Botanical Assessment
for the proposed Houdenbek Dams
near Op-die-Berg, Witzenberg Municipality
Western Cape Province

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Prepared for EnviroAfrica

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National Legislation and Regulations governing this report

This is a 'specialist report' and is compiled in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended, and the Environmental Impact Assessment Regulations, 2014, as amended.

Appointment of Specialist

David J. McDonald of Bergwind Botanical Surveys & Tours CC was appointed by EnviroAfrica CC, to provide specialist botanical consulting services for the assessment of the areas of the proposed Harmony No. 2 and Toeka dams on the farm Houdenbek 415, near Op-die-Berg, Ceres District, Witzenberg Municipality, Western Cape Province.

Details of Specialist

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Expertise

Dr David J. McDonald:

- Qualifications: BSc. Hons. (Botany), MSc (Botany) and PhD (Botany)
- Botanical ecologist with over 37 years' experience in the field of Vegetation Science.
- Founded Bergwind Botanical Surveys & Tours CC in 2006
- Has conducted over 400 specialist botanical / ecological studies.
- Has published numerous scientific papers and attended numerous conferences both nationally and internationally (details available on request)

Curriculum Vitae – Appendix 3

Independence

The views expressed in the document are the objective, independent views of Dr McDonald and the study was carried out under the aegis of, Bergwind Botanical Surveys and Tours CC. Neither Dr McDonald nor Bergwind Botanical Surveys and Tours CC have any business, personal, commercial or other interest in the proposed development apart from fair remuneration for the work performed.

Conditions relating to this report

The content of this report is based on the author's best scientific and professional knowledge as well as available information. Bergwind Botanical Surveys & Tours CC, its staff and appointed associates, reserve the right to modify the report in any way deemed fit should new, relevant or previously unavailable or undisclosed information become known to the author from on-going research or further work in this field, or pertaining to this investigation.

This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of the report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must reference it. If these form part of a main report relating to this investigation or report, the report must be included in its entirety as an appendix or separate section to the main report.

Declaration of independence:

I David Jury McDonald, as the appointed Specialist hereby declare/affirm the correctness of the information provided or to be provided as part of the application, and that I:

- in terms of the general requirement to be independent:
  - other than fair remuneration for work performed in terms of this application, have no business, financial, personal or other interest in the development proposal or application and that there are no circumstances that may compromise my objectivity; or
  - am not independent, but another specialist (the "Review Specialist") that meets the general requirements set out in Regulation 13 has been appointed to review my work (Note: a declaration by the review specialist must be submitted);
- in terms of the remainder of the general requirements for a specialist, have throughout this EIA process met all of the requirements;
- have disclosed to the applicant, the EAP, the Review EAP (if applicable), the Department and I&APs all material information that has or may have the potential to influence the decision of the Department or the objectivity of any report, plan or document prepared or to be prepared as part of the application; and
- am aware that a false declaration is an offence in terms of Regulation 48 of the EIA Regulations, 2014 (as amended).

Signature of the specialist:

Bergwind Botanical Surveys & Tours CC

Name of company:

12 March 2019

Date:

CONTENTS

1. Introduction

EnviroAfrica CC was appointed by the Applicant, Môrester Estates, to conduct the environmental assessment process for the proposed construction of two dams on the fam Houdenbek 415, near Op-die-Berg, Ceres District, Witzenberg Municipality in the Western Cape Province. The study is conducted in terms of the National Environmental Management Act (NEMA) (No.7 of 1998) as amended and the 2014 Environmental Impact Assessment Regulations. Bergwind Botanical Surveys & Tours CC was in turn appointed by EnviroAfrica, on behalf of the Applicant, to carry out a botanical assessment of the areas on the designated property to inform the environmental impact assessment process.

The principles, guidelines and recommendations of CapeNature and the Botanical Society of South Africa for proactive assessment of the biodiversity of proposed development sites have been followed (Brownlie 2005, Cadman *et al*. 2016).

2. Terms of Reference

The Terms of Reference are:

Undertake a site visit to the study area and compile a specialist report that addresses the following:

- Take cognizance of, and comply with, the substantive content requirements outlined within Appendix 6 of GN R982, as amended, which outlines the legal minimum content requirements for specialist studies in terms of the 2014 NEMA EIA Regulations;
- The local and regional context of the vegetation communities and plant species within the affected areas, taking cognizance of the relevant biodiversity plans, bioregional planning documents, Environmental Management Frameworks etc.
- The ecosystem status and conservation value of the vegetation communities, including whether the potentially affected areas comprise critically endangered or endangered ecosystem(s) listed in terms of section 52 of the NEMBA;
- Any rare or endangered species encountered or likely to be or have been present;
- The presence of and proximity of the proposed site to protected area(s) identified in terms of NEMPAA and proximity to a Biosphere Reserve (where relevant).
- Confirm the approximate area (m^2) of indigenous vegetation (as defined in the NEMA EIA Regulations) that would be cleared for the proposed project.
- A description of the direct, indirect, residual and cumulative botanical impacts (both before and after mitigation) and an assessment of the significance of the impacts (on a nominal scale of Neutral/ Negligible, Very Low, Low, Medium, High) by evaluating: (a)

nature of the impacts (positive/ negative), (b) extent of the impacts (zero/ site specific/local/ regional/ national/ international), (c) magnitude of the impacts (zero/ Very Low/Low/ Medium/ High), (d) duration of the impacts (none/ short/ medium/ long term) and (e) probability of occurrence of the impacts (none/ unlikely/ possible/ definite). In addition, (f) the level of confidence in findings relating to potential impacts, (g)reversibility of potential impacts (i.e. the degree to which the impact can be reversed); and (h) the degree to which the impact may cause irreplaceable loss of resources.

- An indication of the degree (very low/ low/ medium/ high) to which the impacts can be avoided, managed and mitigated, a description of the measures to mitigate any impacts, and an indication of whether or not the measures (if implemented) would change the significance of the impact, for the construction and operational phases of the project;
- Delineate the vegetation communities and sensitive areas from a floristic perspective and overlay onto aerial photography and /or site map (i.e. create a vegetation sensitivity map of the project area);
- Take cognizance of the Department of Environmental Affairs (DEA) and Department of Environmental Affairs and Development Planning (DEA&DP) Guideline for Involving Biodiversity Specialists in the EIA Process and the requirements of the Botanical Society of South Africa (BotSoc) in developing an approach to the botanical investigation.

3. Study Area

3.1 Locality

3.1.1 Harmony Dam

Initially two alternative dam sites were considered. The first was on the stream Tuinskloof on the neighbouring Vaalboskloof 221/RE. Use of this site would have required consent from and compensation to the landowner, so this alternative was abandoned prior to the commissioning of this study. The second alternative is on the stream flowing northwards from Vaalbokskloof 221 onto Houdenbek 415. This second alternative (occasionally referred to as the Harmony #2 Dam) has been pursued (location indicated in Figures 1--3), for which four dam wall options have been proposed (see below).

The site proposed for the Harmony Dam is in the southeast corner of Houdenbek 415 at the lower end of a small catchment that lies mainly on the adjacent property Vaalbokskloof 221. The dam site is in a narrow kloof vegetated with fynbos shrubland on either side of a perennial stream. The substrate is sandstone and a prominent ridge of bedrock sandstone

is found on the east side of the stream. The northern section of the dam site has old fields on sandstone alluvium.

3.1.2 Toeka Dam

The site of the proposed Toeka Dam is on the Houdenbeks River, on formerly worked agricultural land, on a wide alluvial plain in the western part of Houdenbeks 415 (Figure 1—3). The site had lain fallow for a few years prior to the survey but in the past the entire area was planted with apple orchards. Prior to that it had been cultivated with onions. Drainage channels run through the site and erosion is notable in the northwest.

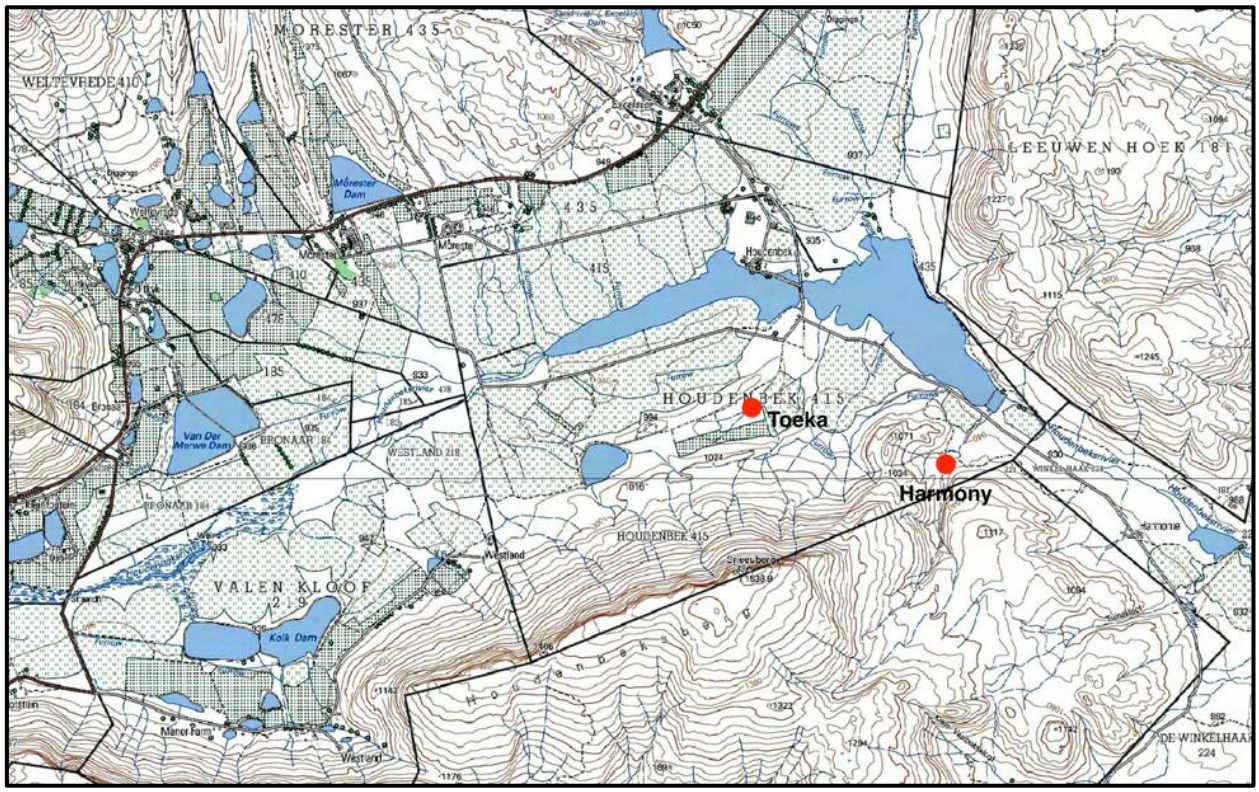

Figure 1. Location of proposed Toeka and Harmony dams at farm Houdenbek 415, Ceres District (Map source: 1: 50 000 3219CD De Meul. Chief Directorate: National Geo-spatial Information).

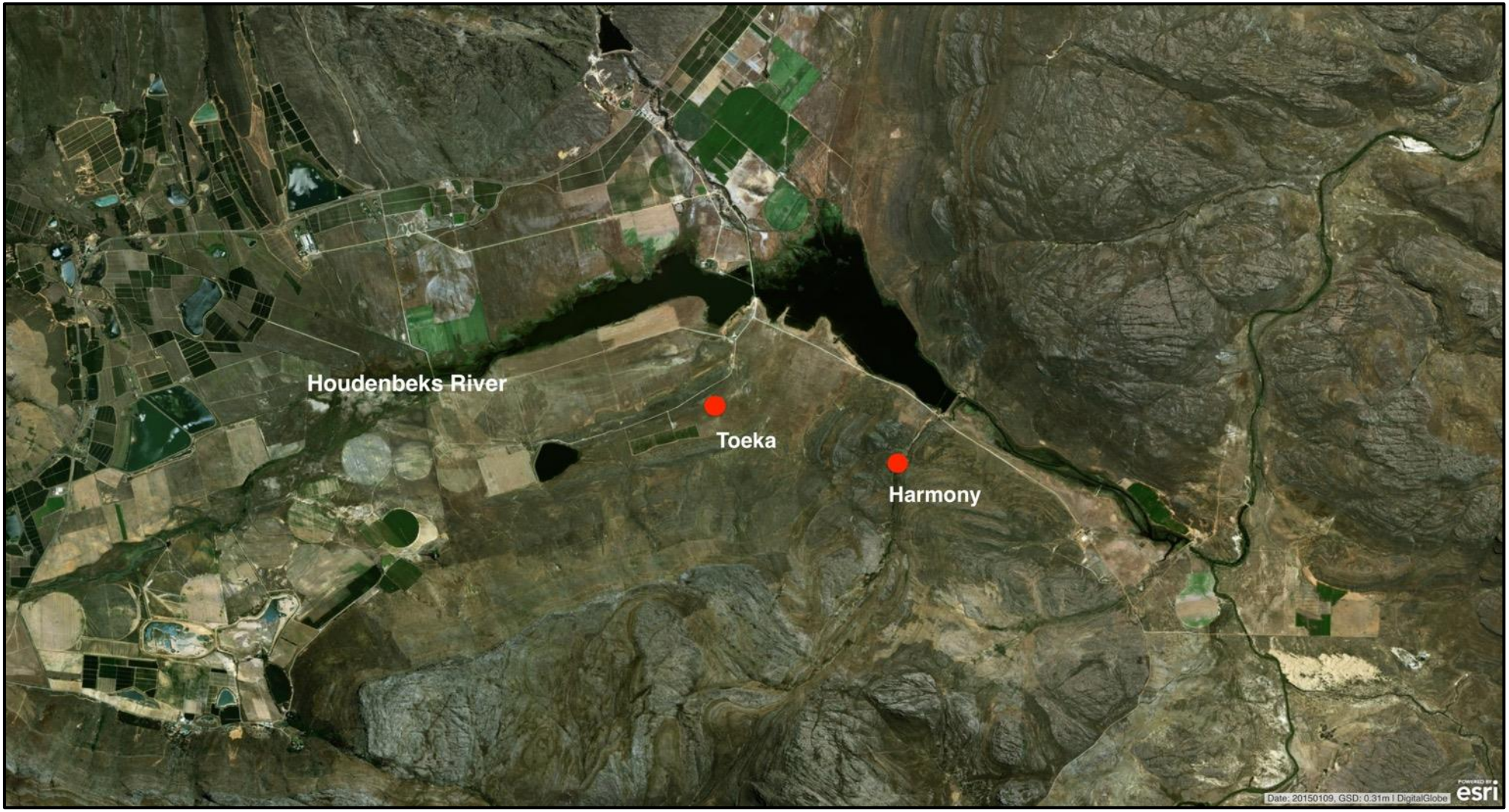

Figure 2. Aerial image (Google Earth ™) showing the location of the proposed Toeka and Harmony dams in relation to the Houdenbeks River.

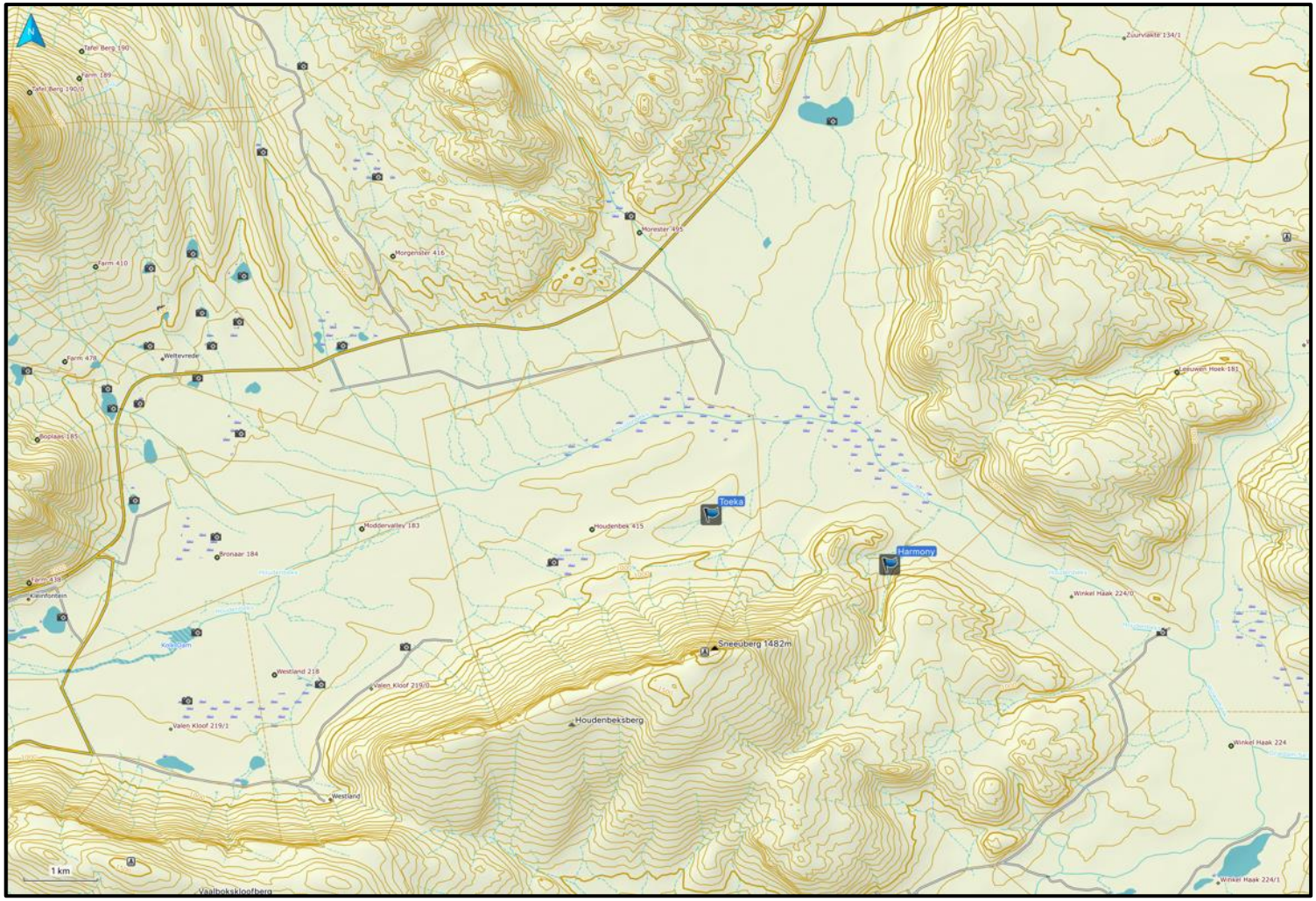

Figure 3. Topographical Map showing the location of the proposed Toeka and Harmony dams north and northeast of Sneeuberg, Koue Bokkeveld

3.2 Topography and geology

3.2.1 Harmony Dam

The Option 1 site (preferred) as well as the Option 3 site of the Harmony Dam are located on sandy shale and siltstone with sandstone bands, becoming mainly quartzitic sandstone, of the Witteberg Group (Figure 4). The preferred site is in an incised valley whereas the Option 3 site is located in more open, even terrain.

Soils at the Harmony Dam preferred site (Option 1) are classified as rocky, being mainly of the Glenrosa and Mispah soil forms. In contrast, the soils of the Option 3 site (indicated by a red arrow in Figure 5) are soils with limited pedalogical development.

3.2.1 Toeka Dam

The Toeka Dam site is on alluvium over shale, siltstone, arenaceous shale and thin sandstone bands of the Bidouw Sub-group, Bokkeveld Group (Figure 4). The Toeka Dam site is relatively flat with a shallow gradient downwards in a northeasterly direction.

The soils of the Toeka Dam site are soils with a plinthic catena meaning that iron oxides are segregated and concentrated in the form of mottling and cementation (Fey, 2010) (Figure 5).

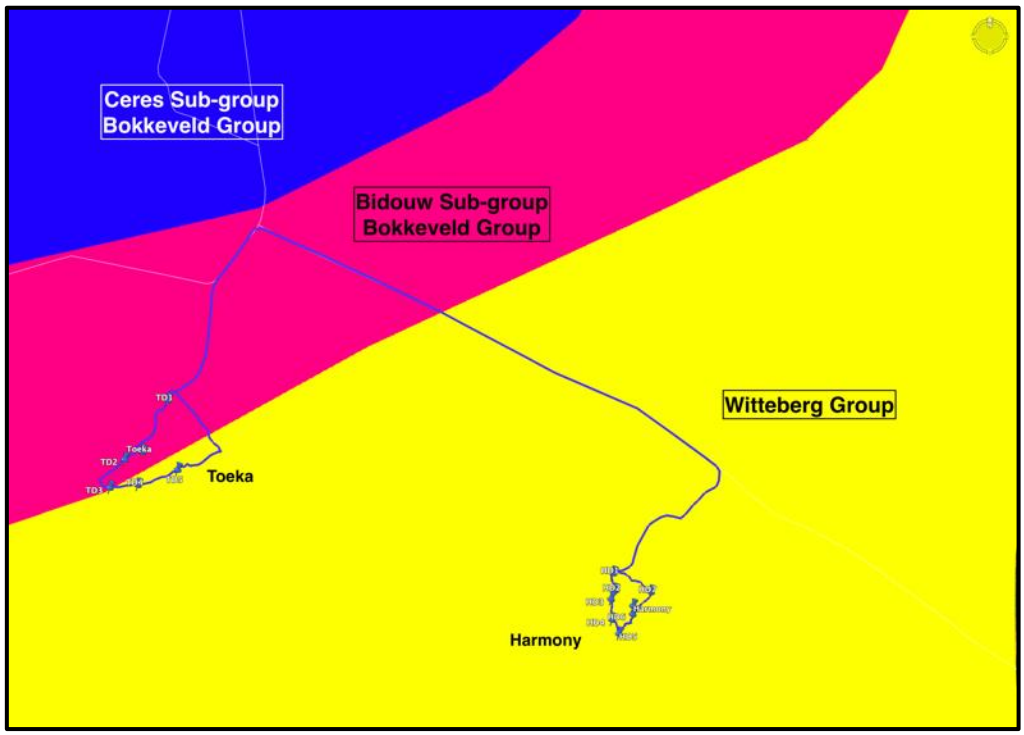

Figure 4. Geological map overlaid on Google Earth ™ with the proposed Harmony Dam located in the Witteberg Group and the proposed Toeka Dam at the contact between the Witteberg Group and Bokkeveld Group.

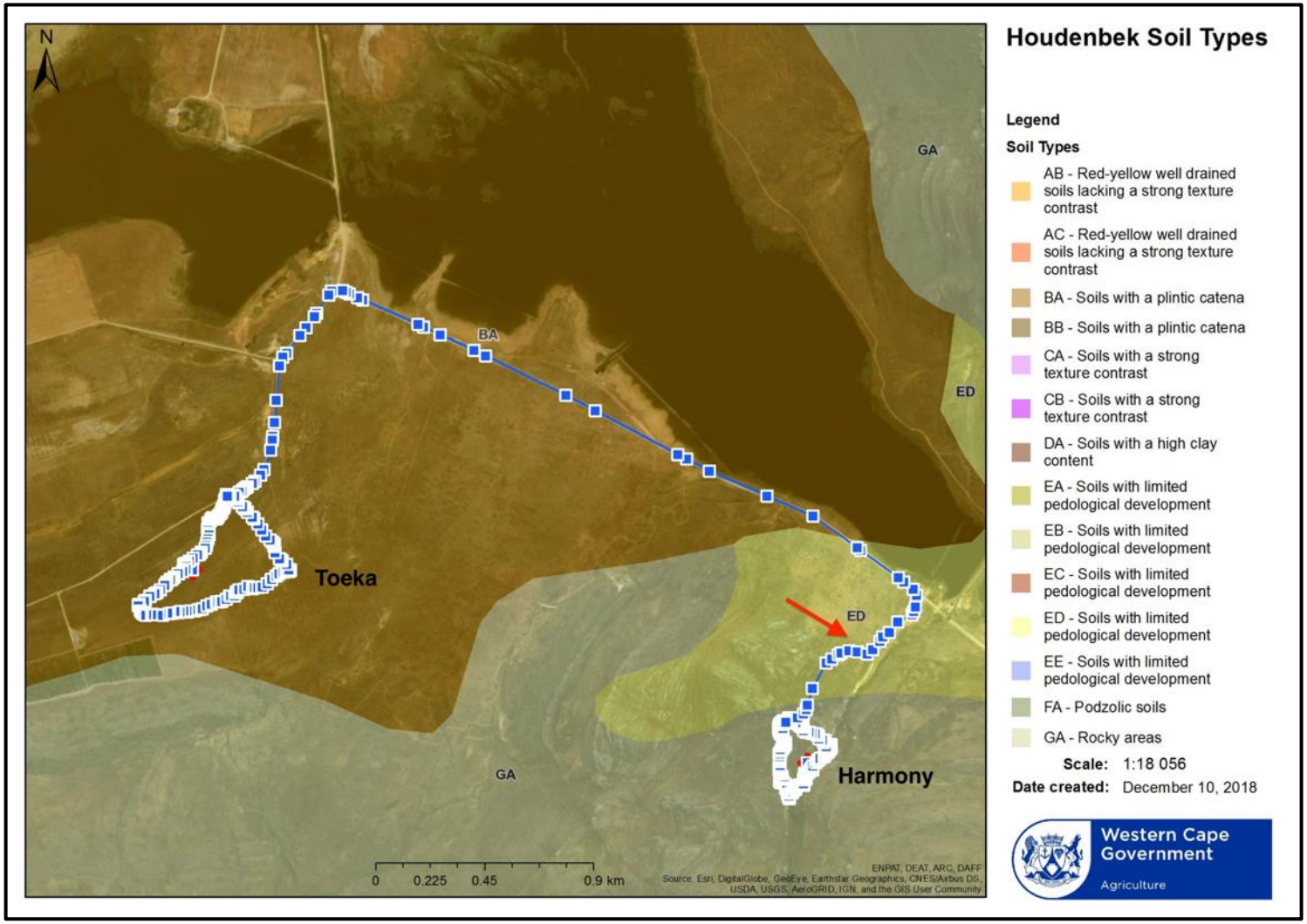

Figure 5. Broad soil types with the proposed Harmony Dam at a site with rocky soils (GA) and the Toeka Dam at a site with soils having a plinthic catena.

3.3 Climate

The study area falls within the Winter Rainfall Region of the Western Cape Province. It experiences a Mediterranean-type climate with cool to cold, wet winters and hot, dry summers. The climate diagram for Winterhoek Sandstone Fynbos (Figure 6) most closely approximates the climate of the Houdenbek study area.

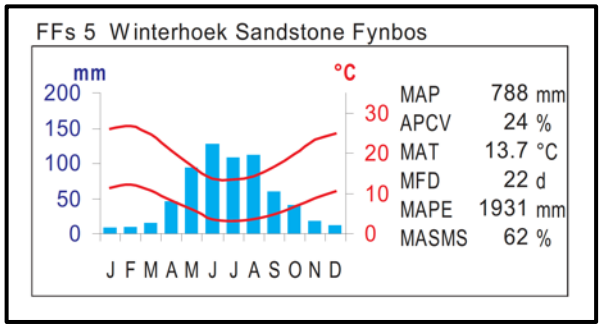

Figure 6. Climate diagram for Winterhoek Sandstone Fynbos, the principal vegetation type in the study area (Rebelo *et al.* in Mucina & Rutherford, 2006) showing MAP – Mean Annual Precipitation; ACPV = Annual Precipitation Coefficient of Variance; MAT = Mean Annual Temperature; MFD = Mean Frost Days; MAPE = Mean Annual Potential Evaporation; MASMA = Mean Annual Soil Moisture Stress.

4. Methods

4.1 Field Sampling

The field-work for the assessment of both the Harmony Dam and Toeka Dam sites was conducted on 30 June 2017 and took approximately 5 hours. The Harmony sites were accessed from the gravel road between Môrester and Winkelhaaks and the Toeka site from a farm road on Houdenbek 415.

4.2 Desk-top analysis and reporting

The photographs obtained in the field as well as available literature and Google Earth Pro ™ were used for the description of the vegetation presented in this report. The National Vegetation Map (SANBI, 2012) (referred to as VEGMAP) was used as the 'base-map' to determine the principal original vegetation types.

5. Limitations and Assumptions

Since the survey took place in June i.e. winter, it was expected that the vegetation would be in good condition. However, with the significantly dry winter during a long drought, the vegetation was not in optimal condition. However, a meaningful survey was still possible since the fynbos shrubland is not as dependent on winter rainfall for it to be successfully surveyed because the vegetation is perennial and the majority of plant species could be seen.

Only the Option 1 location for the proposed Harmony Dam was investigated since the Option 3 site had not been proposed by the time of the field survey. It was only proposed after the Heritage Assessment (Heritage CTS, 2018) had taken place.

6. Development Options

6.1 Harmony Dam

Once it had been determined that the only feasible location of the Harmony Dam would be at the so-called Harmony No. 2 site, four development options were considered (together with the 'No Go' alternative) (Figure 7). They are as follows:

(i) Option 1 (the main area surveyed in this study) was the preferred option for reasons pertaining to construction and potential water storage capacity.

(ii) Option 2 would be with the wall moved further north than Option 1; this option has not been pursued since the capacity of the dam would be too small for it to be viable.

(iii) Option 3 would be with the wall moved further north but with the wall curved to increase storage capacity.

(iv) Option 4 would be as for Option 1 but with an additional wall to the south to protect the identified heritage resources. The cost of the additional wall renders this option unviable.

6.2 Toeka Dam

With respect to the Toeka Dam site, only one development option and the 'No Go' alternative are considered.

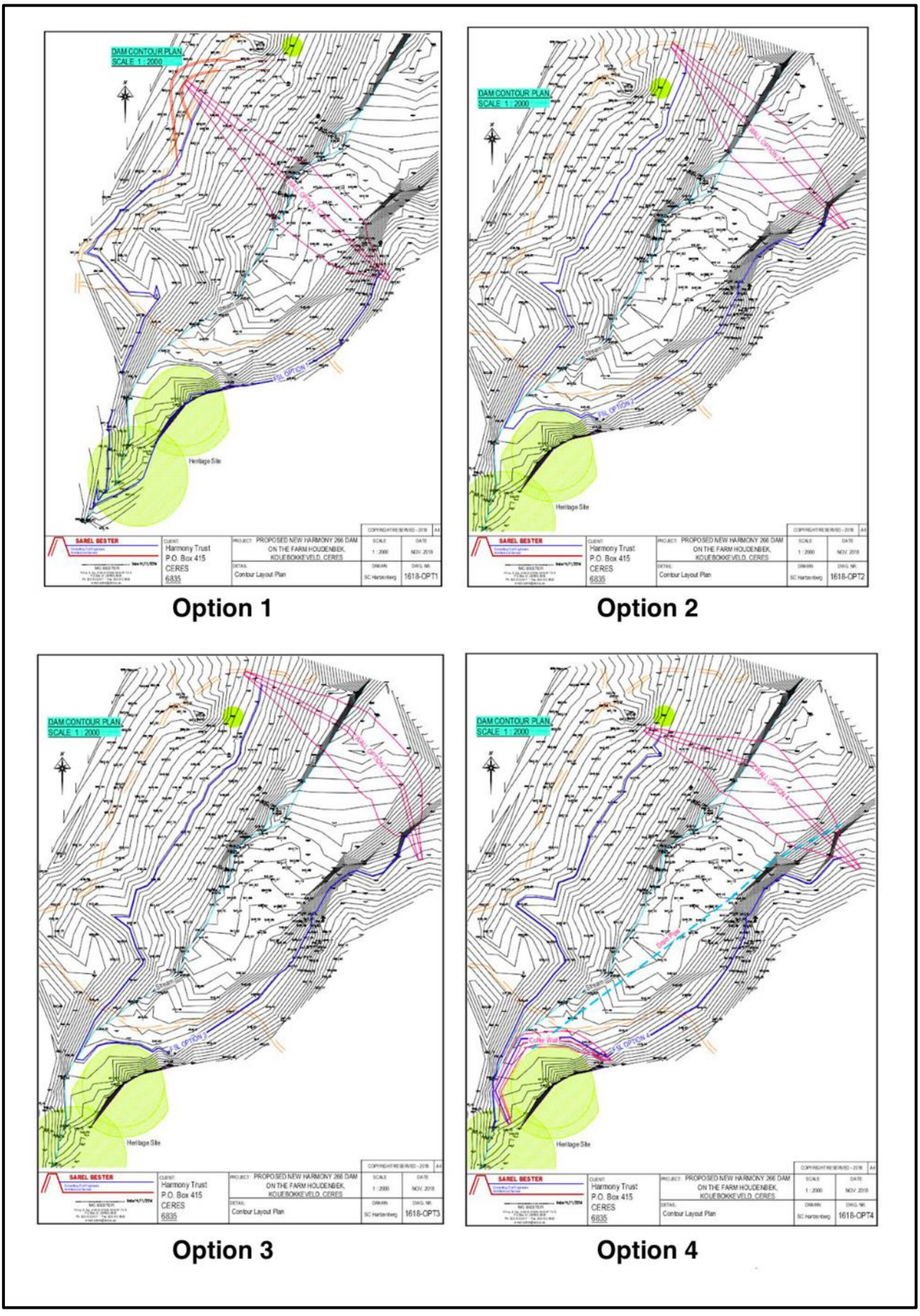

Figure 7. Four proposed alternatives for the harmony Dam

7. Disturbance regime

7.1 Harmony Dam

The preferred site (Option 1) for the Harmony Dam is disturbed very little. The only disturbance is a two-spoor farm track. Selection of this option would result in flooding of pristine fynbos in the dam inundation area (Figure 8).

Figure 8. A view of the typical proteoid-restioid shrubland on sandstone substrate in the valley where the proposed Harmony Dam would be constructed.

The Option 3 site, however, is much more disturbed. No photographs are available but it is clear from historical images obtained from Google Earth Pro ™that there has been some agricultural activity in the area where the dam wall would be constructed. Assuming that Option 3 may be pursued, the dam water would flood an area that has partly been disturbed and is partly undisturbed fynbos (Figures 9—11).

Figure 9. Aerial image (Google Earth ™ of 3 March 2004 with the Option 3 dam wall superimposed.

Figure 10. Aerial image (Google Earth ™) of 17 June 2010 with the Option 3 dam wall superimposed.

Figure 11. Aerial image (Google Earth ™) of 5 July 2017 with the Option 3 dam wall superimposed.

7.2 Toeka Dam

The site selected for the Toeka Dam is entirely disturbed by agriculture. Only secondary vegetation is present, it having colonized the fallow lands (Figure 12).

Figure 12. The site of the proposed Toeka Dam in an area completely transformed by agriculture.

8. The Vegetation

8.1 The vegetation in context

According to the Vegetation map of South Africa, Lesotho, and Swaziland (Mucina, Rutherford & Powrie 2005), the vegetation that occurs at the proposed Harmony Dam site (all options) is Winterhoek Sandstone Fynbos (Figure 12). It is a vegetation type that is fairly widespread on the sandstone substrates of the Kouebokkeveld plateau and mountains, including Houdenbek Mountain, the Agter-Witsenberg and parts of the Groot Winterhoek Mountains. Rebelo *et al.* (2006) describe the Winterhoek Sandstone Fynbos as follows: "*Vegetation is mainly closed restioland in deeper, moister sands, with low, sparse shrubs that become denser and restios less dominant in the drier habitats. Proteoid and ericaceous fynbos are found on higher slopes while asteraceous fynbos is more common on lower slopes. Cape thicket is prominent on the lowest slopes."*

In contrast to the Harmony Dam site, the Toeka Dam site would have originally supported Kouebokkeveld Shale Fynbos that is described by Rebelo *et al.* (2006) as follows:
" *…mainly moderately tall and dense proteoid shrubland. Asteraceous, proteoid and waboomveld fynbos shrublands are dominant, with fynbos restiolands occurring in bottomlands."*

However, the original vegetation has been completely lost from this site and all that now remains is secondary vegetation on the fallows agricultural lands.

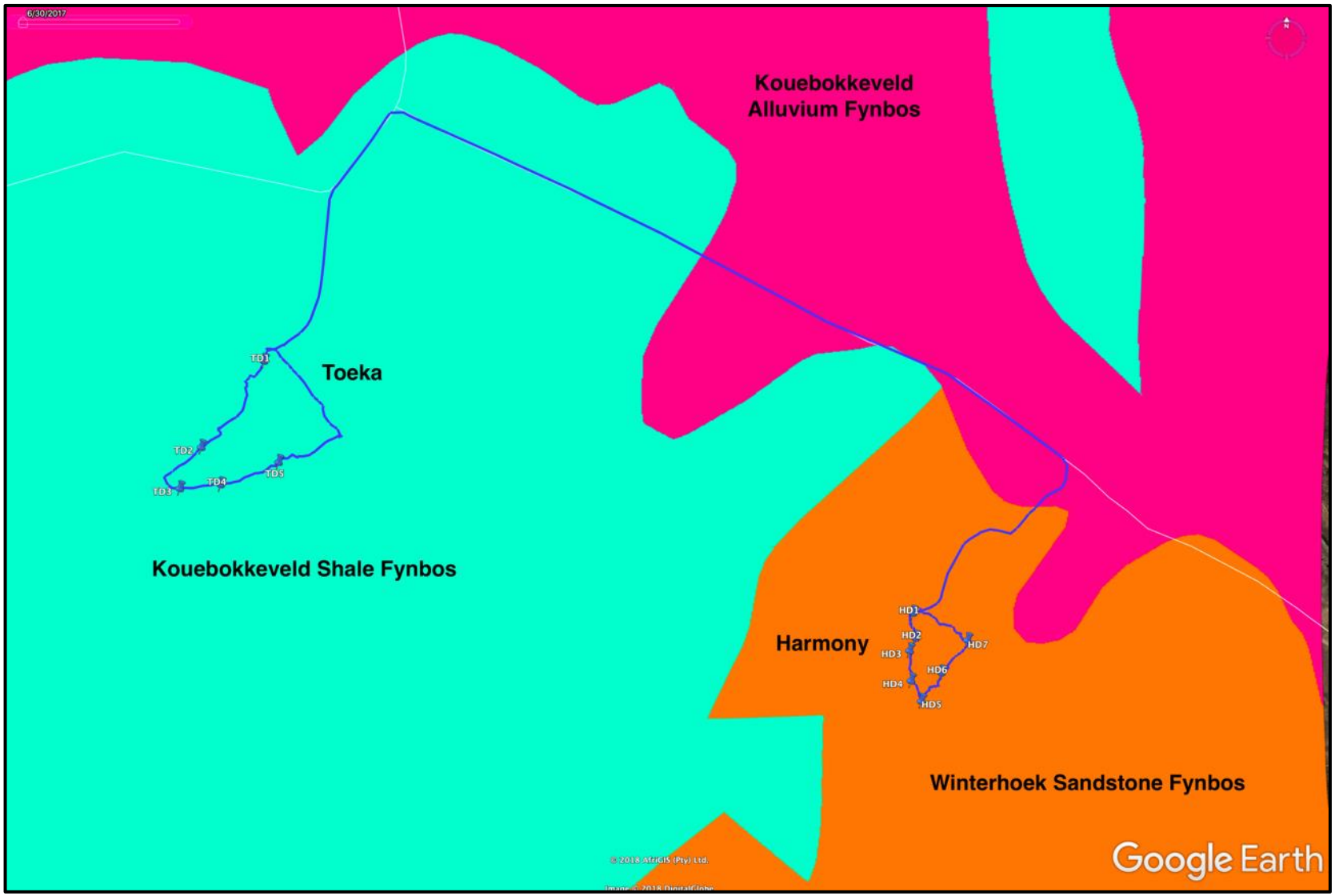

Figure 12. Portion of the *Vegetation map of South Africa, Lesotho, and Swaziland* (Mucina, Rutherford & Powrie 2005) showing the two vegetation types originally or still occurring at the proposed Harmony and Toeka dam sites.

8.2 The vegetation of the Harmony Dam area

The following notes were compiled at the respective sample waypoints at the Option 1 location of the proposed Harmony Dam. The Option 3 location was not investigated in the field because the site has not been determined by the time of the field-survey.

Waypoint HD1: S 32° 59' 50.5" E 19° 27' 39.1"

At the two-spoor track on the west side of the valley. The vegetation is uniform in the area of the dam footprint (Figure 13). It consists of an open to mid-dense, tall proteoid stratum, dominated by *Protea laurifolia*, with a low closed (dense) restioland understorey. Species recorded include: *Centella* sp., *Cymbopogon marginatus*, *Ehrharta ramosa*, *Elytropappus gnaphaloides, Hypodiscus argenteus, Ischyrolepis* sp., *Leucadendron* sp., *Leucospermum calligerum, Metalasia densa*, *Muraltia spinosa, Passerina obtusifolia*, *Phylica* sp., *Protea* sp., *Restio* sp., *Stoebe capitata*, *Tetraria capillacea*, *Thamnochortus* sp.

Figure 13. View up the valley where the proposed Harmony Dam would be located in Winterhoek Sandstone Fynbos.

Waypoint HD2: S 32° 59' 52.9" E 19° 27' 39.3"

Area with localized large sandstone boulders (Figure 14). The same vegetation community is found as at waypoint HD1 but with some additional species namely, *Anaxeton* sp.,

Asparagus capensis, Cliffortia ruscifolia, Diospyros glabra, Felicia filifolia, Lobostemon sp. and *Stoebe plumosa.*

Figure 14. Large sandstone boulders are found in part of the study area.

Waypoint HD3: S 32° 59’ 54.1” E 19° 27’ 38.6”

This area has a mid-dense stand of *Protea laurifolia* in the upper stratum, 1—2.5 m tall. The lower stratum is strongly restioid and the plant community is the same as at waypoint HD1 and HD2 but with the additional presence of *Phylica sp*. and *Protea laevis* (Figure 15).

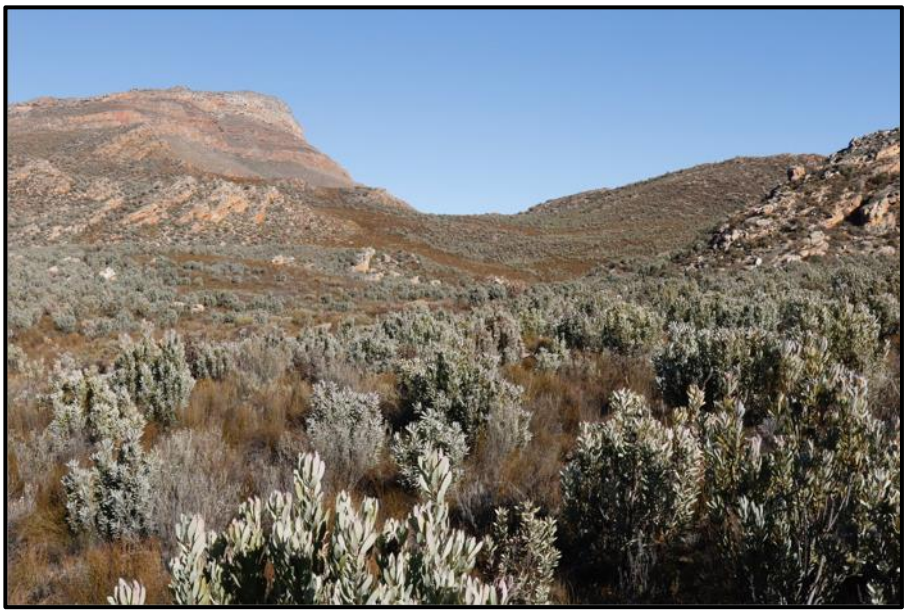

Figure 15. The area around waypoint HD3.

Waypoint HD4: S 32° 59’ 57.0” E 19° 27’ 38.8”

This waypoint is located on a two-spoor track at the upper end of the Option 1 and Option 2 dam footprint (inundation area). The vegetation is the same proteoid fynbos as found at waypoints HD1—HD3. In addition, *Leucadendron salignum* and the ground protea *Protea laevis* (Figure 17) were found here.

Figure 16. A two-spoor track leads up the valley through the site proposed for the Harmony Dam.

Figure 17. *Protea laevis.*

Waypoint HD5: S 32° 59’ 59.0” E 19° 27’ 40.0”

This waypoint was recorded at the dry stream channel (Figure 18). Species include *Asparagus aethiopicus, Cannomois* sp. – dominant, *Cliffortia juniperifolia, Cliffortia strobilifera, Cymbopogon marginatus, Elytropappus gnaphaloides, Elytropappus rhinocerotis, Eragrostis curvula, Erica* sp. – very small flowers, *Imperata cylindrica, Muraltia spinosa, Rhodocoma gigantean, Searsia undulata* and *Willdenowia* cf. incurvata

Figure 18. The seasonal stream channel with dominant Restionaceae

Waypoint HD6: S 32° 59’ 56.3” E 19° 27’ 42.3”

Open grassy area on alluvium. Vegetation is almost exclusively *Eragrostis curvula* (Figure 19). Near the sandstone cliffs is a third community dominated by *Searsia undulata* with *Asparagus lignosus* (entwined in the shrubs.

Figure 19. Open grassy area on alluvium with a shrubby thicket community next to the sandstone cliffs.

Figure 20. *Asparagus lignosus*

Waypoint HD7: S 32° 59’ 53.2” E 19° 27’ 45.4”

This waypoint was recorded at a soil pit more or less where the Option 1 dam wall would be. The vegetation on the sandy alluvium is dominated by restios, mainly *Willdenowia incurvata*. No *Protea laurifolia* occurs at this location. *Leucadendron brunioides* var. *brunioides* was recorded here (Figure 21).

Figure 21. Area of the proposed Harmony Dam Option 1 site

Figure 21. *Leucadendron brunioides* var. *brunioides*

8.3 The vegetation of the Toeka Dam area

The vegetation at the Toeka Dam site was sampled at six waypoints. Most of the area, apart from around waypoint TD1, where the Toeka Dam would be located has been transformed by agriculture.

Waypoint TD1: S 32° 59' 26.2" E 19° 26' 24.2"

At TD1 the vegetation is a low, mid-dense graminoid shrubland with occasional emergent proteoids (*Leucadendron salignum*) (Figure 22). Species record include, *Askidiosperma sp., Cliffortia ruscifolia, Ehrharta ramosa, Elytropappus gnaphaloides, Eriocephalus africanus, Hypodiscus argenteus, Metalasia densa, Muraltia spinosa, Passerina obtusifolia, Pentameris macrocalycina, Pentaschistis sp., Phylica sp. (2), Phylica sp. (3), Tenaxia stricta, Tetraria crassa* and *Tetraria ustulata.*

This area appears to have not been previously cultivated. A contour ridge runs NE—SW and beyond the ridge to the east, the area has been previously cultivated. A few invasive pine trees (*Pinus radiata*) occur here.

Figure 22. Uncultivated area around waypoint TD1 near the proposed position of the Toeka Dam wall.

Waypoint TD2: S 32° 59’ 34.5” E 19° 26’ 17.1”

The area proposed for the Toeka Dam is open, shallowly undulating and has been previously ploughed. Now it has stands of opportunistic shrubs that have recolonized, together with abundant grasses (Figure 22). *Elytropappus rhinocerotis* is co-dominant with *Muraltia spinosa* and *Passerina obtusifolia*. The only other notable species is *Carpobrotus edulis*.

Figure 22. Cultivated area that was originally Kouebokkeveld Shale Fynbos, now transformed but with secondary vegetation present.

Waypoint TD3: S 35° 59’ 38.5” E 19° 26’ 14.6”

At this waypoint the cover is mainly the grass *Cynodon dactylon* (kweekgras) with a few scattered shrubs of *Muraltia spinosa*.

Figure 23. *Cynodon dactylon* (kweekgras) is the dominant grass at waypoint TD3.

Waypoint TD4: S 35° 59’ 38.1” E 19° 26’ 19.3”

This waypoint is at a deep drainage ditch (dry at the time of sampling) that crosses the Toeka Dam site. Large mats of *Carpobrotus edulis* are found in places but no vegetation of any importance was noted.

Cattle graze the entire area.

Figure 24. A drainage ditch runs through the proposed Toeka Dam site.

Waypoint TD5: S 35° 59’ 36.0” E 19° 26’ 26.0”

This waypoint was recorded towards the east-northeast end of the Toeka Dam site close to where the wall would be situated. The area is completely dominated by *Elytropappus rhinocerotis* shrubs, 1-1.5 m tall with open to mid-dense cover (Figure 25).

Figure 25. Mid-high renosterbos shrubs dominate the upper stratum with a graminoid field stratum.

Waypoint TD6: S 35° 59’ 33.6” E 19° 26’ 32.9”

Soil pits have been excacated at the Toeka Dam site and this waypoint was at one of the pits in the area of the proposed dam wall. The vegetation is all secondary colonization of previously ploughed land. *Elytropappus rhinocerotis* is dominant. The soil is deep yellow-brown alluvial sand.

Figure 26. A soil pit in the alluvial sandy soil of the proposed Toeka Dam site.

9. Conservation status

No Red List species (i.e. species of conservation concern) were encountered in the study either at the proposed Harmony Dam site or the Toeka Dam site. Neither of the two vegetation types encountered is listed in the list of Threatened Terrestrial Ecosystems (Government Gazette, 2011).

An overlay on Google Earth ™ imagery of the map from the Western Cape Biodiversity Spatial Plan (WCBSP) 2017 (CapeNature, 2017) (Pool-Stanvliet *et al.*, 2017) for the Witzenberg Municipality is presented in Figure 27. Critical Biodiversity Area 1 (CBA1 and CBA 2) areas (not shown in Figure 27) would not be affected by the dams but the proposed Harmony Dam is well within the Kouebokkeveld Mountain Catchment Area which is a Protected Area in terms of the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) (NEMPAA) (green in Figure 27).

The site proposed for the Toeka Dam is within an Ecological Support Area (ESA2) (light blue in Figure 27).

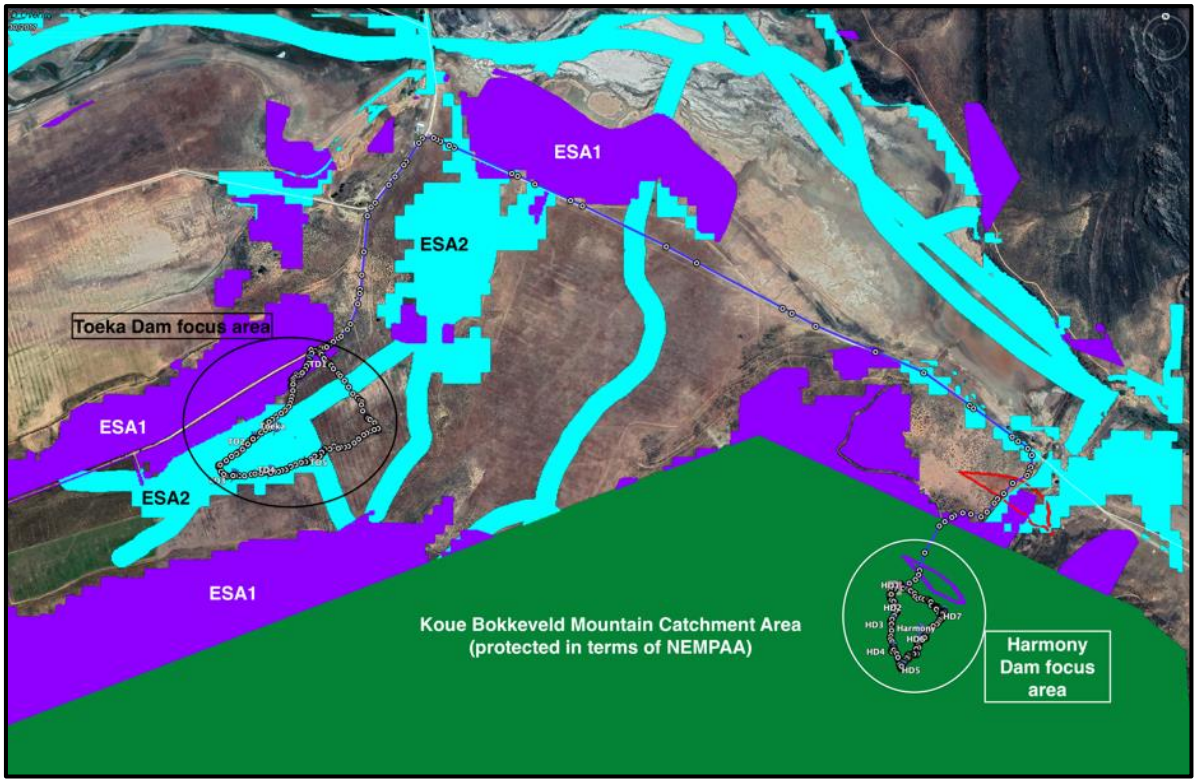

Figure 27. Critical Biodiversity Areas map from WCBSP 2017 overlaid on Google Earth (Note: CBA1 and CBA2 areas are not shown). The Harmony Dam would lie well within the Koue Bokkeveld Mountains Catchment Area [protected] (green)and the Toeka Dam in an area designated at ESA2 (light blue).

10. Impact Assessment

Impacts on the vegetation are assessed for the construction and operation of the proposed dams. For the Harmony Dam, four options (alternatives) and the No Go are assessed. For the Toeka Dam, one option (alternative) and the No Go alternative are assessed.

10.1 'No Go' Alternative

In the case of the **"No Go" alternative,** both the dams would not be built and there would be no change to the *status quo*. The natural veld would persist in the catchment where the Harmony Dam would be built and at the Toeka Dam site, agriculture would be pursued, probably mainly grazing by cattle. The 'no development' alternative or 'No Go' alternative would thus have a **Negligible** impact on the natural vegetation with no significant further loss in the short- to long-term.

The 'No Go' alternative is included in tables 1 and 2.

10.2 Direct Impacts

Direct impacts are those that would occur directly on the vegetation of the two sites as a result of the proposed construction of the dams. The rating system used is given in Appendix 1. In addition to determining the individual impacts using various criteria, mitigation is also brought into the assessment.

The impacts of the proposed dams on the vegetation and habitat are considered with respect to loss of vegetation type and habitat including plant species due to construction and operational activities. Ecological processes are intrinsic to the habitat and are not separated here for assessment but rather the assessment incorporates the effect on ecological processes as part of the affected habitat.

The assessment is not made with respect to the desirability or undesirability of an 'in-stream dam'. That assessment resides in the realm of the freshwater specialist since cumulative effects of the dam on downstream flows must be assessed. This assessment is restricted to the 'terrestrial' vegetation.

10.2.1 Direct Impacts of the proposed Harmony Dam

10.2.1.1 Loss of vegetation type and habitat including plant species (including ecological processes) due to construction and operation of the proposed Harmony Dam (Table 1).

Option 1.

The Option 1 construction of the Harmony Dam would have the greatest negative impact on undisturbed natural vegetation (Winterhoek Sandstone Fynbos) since the largest area of intact fynbos would be affected by the wall construction and inundation by the dam. The impact is rated as **High Negative**.

Option 2.

From a botanical perspective, the Option 2 construction of the Harmony Dam would have a marginally lower negative impact than Option 1 due to a smaller dam wall, but it would still be **High Negative**.

Option 3.

Option 3 is the preferred option. The wall would be constructed lower in the catchment in an area that is more disturbed than higher in the catchment. Less proteoid fynbos (and intact undisturbed fynbos) would be inundated by the dam and hence the impact would be less negative. However, since the dam would still fall within a protected area the negative impact cannot be rated as less than **Medium Negative**.

Option 4.

The Option 4 dam would result in the loss of the most undisturbed vegetation and habitat and is not desirable. The impact would be **High Negative**.

Table 1. Impact and Significance – Loss of natural vegetation and habitat during construction and operational phases for Harmony Dam.

CRITERIA	'NO GO' ALTERNATIVE		Option 1		Option 2		Option 3		Option 4	
Nature of direct impact (local scale)	**Loss of Winterhoek Sandstone Fynbos**									
	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local	Local	Local	Local	Local	Local	Local	Local	Local
Duration	Long-term	Long-term	Long-term	Long-term	Long-term	Long-term	Long-term	Long-term	Long-term	Long-term
Intensity	Low	Low	High	High	High	High	Medium	Medium	High	High
Probability of occurrence	Probable	Probable	Probable	Probable	Probable	Probable	Probable	Probable	Probable	Probable
Confidence	High	High	High	High	High	High	High	High	High	High
Significance	Negligible	Negligible	High negative	High negative	High negative	High negative	Medium negative	Medium negative	High negative	High negative
Nature of Cumulative impact	**Loss of Winterhoek Sandstone Fynbos**									
Cumulative impact prior to mitigation	Low negative									
Degree to which impact can be reversed	Not reversible									
Degree to which impact may cause irreplaceable loss of resources	Low									
Degree to which impact can be mitigated	Low									

Proposed mitigation	Mitigation not possible in the dam inundation area. The only mitigation would be to revegetate the dam wall.
Cumulative impact post mitigation	Low negative
Significance of cumulative impact (broad scale) after mitigation	Low negative

10.2.1.2 Mitigation

Proposed mitigation would be rehabilitation (restoration of vegetation) of the dam wall. No mitigation would be possible in the area of the dam wall and inundation area.

10.2.2 Direct Impacts of the proposed Toeka Dam

10.2.2.1 Loss of vegetation type and habitat including plant species (including ecological processes) due to construction and operation of the proposed Toeka Dam (Table 2).

Even though the area where the Toeka Dam would be situated is located in an area that originally supported Kouebokkeveld Shale Fynbos (Least Threatened), there is none of that vegetation type remaining. The habitat is transformed but now supports secondary vegetation. It consequently has some ecological value and the rating of the area as ESA2 is valid inasmuch as this is a seasonal riparian corridor. As noted above, this study does not address questions of 'instream dams' and the assessment is restricted to evaluating the terrestrial vegetation. In view of these criteria, the impact of a dam at the Toeka site would be Low Negative from a terrestrial botanical perspective.

Table 2. Impact and Significance – Loss of natural vegetation and habitat during construction and operation of Toeka Dam.

CRITERIA	'NO GO' ALTERNATIVE		PREFERRED ALTERNATIVE	
Nature of direct impact (local scale)	**Loss of degraded Kouebokkeveld Shale Fynbos**			
	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local	Local	Local
Duration	Long-term	Long-term	Long-term	Long-term
Intensity	Low	Low	Low	Low
Probability of occurrence	Probable	Probable	Probable	Probable
Confidence	High	High	High	High
Significance	Negligible	Negligible	Low negative	Low negative
Nature of Cumulative impact	**Loss of Kouebokkeveld Shale Fynbos**			
Cumulative impact prior to mitigation	Low negative			
Degree to which impact can be reversed	Not reversible			
Degree to which impact may cause irreplaceable loss of resources	Very low			
Degree to which impact can be mitigated	Not required			
Proposed mitigation	None			
Cumulative impact post mitigation	Low negative			
Significance of cumulative impact (broad scale) after mitigation	Negligible			

10.2.2.2 Mitigation

No effective mitigation would be possible or necessary to compensate for the loss of natural vegetation and habitat since the area is already highly transformed.

10.3 Indirect impacts

By definition indirect impacts occur away from the 'action source' i.e. away from the development site. The impact assessed here is specifically how the proposed dams would have an indirect impact on vegetation and flora away from the development site. No indirect impacts for terrestrial vegetation and flora were identified. The indirect impacts pertain mainly to downstream effects that are not evaluated in this study.

10.4 Cumulative impacts

The receiving environment into which the proposed dams would be imposed is highly altered by farming operations in the case of the Toeka Dam site but only minimally disturbed at the Harmony Dam site. The cumulative effect of a dam at the Toeka site would be minimal and of little consequence. At the Harmony Dam site, good fynbos habitat would be lost but at a local scale. The Winterhoek Sandstone Fynbos would in no way be threatened by the construction of the dam and the contribution of the loss of vegetation and habitat due to the construction of the Harmony Dam would have a low to very low cumulative effect. The Winterhoek Sandstone Fynbos is widespread and well protected in the Kouebokkeveld Mountain Catchment Area and is not generally under threat.

11. General Assessment and Recommendations

- Two vegetation types are mapped as occurring in the study area. However, the Kouebokkeveld Shale Fynbos has already been completely lost at the Toeka Dam site. Good condition Winterhoek Sandstone Fynbos occurs at the Harmony Dam site.
- The Toeka Dam site is located in an ESA2 and has very low botanical sensitivity. Construction of a dam at this location would have **Low Negative** impacts on any vegetation (given that a secondary plant community now occurs at the site) and from a botanical perspective construction of the proposed Toeka Dam is supported.
- The impact of a dam at the Harmony Dam site (preferred option – Option 3) would result in a **Medium Negative** impact at a **local scale**. Scale is important in this case because the vegetation type is not threatened and in a cumulative sense the loss of vegetation and habitat would be relatively small. The construction of the Harmony Dam (Option 3) is supported but not Options 1, 2 & 4.

12. Conclusions

The two sites for proposed dams at Houdenbek are very different in their ecological and vegetation characteristics. The consequence is that they are treated entirely separately in terms of impact assessment on the vegetation and habitat. Each site has been evaluated on its merits and it has been found that both dams are feasible and acceptable from a terrestrial botanical viewpoint. The Toeka Dam site has much fewer concerns than the Harmony Dam site due to the existing high level of disturbance. The important question at the Harmony Dam site is whether the dam is desirable or acceptable in a protected mountain catchment area? This question is not addressed here since the impacts are only based on the merits of the sites in the local and immediate context of the vegetation found.

Construction of dams at both sites is supported when looked at purely from the terrestrial vegetation perspective.

13. References

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Report submitted: 12 March 2019

Appendix 1: Impact Assessment Methodology

The assessment of impacts needs to include the determination of the following:

- The nature of the impact – see Table 1.1
- The magnitude (or severity) of the impact – see Table 1.2
- The likelihood of the impact occurring - see Table 1.2

The degree of confidence in the assessment must also be reflected.

Table 1.1 Impact assessment terminology

Term	Definition
Impact nature	
Positive	An impact that is considered to represent an improvement on the baseline or introduces a positive change.
Negative	An impact that is considered to represent an adverse change from the baseline, or introduces a new undesirable factor.
Direct impact	Impacts that result from a direct interaction between a planned project activity and the receiving environment/receptors (e.g. between occupation of a site and the pre-existing habitats or between an effluent discharge and receiving water quality).
Indirect impact	Impacts that result from other activities that are encouraged to happen as a consequence of the Project (e.g. in-migration for employment placing a demand on resources).
Cumulative impact	Impacts that act together with other impacts (including those from concurrent or planned future third party activities) to affect the same resources and/or receptors as the Project.

Assessing significance

There is no statutory definition of '*significance*' and its determination is, therefore, somewhat subjective. However, it is generally accepted that significance is a function of the magnitude of the impact and the likelihood of the impact occurring. The criteria used to determine significance are summarized in *Table 1.2*

Table 1.2 Significance criteria

Impact magnitude	
Extent	*On-site* – impacts that are limited to the boundaries of the rail reserve, yard or substation site. *Local* – impacts that affect an area in a radius of 20km around the development site. *Regional* – impacts that affect regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries, habitat type/ecosystem. *National* – impacts that affect nationally important environmental resources or affect an area that is nationally important/ or have macro-economic consequences.
Duration	*Temporary* – impacts are predicted to be of short duration and intermittent/occasional. *Short-term* – impacts that are predicted to last only for the duration of the construction period. *Long-term* – impacts that will continue for the life of the Project, but ceases when the Project stops operating. *Permanent* – impacts that cause a permanent change in the affected receptor or resource (e.g. removal or destruction of ecological habitat) that endures substantially beyond the Project lifetime.

Intensity	BIOPHYSICAL ENVIRONMENT: *Intensity can be considered in terms of the sensitivity of the biodiversity receptor (ie. habitats, species or communities).* **Negligible** – the impact on the environment is not detectable. **Low** – the impact affects the environment in such a way that natural functions and processes are not affected. **Medium** – where the affected environment is altered but natural functions and processes continue, albeit in a modified way. **High** – where natural functions or processes are altered to the extent that it will temporarily or permanently cease. ***Where appropriate, national and/or international standards are to be used as a measure of the impact.*** *Specialist studies should attempt to quantify the magnitude of impacts and outline the rationale used.* SOCIO-ECONOMIC ENVIRONMENT: *Intensity can be considered in terms of the ability of project affected people/communities to adapt to changes brought about by the Project.* **Negligible** – there is no perceptible change to people's livelihood **Low** - People/communities are able to adapt with relative ease and maintain pre-impact livelihoods. **Medium** - Able to adapt with some difficulty and maintain pre-impact livelihoods but only with a degree of support. **High** - Those affected will not be able to adapt to changes and continue to maintain-pre impact livelihoods.
Impact likelihood (Probability)	
Negligible	The impact does not occur.
Low	The impact may possibly occur.
Medium	Impact is likely to occur under most conditions.
High	Impact will definitely occur.

Once a rating is determined for magnitude and likelihood, the following matrix can be used to determine the impact significance.

Table 7.5 Example of significance rating matrix

SIGNIFICANCE RATING					
	LIKELIHOOD	**Negligible**	**Low**	**Medium**	**High**
MAGNITUDE	**Negligible**	**Negligible**	**Negligible**	**Low**	**Low**
	Low	**Negligible**	**Negligible**	**Low**	**Low**
	Medium	**Negligible**	**Low**	**Medium**	**Medium**
	High	**Low**	**Medium**	**High**	**High**

In *Table 7.6*, the various definitions for significance of an impact is given.

Table7.6 Significance definitions

Significance definitions	
Negligible significance	An impact of negligible significance (or an insignificant impact) is where a resource or receptor (including people) will not be affected in any way by a particular activity, or the predicted effect is deemed to be 'negligible' or 'imperceptible' or is indistinguishable from natural background variations.

Minor significance	An impact of minor significance is one where an effect will be experienced, but the impact magnitude is sufficiently small (with and without mitigation) and well within accepted standards, and/or the receptor is of low sensitivity/value.
Moderate significance	An impact of moderate significance is one within accepted limits and standards. The emphasis for moderate impacts is on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that 'moderate' impacts have to be reduced to 'minor' impacts, but that moderate impacts are being managed effectively and efficiently.
Major significance	An impact of major significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. A goal of the EIA process is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a development. It is then the function of regulators and stakeholders to weigh such negative factors against the positive factors such as employment, in coming to a decision on the Project.

Once the significance of the impact has been determined, it is important to qualify the **degree of confidence** in the assessment. Confidence in the prediction is associated with any uncertainties, for example, where information is insufficient to assess the impact. Degree of confidence can be expressed as low, medium or high.

Appendix 2: Botanical Assessment Content Requirements of Specialist Reports, as prescribed by Appendix 6 of GN R326.

Regulation	Content as required by NEMA	Specialist Report Section/Annexure Reference
1 (1) (a)	Details of- (i) The specialist who prepared the report; and	Cover & Page 2
	(ii) The expertise of that specialist to compile a specialist report, including a CV.	Page 2 & Appendix 3
1 (1) (b)	A declaration that the specialist is independent in a form as may be specified by the competent authority.	Page 4
1 (1) (c)	An indication of the scope of, and purpose for which, the report is prepared.	Pages 6, 7 & 14
1 (1)(cA)	An indication of the quality and age of base data used for the specialist report.	Page 13; Pages 18—28
1 (1)(cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change.	Pages 16--18
1 (1) (d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment.	Page 13
1 (1) (e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used.	Page 13
1 (1) (f)	Details of an assessment of the specifically identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives.	Pages 30—35
1 (1) (g)	An identification of any areas to be avoided, including buffers.	Not applicable
1 (1) (h)	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers.	Pages 8—12; 15, 19, 29
1 (1) (i)	A description of any assumptions made and any uncertainties or gaps in knowledge.	Page 13
1 (1) (j)	A description of the findings and potential implications of such findings on the impact of the proposed activity or activities.	Page 18--29
1 (1) (k)	Any mitigation measures for inclusion in the EMPr.	Not applicable
1 (1) (l)	Any conditions for inclusion in the environmental authorisation.	Not applicable

Regulation	Content as required by NEMA	Specialist Report Section/Annexure Reference
1 (1) (m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Not applicable
1 (1) (n)	A reasoned opinion- (i) whether the proposed activity, activities or portions thereof should be authorised; and	Page 35
	(iA) regarding the acceptability of the proposed activity or activities; and	Page 36
	(ii) If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Page 36
1 (1) (o)	A description of any consultation process that was undertaken during the course of preparing the specialist report	Not applicable
1 (1) (p)	A summary and copies of any comments received during any consultation process and where applicable, all responses thereto	Not applicable
1 (1) (q)	Any other information requested by the competent authority	Not applicable

Appendix 3: Curriculum Vitae

Dr David Jury McDonald Pr. Sci. Nat.

Name of Company: Bergwind Botanical Surveys & Tours CC. (Independent consultant)

Work and Home Address: 14 A Thomson Road, Claremont, 7708

Tel: (021) 671-4056 **Mobile:** 082-876-4051 **Fax:** 086-517-3806

E-mail: dave@bergwind.co.za

Website: www.bergwind.co.za

Profession: Botanist / Vegetation Ecologist / Consultant / Tour Guide

Date of Birth: 7 August 1956

Employment history:

- 19 years with National Botanical Institute (now SA National Biodiversity Institute) as researcher in vegetation ecology.
- Five years as Deputy Director / Director Botanical & Communication Programmes of the Botanical Society of South Africa
- Thirteen years as private independent Botanical Specialist consultant (Bergwind Botanical Surveys & Tours CC)

Nationality: South African (ID No. 560807 5018 080)
Languages: English (home language) – speak, read and write
Afrikaans – speak, read and write

Membership in Professional Societies:

- South Africa Association of Botanists
- International Association for Impact Assessment (SA)
- South African Council for Natural Scientific Professions (**Ecological Science, Registration No. 400094/06**)
- Field Guides Association of Southern Africa

Key Qualifications:

- Qualified with a M. Sc. (1983) in Botany and a PhD in Botany (Vegetation Ecology) (1995) at the University of Cape Town.
- Research in Cape fynbos ecosystems and more specifically mountain ecosystems.
- From 1995 to 2000 managed the Vegetation Map of South Africa Project (National Botanical Institute).
- Conducted botanical survey work for AfriDev Consultants for the Mohale and Katse Dam projects in Lesotho from 1995 to 2002. A large component of this work was the analysis of data collected by teams of botanists.
- **Director: Botanical & Communication Programmes** of the Botanical Society of South Africa (2000—2005), responsible for communications and publications; involved with conservation advocacy particularly with respect to impacts of development on centres of plant endemism.

- Further tasks involved the day-to-day management of a large non-profit environmental organisation.
- **Independent botanical consultant** (2005 – to present) over 300 projects have been completed related to environmental impact assessments in the Western, Southern and Northern Cape, Karoo and Lesotho. A list of reports (or selected reports for scrutiny) is available on request.

Higher Education

Degrees obtained
and major subjects passed:

B.Sc. (1977), University of Natal, Pietermaritzburg
Botany III
Entomology II (Third year course)

B.Sc. Hons. (1978) University of Natal, Pietermaritzburg
Botany (Ecology /Physiology)

M.Sc. - (Botany), University of Cape Town, 1983.
Thesis title: 'The vegetation of Swartboschkloof, Jonkershoek, Cape Province'.

PhD (Botany), University of Cape Town, 1995.
Thesis title: 'Phytogeography endemism and diversity of the fynbos of the southern Langeberg'.

Certificate of Tourism: Guiding (Culture: Local)
Level: 4 Code: TGC7 (Registered Tour Guide: WC 2969).

Employment Record:

January 2006 – present: Independent specialist botanical consultant and tour guide in own company: **Bergwind Botanical Surveys & Tours CC**
August 2000 - 2005 : Deputy Director, later Director Botanical & Communication Programmes, Botanical Society of South Africa
January 1981 – July 2000 : Research Scientist (Vegetation Ecology) at National Botanical Institute
January 1979—Dec 1980 : National Military Service

Further information is available on my company website: www.bergwind.co.za