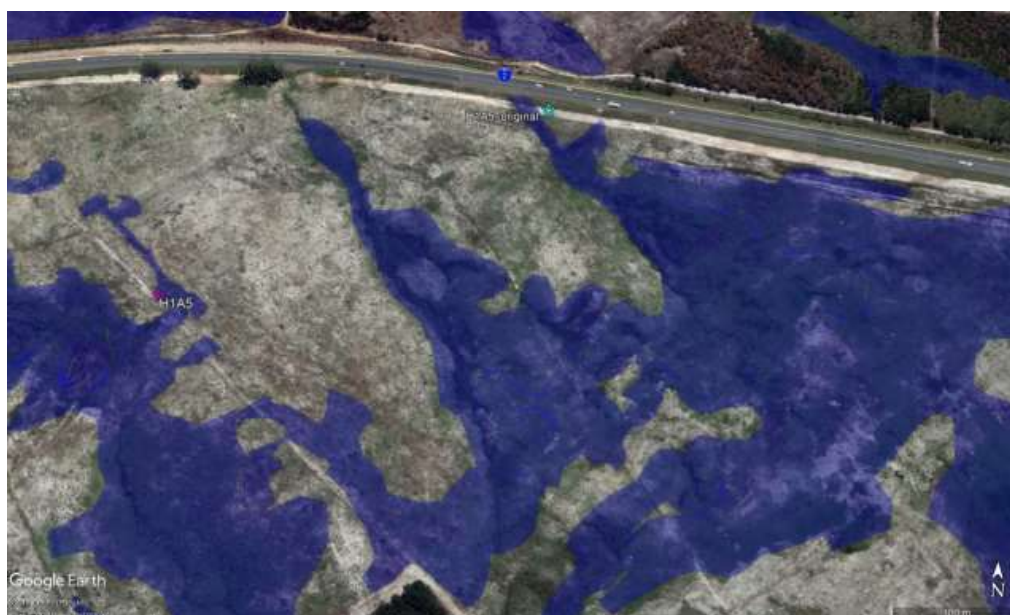


Figure 4 Two alternative locations were considered for the siting of H1A5. The blue star is H1A5 original while the pink star shows the position of the alternative site for H1A5.

H1A5_original: This site is situated on deep saturated (wetland) sandy soils within a firebreak on the border of the Steenbras Reserve, immediately adjacent to the N2 highway. Gently sloping seep wetlands characterise the area to the west of the firebreak, some with channelled outflow that crosses the firebreak and discharges to wetland habitat on the east of the N2 highway via pipes. The seep and channel immediately downslope of H1A5_original can be described as a seasonally inundated, permanently saturated system dominated by *Psoralea pinnata* (burnt) and *Calopsis paniculata* along the channel margins, with *Pteridium aquilinum* and *Pennisetum macrourum* across the seasonally saturated slopes (Figure 5). The area has been burnt in recent years but is relatively intact, with only a few juvenile alien plants (including *Acacia melanoxylon*, *A. mearnsii* and *Pinus pinaster*) scattered through the wetland. The channel flowing via pipes below the N2 highway is somewhat impacted locally by contaminated runoff from the road, together with litter, although the water quality and habitat appear relatively unimpacted a short distance downstream of the N2 Highway. The channel margin in this reach is dominated by *Psoralea pinnata* and *Berzelia* (both recently burnt), together with a dense stand of obligate wetland species such as *Todea sp.*, *Calopsis paniculata* and arum lilies (*Zantedeschia aethiopica*) with healthy in-channel clumps of *Isolepis digitata* (Figure 6). Similar to the seep habitat upslope of the N2 Highway, the slopes flanking the channel are dominated by *Pteridium aquilinum*. These habitats are relatively intact and offer wetland habitat representative of a threatened ecosystem type and together are considered of *High Ecological Importance and Sensitivity*.

Figure 5 The channelled seep habitat adjacent to H1A5_original showing the channel through the firebreak



immediately upslope of the N1 Highway.



Figure 6 **The (a) seep habitat and (b) stream downstream of the N2 Highway.**

The actual footprint for drilling operations and associated sumps and vehicles would be confined to the existing firebreak. Access to the site would also be via the firebreak which is dominated by deep sandy saturated soils typical of wetlands within the area. The maintenance of this area as a firebreak means that the footprint impacts are considered of low significance, although the area would be vulnerable to the formation of dongas with frequent vehicular activity, particularly during the winter wet season when the soils are saturated and even inundated in places. The formation of erosion dongas would affect the sediment loads and hydrological functioning of the wetlands downslope of the N2 highway and thus the footprint (and access route) imposes a moderate risk to the integrity of these wetlands, if not mitigated (Table 2). Also, spillage of sediment laden effluent with rotafoam, if not mitigated would result in an impact of high significance to the wetlands and stream downstream of the N2 Highway (Table 2). Similarly, discharge of pump test water into this small channel would pose a high risk of erosion to this system (Table 2).

Table 2 **Summary of the risks to freshwater ecosystems associated with different activities associated with percussion drilling at H1A5_original both with and without consideration of mitigation.**

Development component	Risk	
	<i>Without mitigation</i>	<i>With mitigation</i>
Borehole Footprint	Moderate	Low
Effluent spillage	High	Moderate
Test pumping	High	Low - Moderate

Recommendations: The drill site should be contained through the placement of sandbags along the northern extent of the site, between the drilling footprint and the channel. It is recommended that vehicular movement to and from the site be limited as far as possible to minimise the risk of erosion and donga formation through the firebreak. Furthermore, it is recommended that coarsely crushed sandstones chips are sourced from the Rockview quarry to stabilise the access route and drilling footprint as far as possible. Should potential erosion and donga formation be effectively monitored and managed, then the risk associated with the actual footprint of drilling is considered low

(Table 2). Sufficiently sized temporary sumps should be placed within the firebreak to contain effluent discharge. The efficacy of sumps to contain effluent during the wet winter period is however questionable, considering the currently saturated state of the sediments, even at the start of the wet season and thus the risk of spillage into the downstream channel and wetlands remains moderate (Table 2). Thus, potential spillage of effluent should be closely monitored by an ECO at all times. In the event of accidental effluent spillage into the stream and / or wetland, a suitably qualified freshwater ecologist should be alerted immediately such that any remediation measures deemed necessary can be implemented immediately to reduce the extent and duration of any impacts. No effluent or pump test water must be discharged into the channel and wetland habitat. The following two options to prevent such discharge into natural freshwater habitats are proposed:

Option 1: Pipe discharge below the N2 and run along the disused track east and adjacent to the N2 Highway, then dissipate runoff into the pine plantations further north.

Option 2: Pipe discharge northwards along the firebreak and discharge into the Steenbras Dam.

The need for rehabilitation following drilling should be assessed by a suitably qualified ecologist and implemented if necessary. While effective implementation of mitigation measures will reduce the risk to freshwater ecosystems associated with the percussion drilling of H1A5_original, there are still risks to freshwater ecosystems associated with this activity (Table 2).

H1A5_alternative: The old track on which this borehole has been sited has not been used for many years and thus much of the natural vegetation has recovered. The seasonally saturated north facing wetland through which the old track traverses is dominated by the wetland grass, *Merxmuellera* sp. with clumps of *Psoralea pinnata* and restios (mainly *Restio bifurcus*). The outer margins are dominated by broad swathes of the wetland fern *Pteridium aquilinum*. Nevertheless, the seasonal wetland habitat was previously under pine plantations and appears to have been burnt in recent years. The area is characterised by deep sandy substrates which have eroded either side of the old track. This has somewhat affected natural drainage through the wetlands and efforts to stabilise eroded channels with stony material is evident either side of the old track. . Also, some alien vegetation, including *Acacia mearnsii* has invaded the area. The site is however relatively intact, supporting a moderate to high diversity of wetland vegetation typical of seasonal seeps within Kogelberg Sandstone Fynbos. As a threatened habitat type, this system is considered of *High Ecological Importance and Sensitivity*. Access to this site via the old track (Figure 8), together with the footprint of drilling, including sumps as mitigation, would result in the loss and / or disturbance of this wetland habitat. Also, the vulnerability of this habitat to further erosion could result in long term impacts of high significance. Thus, percussion drilling at H1A5_alternative, even with mitigation, is considered an impact of high significance that poses a high risk to freshwater ecosystems. .

H1A5_original, with mitigation is therefore considered the preferred alternative from a freshwater ecological perspective



Figure 7 H1A5_alternative is situated within seasonally saturated wetland on an old disused track that has largely recovered.

Table 3 Summary of the risks to freshwater ecosystems associated with different activities associated with percussion drilling at H1A5_alternative both with and without consideration of mitigation.

Development component	Risk	
	<i>Without mitigation</i>	<i>With mitigation</i>
Borehole Footprint	High	High
Effluent spillage	High	Moderate
Test pumping	High	Moderate

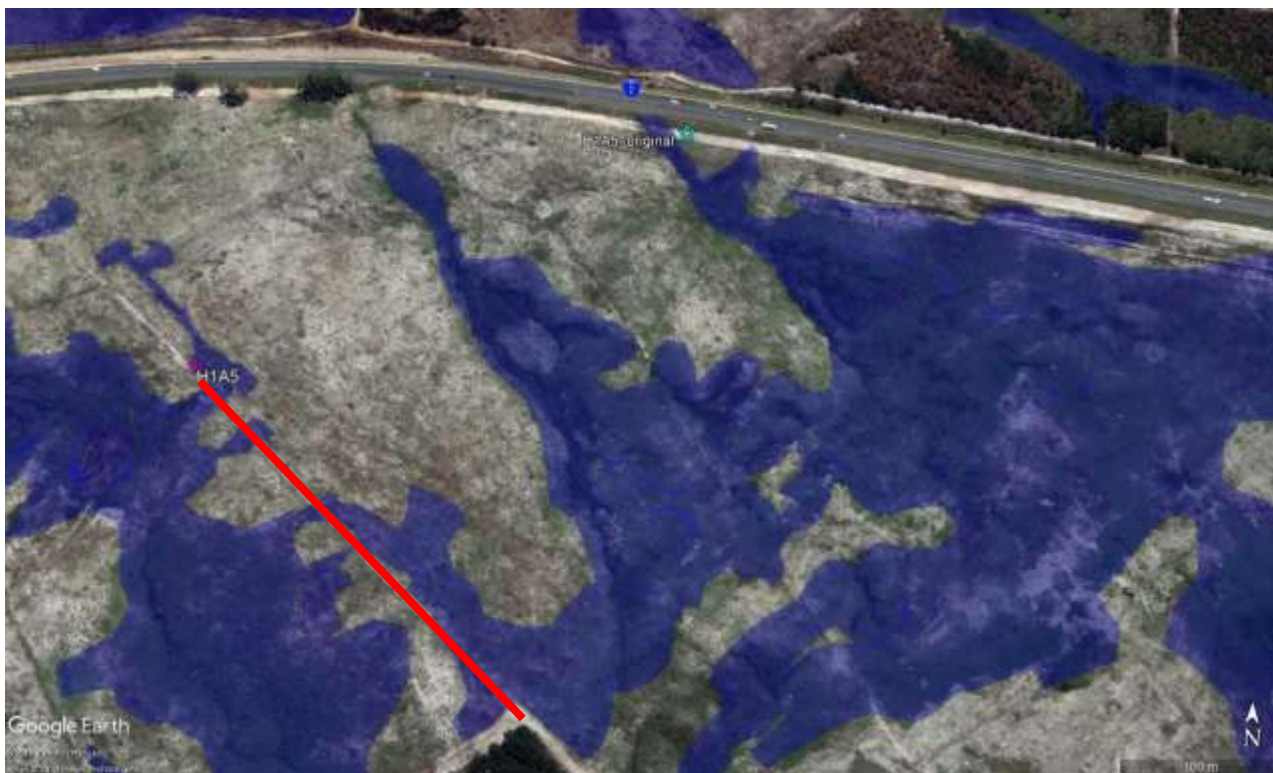


Figure 8 Position of H1A5 (alternative) showing access to the site via an old disused track (red line) through seasonal wetland that has largely revegetated.

4 GENERAL COMMENTS AND RECOMMENDATIONS.

Although H1A2 is situated in close proximity to a channelled seep wetland, it is located within a recently felled pine plantation and, through implementation of mitigation and rehabilitation of the site following drilling, residual impacts are considered of low significance from a freshwater ecological perspective. Potential spillage of drilling effluent is however considered of some risk and should be monitored and all drilling should stop if there is a risk of overtopping. Both alternative sites for H1A5 pose a high risk to freshwater ecosystems. Even with mitigation, risks to freshwater ecosystems are considered moderate in the case of H1A5-original and high in the case of H1A5-alternative. Of the two options, H1A5-original is considered the preferred alternative from a freshwater ecological perspective. However, effective implementation of mitigation with careful monitoring by a suitably qualified ECO is strongly recommended for the protection of the downstream habitat. These measures should be detailed in the relevant Method Statements to contactors and every effort should be taken to ensure that these measures are adhered to.

5 REFERENCES

Corry, F. 2012. Assessment of the environmental condition of wetlands in South Africa. Appendix 5: Wetland plant list for winter rainfall region. Wetland health and importance research programme. Water Research Commission Project K5/1584.

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