APPENDIX 5

SPECIALIST REPORTS

3. Assessment of Surface – Groundwater Interaction on Wysersdrift (Farm 386 Portion 22), Rawsonville by Parsons & Associates Specialist Groundwater Consultants.
Assessment of Surface – Groundwater Interaction on Wysersdrift (Farm 386 Portion 22), Rawsonville

report prepared for
Symington Trust
LIST OF CONTENTS

1. INTRODUCTION 1
2. GEOHYDROLOGICAL SETTING 1
3. SURFACE – GROUNDWATER INTERACTION 3
4. SITUATION ASSESSMENT 3
5. MANAGEMENT RECOMMENDATIONS 5
6. CONCLUSIONS 5

REFERENCES 7

LIST OF FIGURES

1. Locality map showing the extent of Wydersdrift, and the position of pits and boreholes on and adjacent to the farm
2. SW – NE section of interpreted water levels across Wydersdrift
3. Groundwater levels monitored in boreholes adjacent to Wydersdrift
4. Hydrochemical character of water sampled at Wydersdrift
1 INTRODUCTION

Parsons and Associates Specialist Groundwater Consultants were requested by the Symington Trust (through Boland Enviro) to undertake a geohydrological survey of the farm Wysersdrift (Farm 386 Portion 22) located some 5 km northwest of Rawsonville in the Breede River Valley. The farm is 159 ha in extent, about a third of which is planted with vines. The purpose of the survey was to:

- Assess surface - groundwater interaction and the linkage between wetlands and groundwater on the property; and
- Develop management recommendations pertaining to pits used for storage and abstraction of water.

The geohydrological assessment is one of three specialist studies that inform an amnesty application by the current owners pertaining to developments on the property for which authorisation had not been obtained from the Department of Environment Affairs and Development Planning (DEADP).

After studying reports by Day (2006) and Oliver (2006), a site visit was undertaken on 13 April 2007 to ascertain the positions of pits, wetlands and boreholes; measure groundwater levels and take water samples. Geohydrological data stored on the National Groundwater Data Base (NGDB) were sourced from the Department of Water Affairs and Forestry (DWAF).

2 GEOHYDROLOGICAL SETTING

The farm is located in quaternary catchment H10G and directly adjacent to the Breede River. The area experiences a mean annual rainfall (MAP) of about 600 mm/a, most of which falls in the winter months of May through to October. Recharge to the underlying aquifer system is expected to be in the order of 15% MAP (DWAF, 2004).

The area is underlain by surficial deposits characteristic of the Breede River floodplain. These deposits comprise unconsolidated sands, gravels and boulders of varying but unknown thickness. As the mountains directly west of the farm consists of rocks of the Table Mountain Group, it is expected a similar geology underlies the surficial deposits. The fault-control Goudini Hot Spring is located 2.5 km southwest of the farm.

The area is drained by the Breede River. A hydrological divide is interpreted on the farm, with the Platdrif Stream draining the eastern part of the farm, and an unnamed tributary of the Breede River draining the western part of the farm (Figure 1). The Platdrif Stream flows southwards, and the unnamed tributary flows towards the north. This interpretation is different from that presented by Day (2006). It is noted that:

Day (2006) refers to subsurface flows, drainage and water courses. By her definition, she is referring to near surface flow associated with surface run-off (Day, 2007, pers.comm.), and specifically does not include groundwater (defined as water found in the saturated zone below the water table). In this report, the term surface water is equivalent to surface and (shallow) subsurface flows used by Day (2006).
• The slope across the farm is very flat (less than 0.0045 or 2.6°); and
• Interpretation of current aerial photographs indicate drainage patterns have been impacted by agriculture activities (e.g. construction of berms, ploughing, etc.).

Groundwater levels of 14.68m and 27.64 m below ground level were respectively measured in boreholes SM1 and SM2. It is suspected the groundwater level measured in SM2 is not representative of the rest level (Figure 2). Insufficient groundwater level data are available with which to determine groundwater flow directions. It is interpreted groundwater flows in a northeasterly to easterly direction towards the Breede River. This is perpendicular to the orientation of surface water drainage features on the farm.

Groundwater monitoring on adjacent farms provide an indication of seasonal variations in groundwater levels (Figure 3). In instances where the water table is near the surface, groundwater levels can fluctuate by 1.5 m. Greater variations are observed in instances where the water table is slightly deeper. G3319CB00016 is located about 500 m north of Wyersdrift. It is observed groundwater levels display an inter-seasonal range of about 5 m, with a winter high of 4 m below surface.

Unlike elsewhere in the Breede River Valley, the quality of groundwater in the study area is generally very good (DWAF, 2003). On-site measurements indicate groundwater has a quality in the order of 25 mS/m. The electrical conductivity (EC) of the Breede River was measured to be 14 mS/m, while that of the New Pit and Old Pit was 50 mS/m.

The hydrochemical character of water sampled from pits on the farm does not allow for its origin to be determined (Figure 4). Water from the Breede River has a NaCl character, an EC of 14 mS/m and a pH of 7.6. Groundwater has more of a mixed anion character, an EC of about 25 mS/m and a slightly lower pH (7.1). Water from the pits has a character similar to that of water from the Breede River, but a higher EC (50 mS/m) and a pH ranging between that of surface and groundwater. As the Old Pit is not filled with water from the Breede River (and yet has a character similar to that of water sampled from the New Pit) and water level data indicates water in the pits is groundwater (see Section 3, Figure 4), it is interpreted that the NaCl character of water in the pits is a result of evaporation.

The aquifer was classified as a major aquifer system by Parsons and Conrad (1998). These aquifers are capable of yielding large quantities of groundwater of good quality. The general authorisation for the area is set at 400 m³/ha/a.³ The extent of groundwater use in the immediate vicinity of Wyersdrift is not known. A number of pits are evident on aerial photographs, suggesting groundwater at least plays a component part in the water supply of the area.

---

² Day (2006) referred to the New Pit, Wattle Pit and Old Pit as irrigation pits P1, P2 and P3 respectively.
³ It is specifically noted general authorisation for taking and storing water does not apply to wetlands.
⁴ DWAF (2003) estimated 46% of water used in the Rawsonville area is derived from the alluvial aquifer.
3 SURFACE - GROUNDWATER INTERACTION

At the time of the site visit, the wetlands on Wysersdrift were dry. This - together with the facts that the direction of groundwater flow is interpreted to be perpendicular to that of surface water drainage features and groundwater levels are at least 4 m below surface - suggests the wetlands are not groundwater driven. Rather, they are seasonal features whose hydrology is dominated by winter surface run-off.

Groundwater levels in the general area are known to rise during winter (Figure 3), causing low-lying areas to become water logged. Consequently, groundwater may contribute to the winter hydrology of the area, but is not expected to be the major driver. It is noted the Department of Agriculture (DAg) facilitates the installation of subsurface agricultural drains, the purpose of which is to lower groundwater levels so vines can be planted in the areas that otherwise would not be suitable.

Water levels in the New Pit and the Wattle Pit are about 4 m below surface. Observations during the site visit indicated, that when full, the water level in the New Pit rises to about 1 m below surface. Water is pumped from the Breede River into the New Pit, and then abstracted from the pit for irrigation. Given the presumed permeable nature of the underlying sands, gravel and boulder layers, it is expected significant losses from the pit into the subsurface occur i.e. the pits inadvertently act as a source of artificial recharge to the underlying groundwater bodies. Unfortunately, the absence of data pertaining to the volumes of water abstracted from the river and discharged into the pit, water level fluctuations in the pit and abstraction from the pit for irrigation prevent any reasonable assessment of the water balance of the pit.

Because of the flat nature of the topography and the low level of accuracy of handheld global positioning systems (GPS), it was not possible to accurately compare water levels. However, analysis of the water level data shows that (Figure 2):

- The groundwater level measured at SM2 is not rest or static water levels, but reflects some residual effects of pumping; and
- Water levels observed in the pits are at a similar level to groundwater, and thus represent groundwater exposed through excavation.

4 SITUATION ASSESSMENT

Oliver (2006) reported that from a biodiversity and indigenous plant perspective, Wysersdrift is in poor condition; with over 50% of the farm having been cultivated and with dense stands of invasive exotics along the northern boundary with the Breede River. Historically, parts of the seasonal freshwater wetland located in the western and central sections of the farm have been drained for agricultural activities. This practice is still actively supported and promoted

---

5 Sand or gravel falling into the borehole was heard when measuring the groundwater level in SM2. This indicates a potential problem with the structure of the borehole, and requires further investigation.
by DAg. It is accepted that the local hydrology has been significantly modified through agricultural development.

Both the aquatic ecology and vegetation studies recommend ecological corridors be rehabilitated and re-established (Day, 2006; Oliver, 2006). These corridors would link the natural areas of the Badsberg Conservancy with the Breede River and Platdrift wetland. The New Pit was established in the proposed corridor, while lands recently cleared or cultivated are in or on the fringes of the proposed corridor.

The wetlands on Wyserdrift are not groundwater driven, and are considered seasonal freshwater wetlands stained by surface water run-off during wet winter months. The locality of the wetlands is a function of topography and surface water drainage patterns. Based on our understanding of the geohydrological regime of the area, we disagree with the following of Day’s (2006) statements and findings:

- Page 13 - large-scale abstraction from subsurface water sources (pits and boreholes) has resulted (or contributed to) shrinkage of wetland areas.
- Page 14 - of all the recent impacts, this (abstraction of water from the new irrigation pit – P1 – New Pit) is one of the most profound, since it results in the near-complete disruption of flows from the wetlands on the site into the stream / remnant wetlands downstream.
- Page 14 - viewed cumulatively, the large-scale abstraction of surface and subsurface water from the new irrigation pit (New Pit) since 2002 has resulted in or contributed to the shrinkage of downstream rivers and wetlands.
- Page 15 - abstraction of water from upstream wetland areas by the new irrigation pit (P1 – New Pit) should be halted.

The New Pit may capture surface run-off, and prevent it from flowing eastwards toward the Platdrift wetland. However, it is improbable abstraction from the pit has any impact on the groundwater flow regime or subsurface flows (as defined by Day, 2006). If anything, groundwater levels in the immediate vicinity of the pit are likely to be raised as a result of discharge from the pit into the subsurface. This impact is likely to remain localised (no more than 50 m from the pit) and the water level change in the range of 0.5 to 0 m. It is unlikely that these localised changes to groundwater levels have any bearing on wetlands in the immediate vicinity.

From a groundwater perspective, recommendations pertaining to the infilling of the New Pit by Day (2006) cannot be supported. Any management actions recommended for the New Pit must be motivated from a drainage and / or wetland perspective.

The suggestion that a series of interceptor pipes be laid immediately upstream of the detention pit (New Pit) to convey surface water around the pit and to downstream wetlands has merit from a surface water perspective, but requires reconsideration. As installing the pipes has little benefit during summer, a lined open canal would serve the same function during winter, be cheaper and easier to maintain.

Without site-specific data, it is difficult to quantify the volume of water discharged from the pit into the subsurface. Using a floor area of 3 900 m$^2$ (30 m x 130 m) and an infiltration rate
of 0.2 m/d \(^6\), daily losses could be in the order of 780 m\(^{3}\)/d. This equates to 20 L/s for a 12 hr pumping cycle and is at least four times greater than evaporation losses. The use of these unlined pits to "store" water is considered poor practice - both from a water conservation and economic perspective. It is recommended water be stored in lined dams to prevent losses.

The diametrically opposed philosophies of draining wetlands for agriculture (DAg) and conserving wetlands (DEADP, Cape Nature) cannot be addressed on a single farm. In support of the recommendation by Day (2006), the area has to be managed holistically, with the balance between agriculture and conservation. To adopt a conservation policy on this farm only will be ineffective and costly. As a result, it would be unfair, unreasonable and unjust. DWAF, DAg and DEADP - in consultation with stakeholders in the area - should develop and implement an Agricultural Development and Management Framework for the area.

5 MANAGEMENT RECOMMENDATIONS

If required, it is recommended a lined open canal be used to convey surface run-off from upstream of the New Pit to downstream wetlands.

Because of significant seepage losses, it is recommended unlined pits no longer be used for the storage of water, and all water storage facilities be lined.

If a decision is taken to fill in the New Pit, any material found in the general area (sand, gravel and/or boulders) can be used. From a groundwater perspective, the type of material and the layering thereof is of little consequence.

6 CONCLUSIONS

Based on a site visit in April 2007 and limited data, it is concluded the wetlands on Wysersdrift are not groundwater driven, but are seasonal freshwater systems sustained by surface run-off during the wet winter months. Consequently, any decisions regarding the future rehabilitation of the wetlands and the New Pit need to be based on surface drainage and wetland considerations.

An Agricultural Development and Management Framework - to be developed by the relevant authorities in consultation with stakeholders in the area - should form the basis for holistically managing the area and obtaining a balance between agriculture and conservation. Adopting a conservation policy on a single farm will be ineffective and costly; as well as unfair, unreasonable and unjust.

---

\(^6\) Parsons (1991) undertook double ring infiltrometer tests on similar geological material at the Worcester waste disposal site. He reported hydraulic conductivities to range between 0.2 and 3.4 m/d. Use of the most conservative estimate was considered appropriate, as it allows clogging affects to be taken into account. It is possible that losses from the pit into the subsurface could be an order of magnitude greater than that calculated.
Specific management recommendations include:

- Use of a lined open canal to convey surface water around the New Pit and to downstream wetlands is recommended as a better alternative to interceptor pipes installed 1 m below the surface.
- Because of significant seepage losses, it is recommended unlined pits no longer be used for the storage of water, and all water storage facilities be lined.
REFERENCES


DWAF (2003) Breede River Basins Study - Groundwater Assessment; Report PH00/00/2502 prepared by Groundwater Consulting Services For the Department of Water Affairs and Forestry, Pretoria.


Figure 1: Locality map showing the extent of Wyserstrei, and the position of pits and boresholes on and adjacent to the farm.
Figure 3: Groundwater levels monitored in boreholes adjacent to Wysersdrift.
Figure 4: Hydrochemical character of water sampled at Wysersdrift.