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Attention: Mr. Tamaryn Hale

HYDROPEDOLOGICAL OPINION AS PART OF THE WATER USE AUTHORISATION PROCESS FOR THE PROPOSED HLOMENDLINI SPORTS FIELD AND ASSOCIATED INFRASTRUCTURE IN MANDENI, KWAZULU-NATAL PROVINCE.

1. INTRODUCTION

Scientific Aquatic Services (SAS) was appointed to provide a hydropedological opinion as part of the authorisation process for the proposed development of a sport field and associated infrastructure development on ERF 1118 in Mandeni, KwaZulu-Natal.

The study area is located approximately 3 km north-west of the Harold Johnson Nature Reserve, 2.5 km west of the R102 and 2km south of the Tugela River. The general surrounding area is highly developed with surrounding land uses such as residential developments and other developments (Figure 1 and Figure 2).

The objective of this study was to:

- Investigate the hydropedological drivers of the watercourse;
- Determine the risk of the proposed activities on the freshwater feature; and
- Define the developable areas from a hydropedological point of view taking into consideration the findings of other relevant studies.

The proponent has identified the opportunity to develop an area associated with watercourses which traverse the study area. The proposed activities will likely entail earthworks preparation of foundations for development of associated infrastructure which may intercept the subsurface flows in the vadose zone feeding the watercourse as well as affect vadose zone recharge mechanisms. Thus, it was

deemed necessary to investigate the recharge mechanism of the watercourse within and near the study area to ensure that development planning takes cognisance of the hydropedologically important areas and hence enable informed decision making, construction design in support of the principles of sustainable development.

The proposed sports field development will entail the following as shown in Figure 3 below:

- Main soccer field (110 m x 75 m);
- A new fence line along the study area;
- Gravel access road to tie in with the existing gravel road north of the study area;
- Parking area and a guardhouse;
- Combi courts;
- Ablution facilities and stands;
- An irrigation line south of the proposed main soccer field;
- Water pipeline (90 mm Ø);
- Sewer pipeline (110 mm Ø);
- Septic tank and soakway system; and
- A walkway south of the study area.

The purpose of this assessment is to investigate the hydropedological properties of the soils in the vicinity of the watercourses within the study area, in order to infer the potential recharge mechanisms and destination of the transferred water of the surrounding soils that may be affected by the proposed development. It was also an objective to assess the impact of the proposed development activity on the watercourse in terms of the hydropedological drivers.

2. ASSUMPTIONS AND LIMITATIONS

- Hydropedological science and research is rapidly evolving and there are currently no standard methods to assess and/or model the recharge capacity of soils, as a result, the findings of this assessment are therefore a mix of qualitative and quantitative results and based on the specialist's training, opinion and experience with the hydrological properties of the identified soil types.
- Sampling by definition means that not all areas are assessed, and therefore some aspects of soil and hydropedological characteristics may have been overlooked in this assessment. However, it is the opinion of the professional study team that this assessment was carried out with sufficient sampling and in sufficient detail to enable the proponent, the Environmental Assessment Practitioner (EAP) and the regulating authorities to make an informed decision regarding the proposed activity.
- The effects climate change dynamics were not considered as part this assessment; however, it is acknowledged that this might exacerbate the anticipated reduction in water inputs and the resultant hydrological function of the watercourse beyond the extent of the proposed development.
- This assessment is confined to the study area as depicted in Figures 1, and does not include the neighbouring and adjacent properties, although land uses and possible catchment impacts occurring on surrounding properties were taken into consideration; and
- Although the delineations of the hydropedological soils is confined to the boundaries of the study area, adjacent areas were considered.

3. SITE CONDITIONS

Upon the site visit conducted in February 2021, the following observations were made:

- The site occurs in an area where most of the surrounding area has been developed and are characterised by roads and impervious surfaces which have altered the hydrological processes (i.e. pattern, timing and flow) of the area, with specific mentions to runoff patterns;
- The topographic alteration associated with the construction of the road and residential areas within the catchment have significantly altered the hydrological drivers of the wetland and possibly its extent; and
- The soil in some portions within the footprint area have been impacted due to historic activities which have led to some alteration of the natural soil characteristics. This has ultimately impacted on the natural hydropedological recharge mechanism.

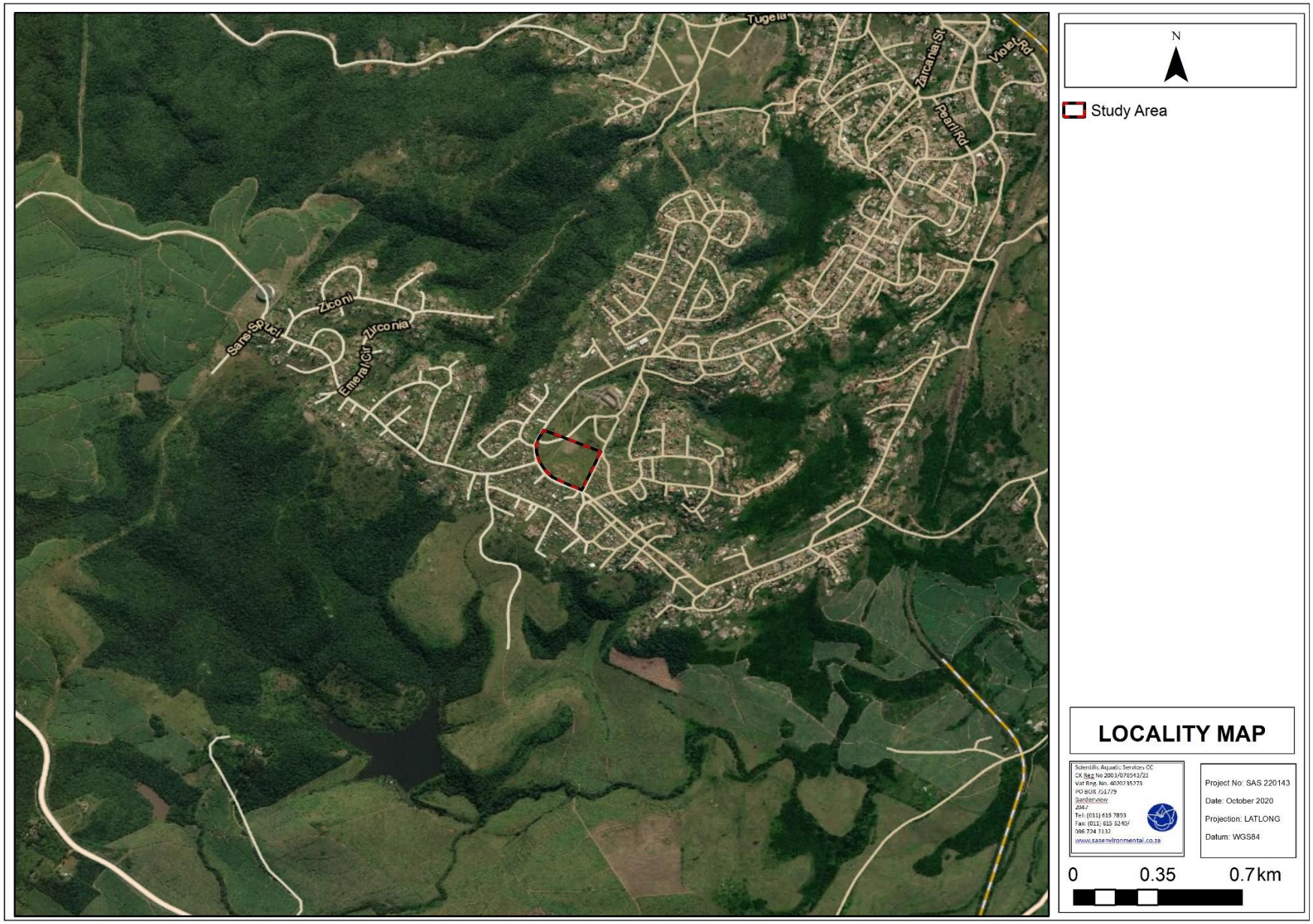

Figure 1: Locality map depicting the proposed diversion drain within the study area and surrounding areas

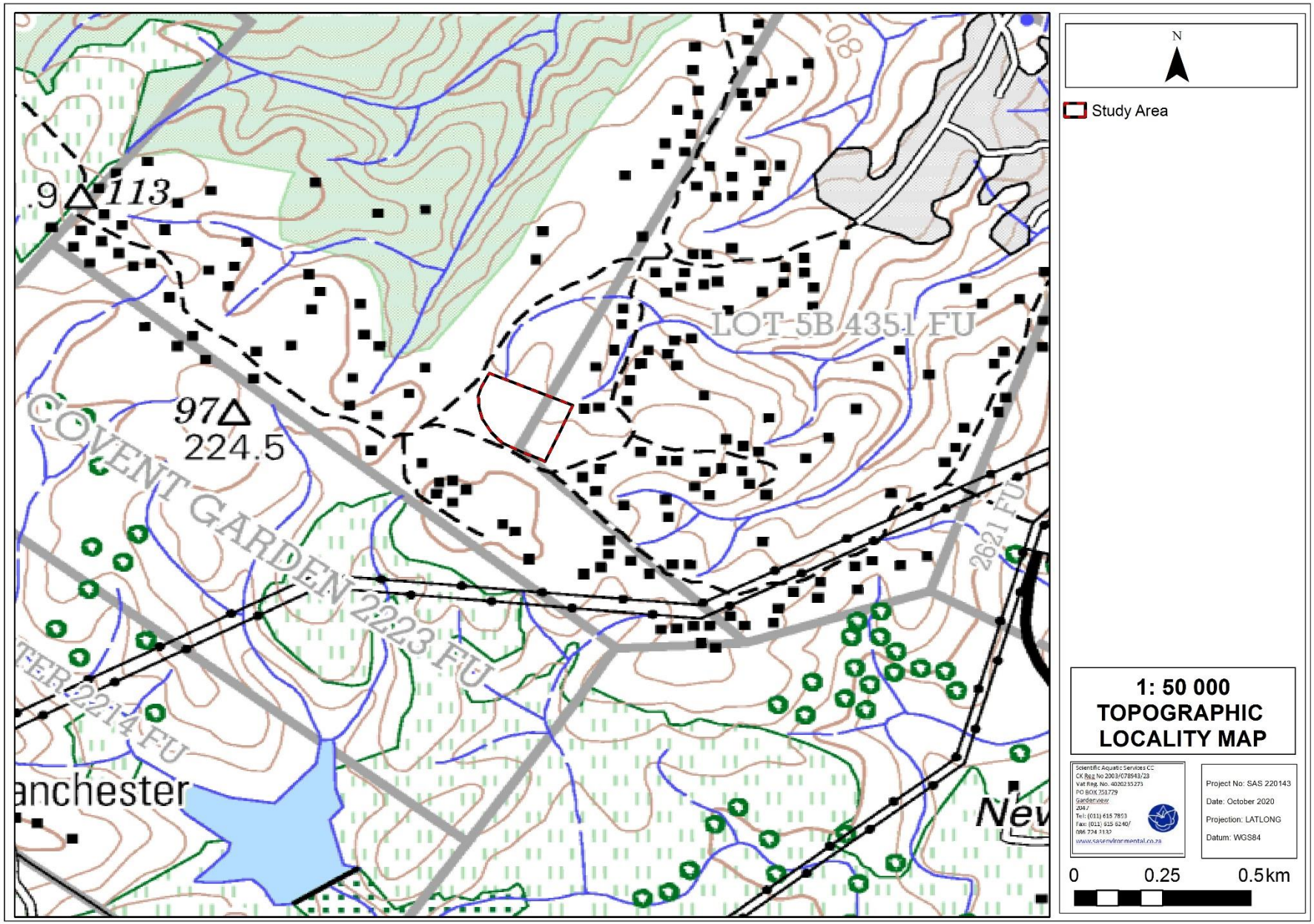

Figure 2: 1:50 000 topographic map depicting the study area in relation to the surrounding areas

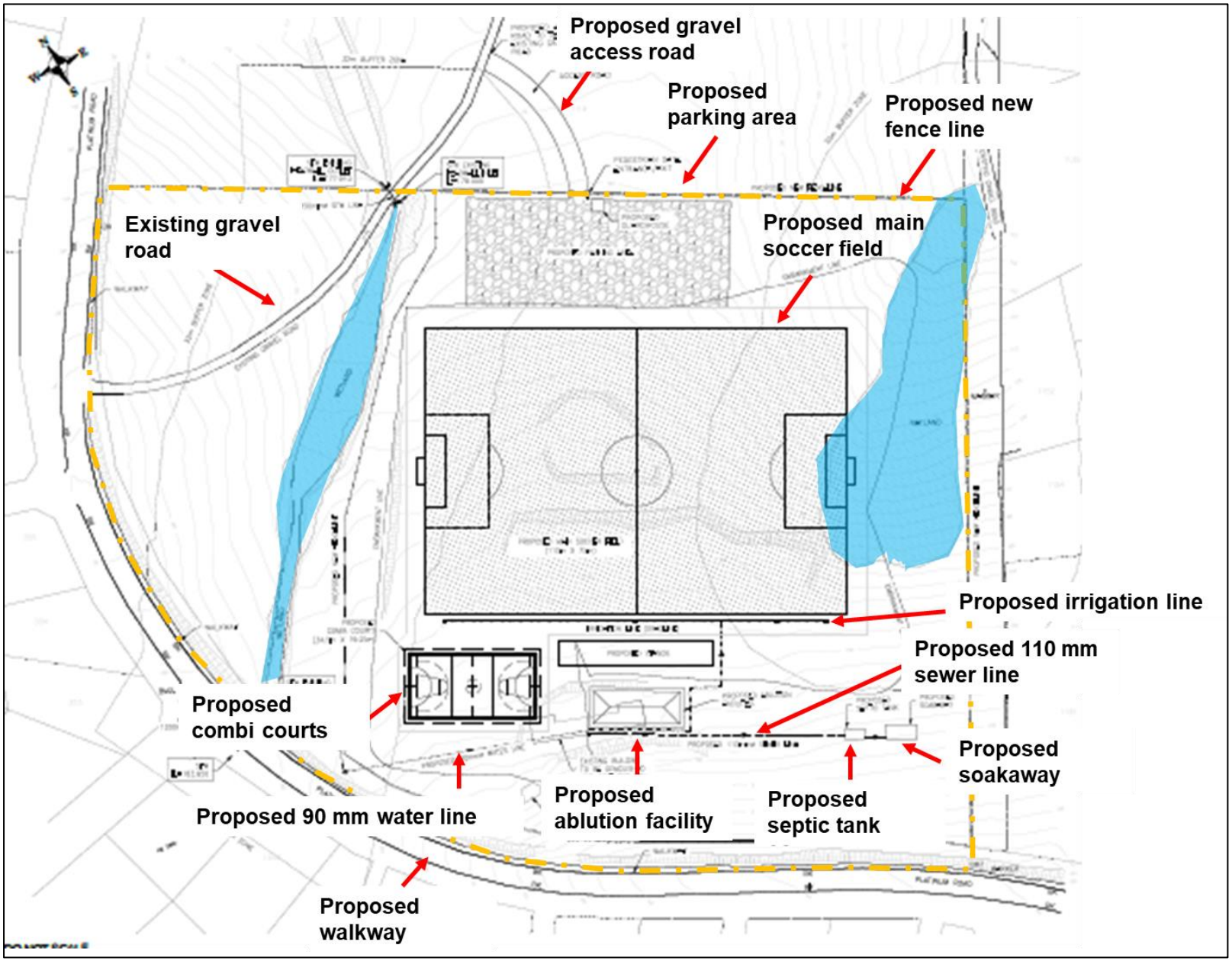

Figure 3: The proposed layout

4. ECOLOGICAL IMPORTANCE

During the site assessment, two watercourses depicting wetland characteristics were identified adjacent to the proposed development footprint. The soils showed signs of hydromorphy (i.e., prominent signs of prolonged wetness) while vegetation was varied due to the disturbances on site. The proposed development overlaps between two catchment areas of the systems associated with the development. The sensitivity of the systems calculated to be moderately and largely modified for the impacts within the catchment (i.e., stormwater, roads, and residential areas) is considered low and the PES is ranges between moderately to seriously modified. Table 1 below presents the summary findings of the freshwater assessment (SAS, 2021).

Table 1: Summary of results of the assessment of the wetlands.

Wetland	PES	Ecoservices	EIS	REC and RMO
Valley head seep	Category: C (Moderately modified)	Intermediate	Moderate	REC: Category C (Moderately modified) BAS: Category: C (Moderately modified) RMO: Maintain
Extent of modification anticipated	**High** Significant modifications are anticipated to the extent of the valley head seep wetland associated with the proposed main soccer field, where wetland habitat will be lost as a result of the proposed sports field development. However, this is not likely to fragment the system as the wetland habitat lost will be along the (western) boundary of the wetland. Stormwater released from the proposed sports field development into the adjacent valley head seep wetland must disperse before entering the wetland to prevent incision and erosion.			
CVB wetland	Category: E (Seriously modified)	Intermediate	Moderate	REC: Category D (Largely modified) BAS: Category: D (Largely modified) RMO: Improve
Extent of modification anticipated	**None** No modification is anticipated to the extent of CVB wetland as no infrastructure is proposed within the CVB wetland that may fragment or degrade the system. However, stormwater releases alongside the delineated CVB wetland will need to be monitored to ensure base flows, quantity or quality of water within the CVB wetland are not adversely affected.			

Modifications to the watercourses, with specific mention to the watercourse to the west of the footprint area have occurred. Runoff from the adjacent residential areas and roads have potentially augmented the surface water input into this system such that the system receives increased volumes of water, leading to development of prominent wetness indicators and hydrophilic plants.

System on the western portion and associated soils depicted hydromorphic characteristics.

System on the eastern portion and associated soils depicted hydromorphic characteristics.

Figure 4: Images depicting the identified systems and the occurrence of hydromorphic soils.

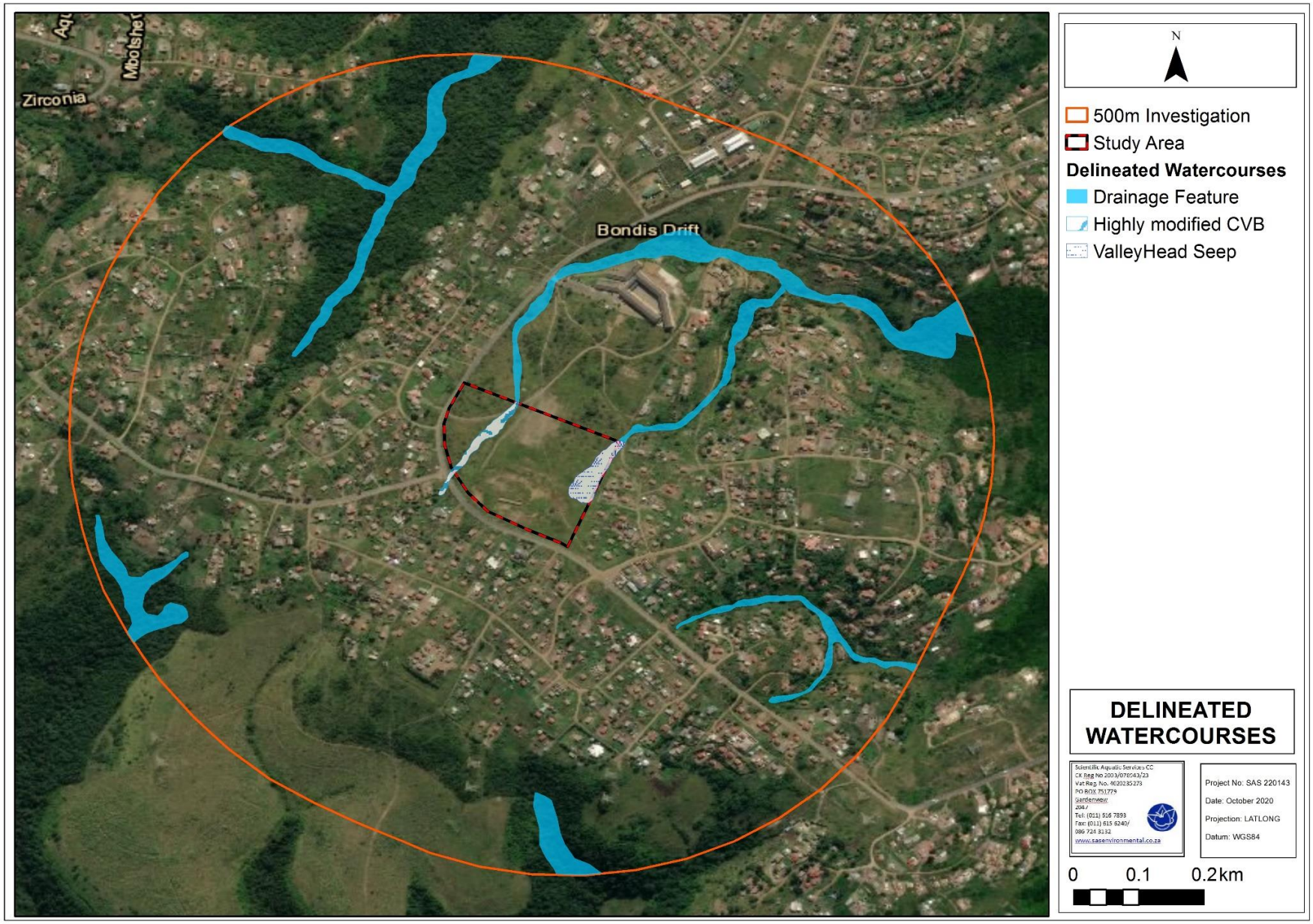

Figure 5: The location of the delineated watercourses associated with the study area

5. HYDROPEDOLOGICAL CONSIDERATIONS

Most of the soils associated with the footprint area are shallow, where the topsoil is underlined by either hard rock or plinthic material which largely inhibits infiltration. These soils based on the South African Soil Classification System (2018) can be classified as Mispah and Dresden soils forms. The best suited hydropedological recharge mechanism definition for these areas is responsive shallow. Shallow responsive soils are characterised by limited storage capacity which results in the generation of overland flow after rainfall events. These soils lead to a rapid runoff response time during intense rainfall events attributed to their shallow nature which inhibits infiltration. The contribution of these soils to wetland recharge is significant during a rainfall event and minimal during drier periods. The soils within associated with the valley bottom and valleyhead seep wetland can be best classified as Kroonstad and Wasbank soil forms. Figure 7 and 8 present the dominant soil forms and the hydropedological soil responses, respectively.

Figure 6: Photographs depicting the shallow soils and outcropping areas associated with the study area

Figure 7: Dominant soil forms associated with the study area

Figure 8: Hydropedological soil response

Figure 9 depicts the location of the transects, while Figure 10 and 11 below presents conceptual hydropedological flow paths for pre and post development scenarios.

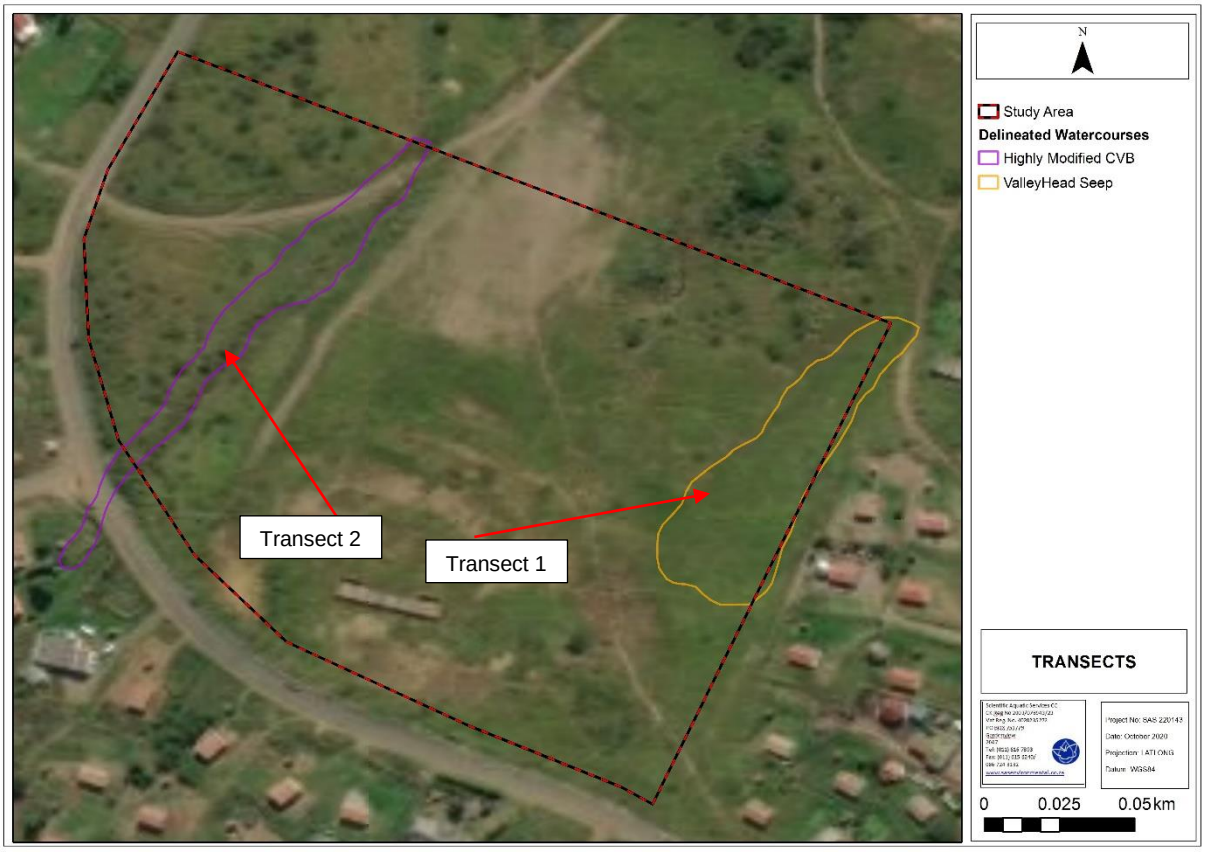

Figure 9: Conceptual hydropedological model transect positions

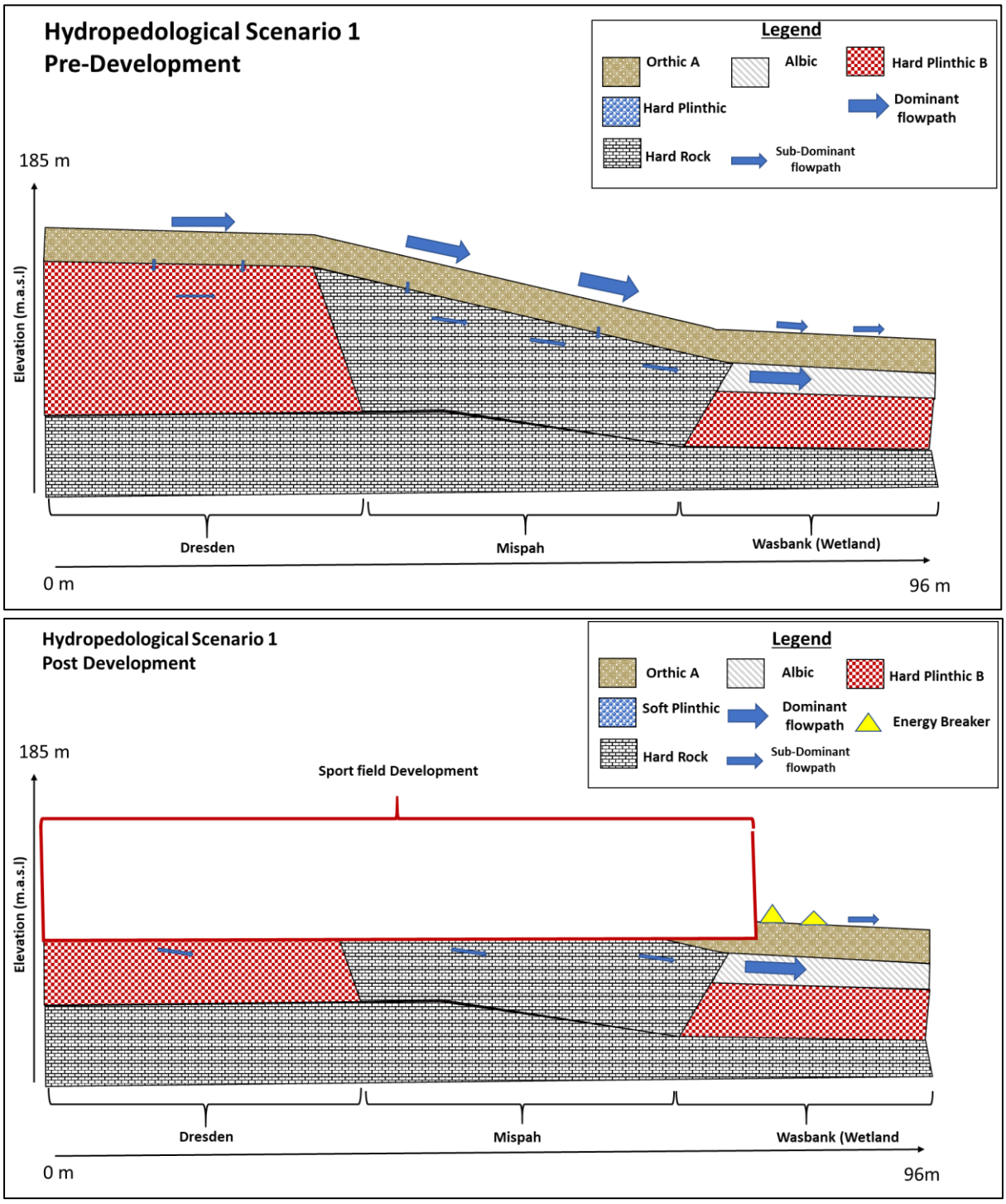

Figure 10: Conceptual hydropedological flow paths for transect 1 for pre- and post-development scenarios

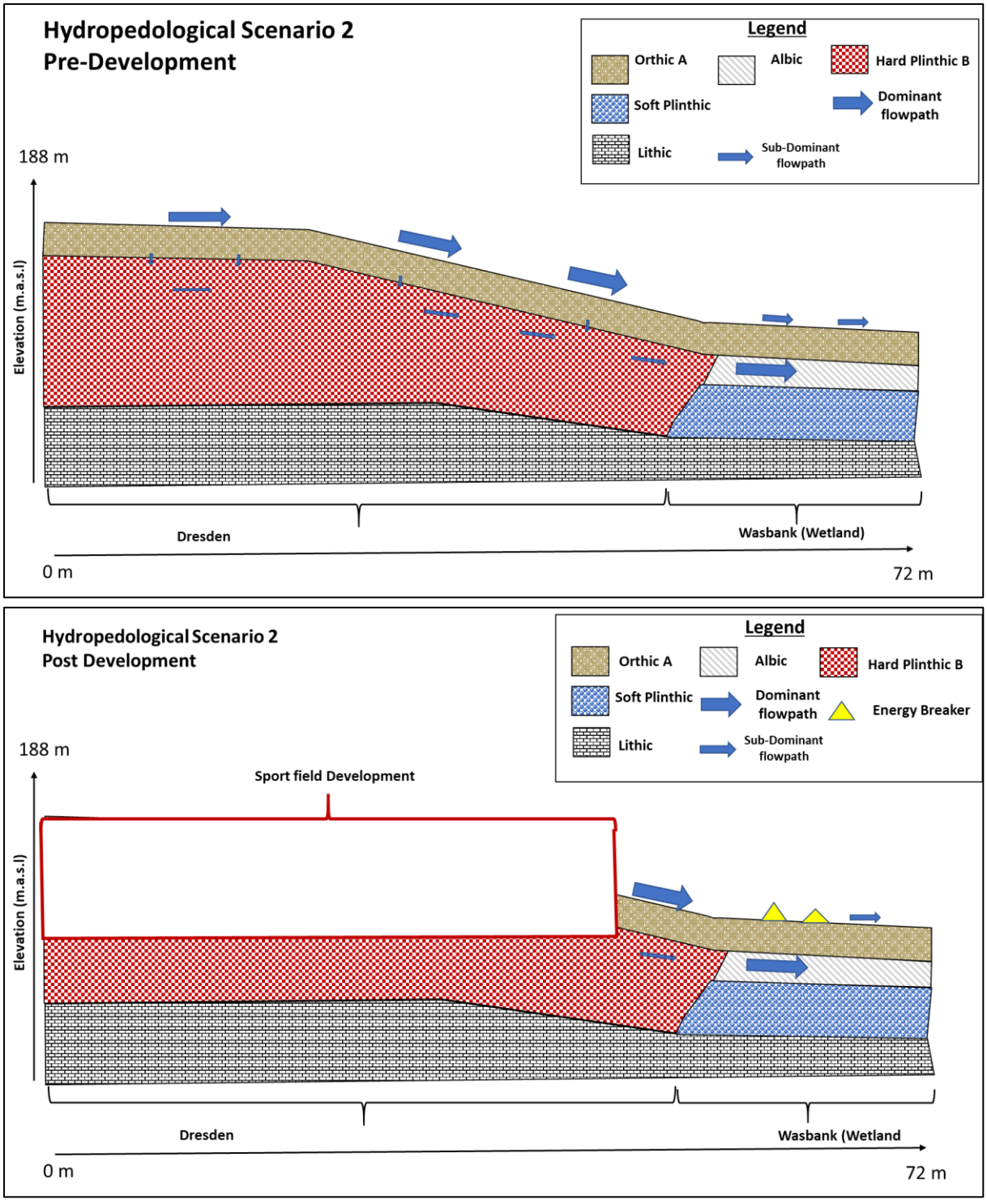

Figure 11: Conceptual hydropedological flow paths for transect 2 for pre- and post-development scenarios

The construction of the sport field is not anticipated to cause a significant loss of hillslope processes driving the adjacent wetlands on both the local and catchment to the nature of development as well as the absence of hydropedologically important soils associated with the study area. This is with specific mention to the area where the proposed development is to occur and the portion of the sport field encroaching on the valleyhead seep wetland. Although direct impact will likely occur, the post development scenario is unlikely to disrupt the functionality of the hillslope process if mitigation measures are implemented. This development is regarded acceptable from a hydropedological point of view.

6. CONCLUSION AND RECOMMENDATIONS

Recommendations include, but are not limited to:

- Excavation and soil disturbacnes within the wetlands should remain as small as possible;
- Drainage systems associated with the sport field should be designed in a manner discharges clean water back into the adjacent systems in an attenuated manner;
- Water from the sealed surfaces associated with the development should also be collected, and discharged back into the wetland in an attenuated manner;
- The development must ensure that runoff from all surfaces surrounding the development is attenuated before discharging into the adjacent systems, thus recharging the wetlands in an ecologically appropriate manner;
- Following the completion of the construction phase, areas of disturbance should be monitored at least once after an intense rainfall event for erosion arising from the surface runoff management;
- Implementation of erosion control measures to limit loss of soil and sedimentation of the adjacent systems associated with the proposed project; and
- All surface development footprint areas should remain as small as possible and disturbance of soil profiles to be limited to what is essential.

We trust we have interpreted your requirements correctly. Please do not hesitate to contact us if there are aspects of our proposal that you would like to discuss further.

Yours Faithfully,

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Stephen van Staden