Level	*DUSTFALL RATE (D) (mg/ m² /day [1] 30-day average)*	*Averaging period*	*Permitted frequency of exceedances*
Target	*300*	*Annual*	
Action residential	*500*	*30 days*	*Three within any year, no two sequential months*
Action industrial	*1 200*	*30 days*	*Three within any year, no two sequential months.*
Alert threshold	*2 400*	*30 days*	*None. First exceedance requires remediation and compulsory report to authorities.*

4.8.4 Margin of Tolerance

An enterprise may submit a request to the authorities to operate within Band 3 (ACTION Band), as specified in Table 9, for a limited period, providing that this is essential in terms of the practical operation of the enterprise (for example the final removal of a tailings deposit) and provided that the best available control technology is applied for the duration.

No margin of tolerance will be granted for operations that result in dust fall rates which fall within Band 4 (ALERT Band) as specified in Table 9.

4.8.5 Exceptions

Dust falls that exceed the specified rates but that can be shown to be the result of some extreme weather or geological event shall be discounted for the purpose of enforcement and control. Such event might typically result in excessive dust fall rates across an entire metropolitan region, and not be localised to a particular operation. Natural seasonal variations, such as dry windy period during the Highveld spring will not be considered extreme events for this definition"

4.4.2. Established dust sources and their attenuation

At alluvial diamond mines, fall-out dust is generated by the following activities and the respective attenuation measures are generally considered and/ or applied to limit resultant dust.

Dust generation activities/areas/points	Related attenuation measures when necessary
Site preparation, including dozing of topsoil to berms, road construction and construction of the primary plant ramps.	Pre-wetting of areas prior to earthmoving.
Drilling (Not generally but on an ad-hoc basis).	As international standard, all rigs are equipped with dust extraction equipment.
Blasting (Not generally but on an ad-hoc basis).	As ad-hoc events in alluvial mining, blast dust is not excessive and requires no attenuation given its isolation and periodicity.
Loading of especially overburden to overburden dump sites or backfill and the loading of dry ore horizon gravels.	When mining occurs up-wind of dust sensitive receiving environments such as sensitive vegetation and built environment, the overburden can be wet by firehose spraying from water cart prior to loading but is generally not advocated unless the material being loaded has characteristics of unusually high dust generation as wetting can interfere with dry screening and introduce additional salt into the system.

Hauling overburden to dumps or back-fill and hauling of ore to processing plants.	Water cart wetting of haul roads to reduce vehicle generated dust impact on traffic safety and reduce roadside dust plume impact on vegetation. Levelling of the load to reduce wind-swept dust off the load during transport.
In-field screening.	Site visits have noted that by comparison to many other alluvial diamond mining areas, the ore at WCR is often moist with lower dust generation than witnessed elsewhere at dry in-field screening plants. Furthermore, the higher clay content occurring in the ores of WCR seen to-date also requires wet screening which totally eliminates dust. In planning of mobile in-field screening plants, which will receive dry ore feed and be run as dry screening plants, the production planning team shall give consideration to the plant locality in ensuring it is not upwind of sensitive receiving environments and preferably be replaced in the up-wind end of large previously mined areas, which can receive the down-wind dust generated by such dry screening plants. Where further dust control on the plants is required, the well-established methods of mist sprays on the screens and conveyor transfer points should be applied.
Stockpiles, overburden dumps and back-filled mine blocks	The control of dust on such stockpiles and over such areas shall be dealt with through the same attenuation measures of promoting revegetation and through the use of temporary sand-trap cut-off netting systems as advocated for dust plume control hereafter.

4.4.3. Monitoring of fall-out dust

The industry can fortunately rely on established methods, contractors and commercially available, affordable equipment for this purpose and given the proximity of WCR to the Western Cape DustWatch™ supplier/ service provider, the use of the DustWatch™ system is advocated. It is designed for ease of operation by the mine personnel and provides results which reflect both ambient and mine generated dust through the combination of two or more installations on-site. (Refer para 8 for further requirements of monitoring)

5. CURRENT AND EXPECTED LEVELS OF DUST PLUME IMPACT

Table 1 in para 4.2. read with Figures 2a, b and c against the sources of dust plumes in para 4.1. identifies the following areas of high risk of dust plume generation as follows:

5.1. Risk of beach and back-of-beach plumes.

On-shore orientated beaches, half-heart bays and low lying back-of-beach areas fed with either river mouth sand or littoral sand, with such existing plumes including the following:

(i) Planned Rooiwal Bay coffer dam development and the planned Rooiwal-Spoeg River paleo channel of mine blocks 102, 89 and 90, both of which will contribute to the existing Spoeg River natural plume and dune-sea advance and will require attenuation.

(ii) Planned Langklip (LK) Beach Zone and coffer dam (see photo 7), on the LK beach, opposite the Mitchell's Bay seawater intake and already revealing half-heart bay type plume generation. Further beach sand and littoral zone disturbance by the coffer dams will increase the risk posed by the half-heart plume and require attenuation.

Photo 7: The LK beach bay where proposed further beach mining and coffer dams can intensify the plume

(iii) LKC Beach Zone and Grysduine area of northern Mitchell's Bay photo 8. Further mining of this low lying beach and back-of-beach area, which has already generated the dune sea and plume in photo 9 require intervention now and in future through the proposed methodology adopted in the study in para 6, which shows the application of the methods of attenuation to the LKC/ Grysduine plume. This requirement for intervention will be exacerbated through the further littoral zone disturbance by the intended coffer dam mining.

Photo 8: Current beach mining on LKC beach

Photo 9: The high level LKC plume with dune-sea

(iv) 68/69 beach mining to-date has, together with the high level of Swartlintjies River sediment supply resulted in the extensive moderate-to-high Swartlintjies River plume (photo 10). The

further contemplated 68/69 beach and coffer dam mining will increase the sand movement in the littoral zone and increase the need for intervention in the mining generated component of the Swartlintjies River plume (it must be emphasized that a large component of this, the largest plume system in the WCR, is river-mouth generated and will remain active, irrespective of mining).

Photo 10: Existing 68/69 beach mining with half-heart plume in the distant right of photo

(v) Koingnaas (KN) Beach Zone. Given the cliffed nature of the Koingnaas coastline, the KN beach and coffer dam mining presents a low risk for plume development but the actions on the beach will increase littoral drift thereby increasing the source material at Visbeen and 68/69.

(vi) Visbeen (VB) Beach Zone. Given the general cliffed nature of this coastline, plume management must focus on the half-heart beach plume generation (as per photo 11), which under greater littoral drift sand supply from the extended VB beach and coffer dam mining, will require increased attenuation of this source within the greater Swartlintjies River plume.

Photo 11: Nothern end of the Visbeen beach mining with half-heart bay Visbeen plume distant right

(vii) Somnaas Bay (SN) and associated planned inland channel mining (blocks 94, 99). These activities have already resulted in a very typical on-shore beach and half-heart bay plume as in photo 11a.

Photo 11a: Extensive Somnaas high level half-heart plume in distance

Generation of the high level Somnaas plume and associated dune-sea. With planned beach, coffer dam and channel mining in the SN Beach Zone, the sand source will increase and attenuation measures for the Somnaas plume must be introduced with significant sand traps to stem the advance of the early stage dune-seas and avoid them reaching the tar road as per photo 12.

Photo 12: Somnaas plume ridge (longitudinal dune) as seen from the tar road.

5.2. Risk of slimes dam plumes

(i) Within the WCR the two slimes dams of Koingnaas and the old Mitchell's Bay Plant have developed the highest dust risk of all inland mining activities but even so, the resultant plumes following the slimes dam abandonment are limited in extent by comparison to the plumes generated by Alexkor's abandoned slimes dams. The difference is ascribed to the slight clay content of the WCR material used in the slimes dam walls and generally occurs in the slimes whereby upon drying or even during production, the walls do not generate wind-blown sand/ dust, while those at Alexander Bay do, in the absence of any clay fraction.

While, as seen in Photos 13 and 14 of the Koingnaas and Mitchell's Bay slimes dam plumes, which are partially, fairly successfully revegetating, with and without netting, further attenuation of especially the Koingnaas slimes dam plume must be applied as it presents a significant dust nuisance impact on Koingnaas town. It is advocated from a dust perspective that this slimes dam should be fully rehabilitated and not reused as it is located directly upwind of Koingnaas town and the extent of its surface presents a shallow dam development with high-lying wind exposure, which is not preferable for new slimes dam development. Furthermore, in the long term it is not advisable to develop further silt generation activities in the catchment of the Swartlintjies River estuary.

Photo 13: Koingnaas slimes dam plume revegetation

Photo 14: Mitchell's Bay slimes dam plume

In terms of method of attenuation, it is advocated that a single dust plume cut-off system (dust trap) be provided along the northern perimeter roads of the slimes dams, together with periodic hand-broadcast seeding to infill the groundcover between the existing shrubs. Armouring of the walls and the plume with coarse tailings from the nearby Koingnaas coarse tailings dump can also be considered now while later armouring of the surface may be required once dried.

(ii) As numerous slimes dams are currently being planned, it is important that the locality and design/ selected site topography takes cognisance of the following dust generation considerations in new slimes dam development, which include:

- Limiting the surface area of the dams (within the considerations of slimes dam design) and plan them as deep as possible to reduce their surface area and especially any area (such as shallows) which, during operation will periodically or seasonally dry presenting as a major dust source.
- Giving preference to locating in existing excavations or deep valleys between dumps to avoid or minimise walls which can present as dust sources and to also restrict the lateral extent of the dams. Such location will also ensure proximity of overburden cover material in the post drying rehabilitation of the surface.
- Ensuring that if walls are required, material with the highest possible clay content is used in such walls to limit dust generation by the walls during and after operation.
- Ensuring that, under no circumstances, natural, low depressions nor deflation pans be used as slimes dams (as has occurred elsewhere) as their shallow perimeters, broad lateral extents and exposure to high winds result in significant plume generation both during low water levels in operation and following drying on abandonment.
- Slimes dams should never be located upwind of sensitive built or natural receiving environments, given the high dust risks associated with them.

6. MITIGATION (ATTENUATION) MEASURES

6.1. Mitigation of non-plume fall-out dust

These mitigation measures are discussed fully in paragraph 4.4.2.

6.2. Mitigation/ attenuation of sand plumes

6.2.1. Lessons from Alexkor

At Alexkor, under extreme dust plume development conditions which posed the greatest single threat to the natural and built environment of the mine and surrounding area, the study and trials of dust intervention methods were conducted in the period 2004-2013 with documentation of the methods initially done in the EMP update of 2008. Then, during 2013/2014 a comprehensive reassessment of dust plume attenuation was conducted and documented in the Alexkor Dust Plume Study SPC #2714/DP/R1 February 2014.

Such reassessment culminated in the framing of a 3-pronged holistic approach to dust plume attenuation to consist of:

" · *stabilization of sources*
· *cut-off system for dust removal from the mobile dust columns; and*
· *stabilization of dust impacted areas to facilitate recuperation of remnant vegetation"* or introduction of pioneer seeding.

While general netting had previously served West Coast mining as the appropriate method to restrict sand movement and promote revegetation, the Alexkor review of 2014 by Site Plan Consulting's Stephen van der Westhuizen and Bergwind's Dr Dave McDonald, showed categorically

that extensive netting as had been undertaken in the 2005 – 2013 period, had impacted negatively on revegetation by comparison to un-netted areas where the uninterrupted wind transfer of both high levels of sand but also seed occurred with success.

6.2.2. The role of netting in sand plume attenuation

It was concluded that netting had a crucial role when applied and maintained as narrow sand traps from which excess sand accumulations are removed to stem the perpetuation of the plume but that such netting systems be non-continuous and temporary in order that seed could pass relatively freely through the system to germinate and stabilize the remainder of the plume. Unfortunately the sand-trap projects also showed that the introduction of these systems is only as successful as their maintenance (periodic removal of excess sand from the netting trap).

Photo 15: Shows the failure of unmaintained cut-off netting systems at Alexkor at the time

6.2.3. Stabilization of the source

The studies and pilot projects further confirmed the success and affordability of attenuating sand plume sources by armouring source areas such as dried slimes heaps/ slimes dams with coarse tailings. The coarse tailings cover mimics the natural desert geomorphological phenomenon of "pebble deflation deserts (surfaces)" and was very successfully undertaken in the pebble cover of the Alexkor Rietfontein Inland and Noordsif slimes dumps which were sources of the massive plumes invading the sensitive Boegoeberg and Alexander Bay town. In the wetter WCR climate such pebble cover of surfaces will very readily promote revegetation through their accumulation of in-blown sand and seed to germinate within the cool germination environment presented by the pebble

horizon.

Photo 16: Armouring by coarse tailings of sandy slimes dam wall dust source at Alexkor

6.2.4. Promotion of revegetation

As the Alexkor 2014 review of revegetation trial areas in previously disturbed back-fills and plume areas proved less successful than natural revegetating areas or areas where only hand-broadcasting of seed occurred, this WCR dust plume study promotes revegetation by hand-broadcasting of seed, with limited direct transplant of chosen mature plant specimens immediately following rain episodes with repeated follow-up seeding during a later rain episode. Preferably such seeding should be accompanied by light hand-raking of the soil, which is especially important in the WCR wherein the inland orange sand areas form a crust which inhibits seed germination unless the crust is broken as was shown in trials conducted by Transhex in their Hondeklip Bay mining area rehabilitation. In the case of the white coastal sand plumes of WCR, such sand has no clay content and readily accepts hand-broadcasted seed and also promotes the rapid landward spread of restioid grass pioneer, *Cladoraphis cyperoides*. Photo 17 below, taken in an area with no netting to hinder sand or seed movement, shows the establishment of pioneer grass which then develops a small hummock dune in its lee and the subsequent germination of in-blown seed of a variety of species in such hummock dune to achieve sought-after species diversity.

Photo 17: Showing natural revegetation in an intense plume where seed movement is not hindered.

6.3. Proposed method of dust plume attenuation for WCR

The generic plan for the proposed WCR plume attenuation is depicted below as would be applied to the back-of-beach blow-out at Langklip LKC, Grysduine in the northern Mitchell's Bay Mining Right Area for illustration purposes to consist of:

- Stabilization of the source by armouring with coarse tailings as immediate stabilization, which will later promote revegetation of a back-of-beach hummock dune zone.
- Plume cut-off netting systems at both the root of the plume and the plume toe for periodic removal of the accumulated excess sand from the traps, thereby reducing sand movement in the plume.
- Hand-broadcasted seeding (in rain episodes) of both the armoured source area and the plume surface as well as the distant landward extent of the plume.

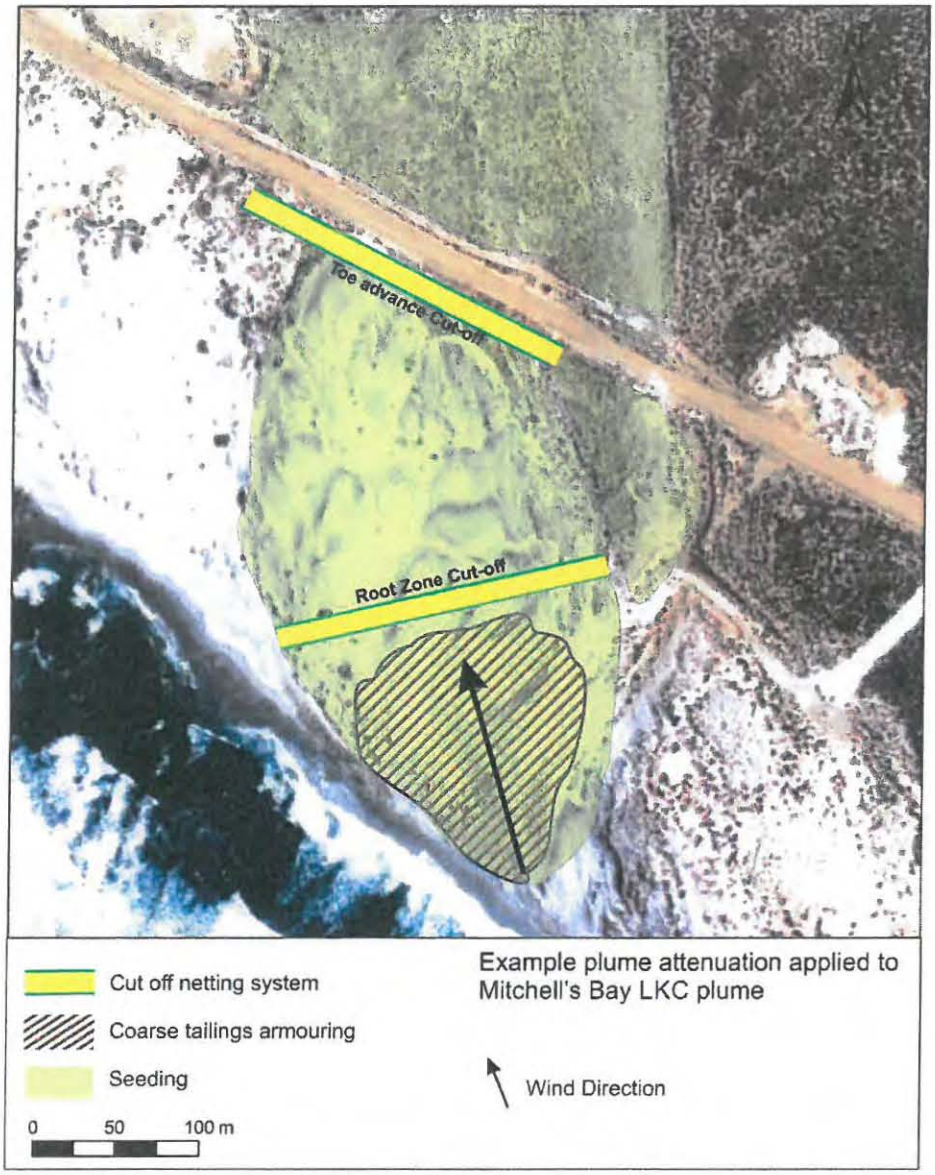


Diagram 5: Example of generic plume attenuation applied to Mitchell's Bay LKC plume

7. MANAGEMENT CONDITIONS FOR INCLUSION IN ENVIRONMENTAL AUTHORISATION

Once the structure of the EMP update has been formulated, the author thereof should draw on the following attenuation methods in the preparation of the EMP, which wording will then serve the wording of the Environmental Authorisation.

The following management conditions/ attenuation measures should apply to limit the generation and impact of wind-blown dust in the considerations of:

- General mining activity fall-out dust; and
- Sand drift plumes

7.1. General mining activity fall-out dust

Attenuating fall-out dust relates to all mining and site development activities and relies on pre-establishment consideration of dust risk in terms of location relative to downwind uses, planned disturbance of vegetation exposing the surface to wind generated dust, trafficking of roads and manoeuvring areas where soils are pulverised to significantly increase dust generation potential and

to processing activities which may be related to the specific project and present as high dust generating sources.

Implementation of the following dust attenuation methods are to be considered.

a) Minimising disturbed areas.
b) Avoidance of dumping with exposed surfaces as opposed to alternative dumping in existing nearby excavations.
c) Planned dust attenuation:
   (i) Watercart or sprinkler wetting of heavily trafficked roads and manoeuvring areas.
   (ii) Considering dust generation by especially in-fiend screening plants in the choice of wet or dry screening.
   (iii) For dry screening plants planning the dust control systems of sprays, covering of conveyors and transfer points etc.
   (iv) Planning rounding, topsoiling and revegetation of unavoidable dumps.
   (v) Planning/ scheduling topsoiling and revegetation of all areas to be disturbed

7.2. Planned new slimes dam fall-out dust plume attenuation

Apply the following dust attenuation considerations in planning of new slimes dams

- Limiting the surface area of the dams (within the considerations of slimes dam design) and plan them as deep as possible to reduce their surface area and especially any area (such as shallows) which, during operation will periodically or seasonally dry presenting as a major dust source.
- Giving preference to locating in existing excavations or deep valleys between dumps to avoid or minimise walls which can present as dust sources and to also restrict the lateral extent of the dams. Such location will also ensure proximity of overburden cover material in the post drying rehabilitation of the surface.
- Ensuring that if walls are required, material with the highest possible clay content is used in such walls to limit dust generation by the walls during and after operation.
- Ensuring that, under no circumstances, natural, low depressions nor deflation pans be used as slimes dams (as has occurred elsewhere) as their shallow perimeters, broad lateral extents and exposure to high winds result in significant plume generation both during low water levels in operation and following drying on abandonment.
- Slimes dams should never be located upwind of sensitive built or natural receiving environments, given the high dust risks associated with them.

7.3. Attenuation of existing slimes dam dust generation (Koingnaas and Mitchell's Bay slimes dams)

Apply the 3-pronged holistic approach to dust plume attenuation to consist of:

" · *stabilization of sources*
· *cut-off system for dust removal from the mobile dust columns; and*
· *stabilization of dust impacted areas to facilitate recuperation of remnant vegetation"* or introduction of pioneer seeding.

In practise:

(i) Slope and then armour the walls in coarse tailings.
(ii) Armour the high level dust plume areas (dune-seas), which now serve as dust sources in the plume.
(iii) Apply a system of netting dust traps as per the generic method in Diagram 5.
(iv) Armour the slimes dam surface once dried sufficiently to permit equipment movement on it, without the risk of liquification by equipment vibration.

(v) Apply seeding programmes to the moderate plume areas, both where armoured and where natural vegetation requires assistance.
(vi) Allow the treated areas to accumulate in-blown seed and revegetate naturally in the long-term.

7.4. Attenuation of dust plumes generated by littoral zone Beach and Coffer Dam mining

As discussed in para 5.1, the risk of plume development by beach/ coffer dam mining relates primarily to either on-shore coastal orientations or half-heart bays. In most cases such plume development will not be new as Figure 1 shows that the proposed areas of beach and coffer dam mining already support natural and mining generated plumes. The task at hand is therefore to expect that the increased littoral drift sand caused by beach and coffer dam littoral zone disturbances, which migrates to on-shore beaches and half-heart bays is potential for adding to the existing system and therefore requires focussing on attenuation of existing plumes to accommodate the increase which is likely given future mining.

Fortunately the plume sources are fairly well defined by coast-line form and allow the following intervention to reduce risk of increased plume generation:

a) When scheduling a planned beach and coffer dam mining operation:
   - Assess the coastal form in terms of littoral drift towards on-shore orientated beaches and half-heart bays and use existing plume development on the coastline to indicate where increased plume feed can result from the proposed littoral zone mining project.

b) Within the model described in Diagram 5, consider the wind-path in relation to the coastal characteristic and define:
   - The source areas.
   - The plume root zone for cut-off netting intervention.
   - A suitable traverse for plume toe intersection as a planned toe cut-off netting system.

   Based on such understanding of the expected plume, design a comprehensive plume management project for the site and schedule equipment availability for removal of accumulated sand from the netting traps.

8. MONITORING REQUIREMENTS

From the updated EMP, define a full dust monitoring system for the WCR to deal with site specific and generic applications for new activities on the following basis.

8.1. Monitoring of fall-out dust

Monitoring of fall-out dust is best achieved by using the DustWatch™ equipment with in-house environmental officer implementation.

On the basis of visual dust occurrence assessments such as the Koingnaas and Mitchell's Bay slimes dams as well as planned mining operations where fall-out dust is expected to be generated follow the guidelines below:

(i) Assess dust source, wind-path and affected receiving environment;
(ii) Position a DustWatch™ station in the downwind path (i.e. north of source at WCR) generally within 200-600m downwind of the source;
(iii) Position a second DustWatch™ station upwind of the source (i.e. south) to yield ambient dust level results, which can be deducted as import dust from the north station results; and
(iv) At a regular periods preferably once per month, collect the dust cups and weigh the dried dust content to express the results in grams/ m^2/ day to offer comparative results to dust specifics established in the industry.

Use the results to consider attenuating measures to be applied and thereafter monitoring of their successes achieved.

Once a representative recordal is achieved over an appropriate period (season or year), the DustWatch™ stations can be relocated to other monitoring sites (always record the locality of the equipment by GPS in order that the equipment can be reinstalled later at the same place, if required and will report comparative results).

8.2. Monitoring of plume extent and intensity by periodic measurement

As measurement of sand mass in drifts is extremely difficult, the monitoring of dust plumes is to be based on:

(i) Visual observation and photographic recordal of plumes within the categorisation of low, medium and high as per the description and photographs in paragraph 4.2. (To be expanded on by the E.C.O. based on further observations and categorisation definition).
(ii) Aerial photo record of plume extent/ advance and intensity.
(iii) Capture of the plume extent and intensity by .shp polygon overlays and hectarage measurement expressed in a tabled record of measurement using Table 2 in para 4.3. and plume mapping in Figures 2a, 2b and 2c .shp files as the current baseline data.

8.3. Monitoring of intervention successes and failures of methods

8.3.1. Fall-out Dust

By DustWatch™ result recordal in spreadsheets and graph generation of the data over the period when attenuations have been applied, the success of intervention can be assessed in terms of reduction of dust expressed in grams/ m^2/ day.

8.3.2. Dust Plumes

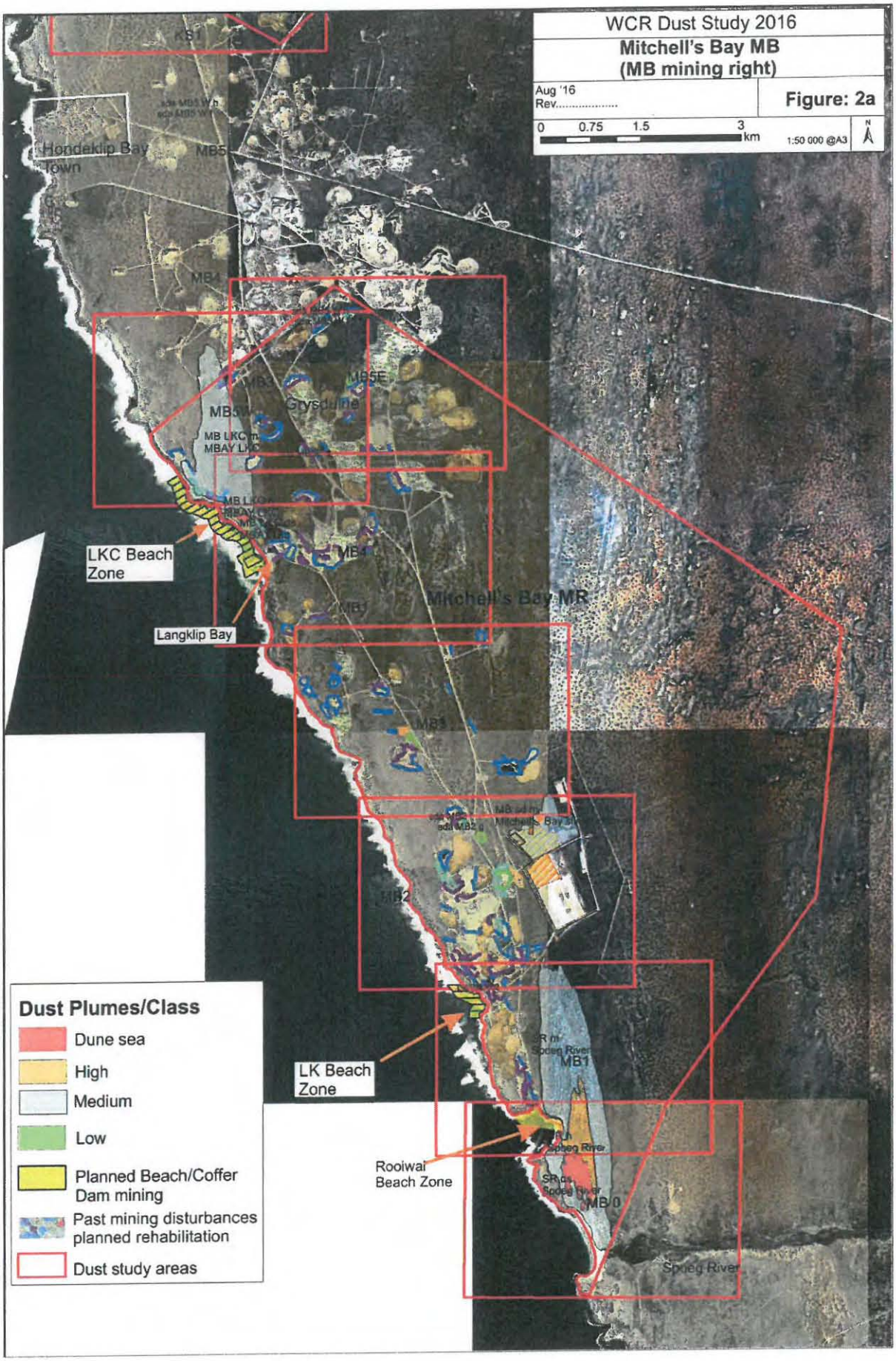
As described in 8.2 above, subsequent .shp polygon shapes can be overlain to reflect lateral growth of plumes per intensity after each mapping cycle while the tabled hectarages can be expressed in graph format also reflecting the growth of plumes.

With such monitoring traversing the attenuation implementation period within the consideration of response time, the success and failure of interventions can be assessed in hectarage, length of plume and changes in intensity

9. COSTING OF SAND PLUME CONTROL

Once the mine plan and draft EMP have been prepared, a dust intervention schedule, together with a costing system can be prepared by WCR. In the interim, the following considerations would serve as a basis for preparation of such costing:

(i) Stabilization of dust sources if by coarse tailings cover to include shaping of the source and then the cost of hauling and spreading the coarse tailings.
(ii) Dust trap netting systems to be costed per linear meter of netting as construction cost.
(iii) Provision for the cost of periodically loading, hauling and dumping the accumulated sand.
(iv) Cost of seeding (at this stage seed collection, hand broadcasting with raking) as well as an allocation for mature plant specimen transplant.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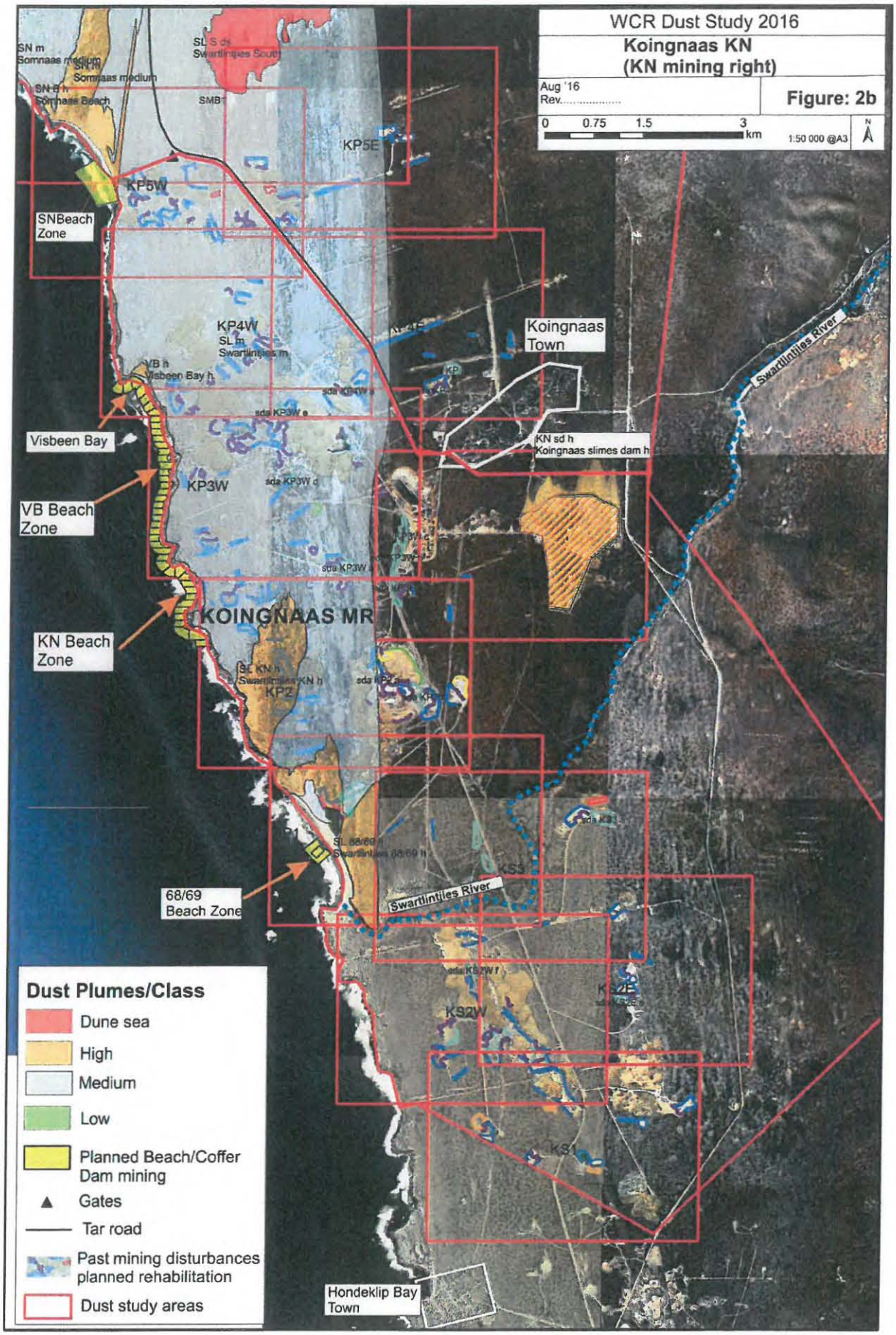
Planned Beach/Coffer Dam mining
Past mining disturbances planned rehabilitation
Dust study areas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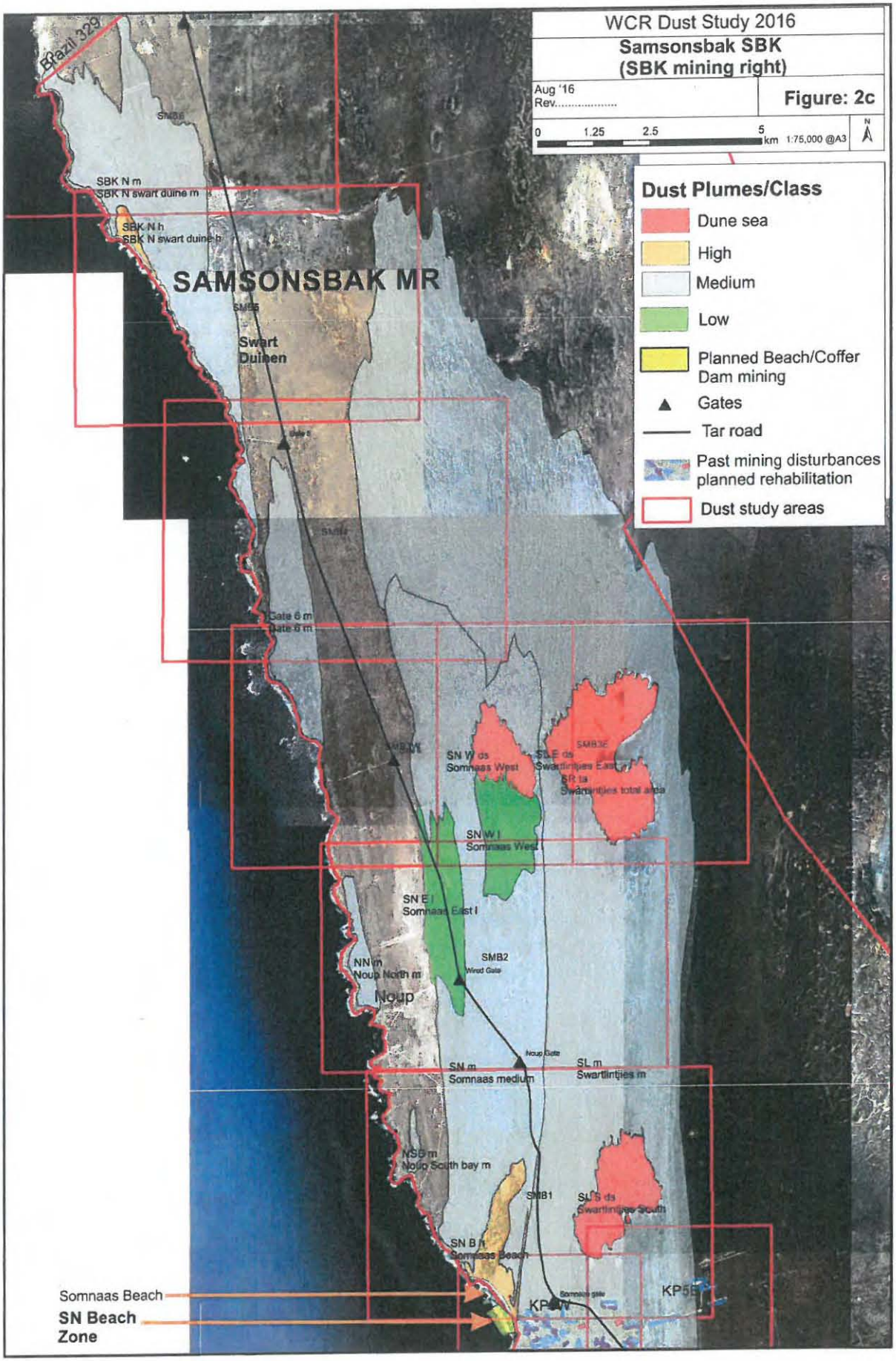
Planned Beach/Coffer Dam mining
Gates
Tar road
Past mining disturbances planned rehabilitation
Dust study areas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SN W l
Somnaas West l
SN E l
Somnaas East l
SMB2
Wind Gate
NN m
Noup North m
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SN m
Somnaas medium
SL m
Swartlintjies m
NSB m
Noup South bay m
SMB1
SL S ds
Swartlintjies South
SN B h
Somnaas Beach
Somnaas gate
KP5E
KP5W
Somnaas Beach
SN Beach Zone

5. Estuary management study

West Coast Resources

MYEZO ENVIRONMENTAL MANAGEMENT SERVICES
Environmental Stewardship

WEST COAST RESOURCES - NAMAQUALAND MINES ENVIRONMENTAL IMPACT ASSESSMENT

ESTUARINE SPECIALIST STUDY REPORT

Draft for Comment

July 2016

ANCHOR environmental

Anchor Environmental Consulting Report No, 1725/1

West Coast Resources

MYEZO ENVIRONMENTAL MANAGEMENT SERVICES
Environmental Stewardship

WEST COAST RESOURCES-NAMAQUALAND MINES ENVIRONMENTAL IMPACT ASSESSMENT

ESTUARINE SPECIALIST STUDY REPORT

For the Amendment of an Environmental Management Programme and Environmental Impact Assessment in Support of a Mining Right held by West Coast Resources (Pty) Ltd over the Namaqualand mines, Northern Cape Province

Draft for Comment
July 2016

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1 Details of specialist

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Phone: 021 701 3420

Fax: 021 701 5280

Email: vera@anchorenvironmental.co.za

1.2 The expertise of that specialist to compile a specialist report including a curriculum vitae;

1.2.1 Curriculum vitae: Dr Barry Clark

Academic qualifications:

- Ph.D. Marine Biology, 1997, University of Cape Town
- BSc (Hons) Marine Biology, 1991, University of Cape Town
- BSc Zoology and Ocean & Atmosphere Science, 1990, University of Cape Town

Language proficiencies: English (Excellent), Afrikaans (Good)

Country experience: South Africa, Namibia, Mozambique, Tanzania, Kenya, Mauritius, Angola, Ghana, Cote d'Ivoire, Nigeria, Egypt, United Arab Emirates, Azerbaijan

Employment history:

- 1991-1993 – Scientific Officer, University of Cape Town
- 2000-2002 – Marine Coordinator, Cape Peninsula National Park
- 1996-Present - Director, Anchor Environmental Consultants CC
- 2002-Present – Research Associate, University of Cape Town

Summary profile:

Dr Barry Clark has twenty-one years of experience in marine biological research and consulting on coastal zone and marine issues. He has worked as a scientific researcher, lecturer and consultant and has experience in tropical, subtropical and temperate ecosystems. His main area of scientific study involved fisheries management and the biology and ecology of marine and estuarine fishes. He is presently Director of an Environmental Consultancy firm (Anchor Environmental Consultants) and Research Associate at the University of Cape Town. As a consultant has been concerned primarily with conservation planning, monitoring and assessment of human impacts on estuarine, rocky shore, sandy beach and temperate and tropical marine fauna and flora as well as coastal and littoral zone processes, aquaculture and fisheries. Dr Clark is the author of 27 scientific publications in class A scientific journals as well as numerous scientific reports and popular articles in the free press. Geographically, his main area of expertise is

southern Africa (South Africa, Lesotho, Namibia, Mozambique, Tanzania, Seychelles, Mauritius and Angola), but he also has working experience from elsewhere in Africa (Cote d'Ivoire, Ghana, Nigeria), the Middle East (UAE) and Europe (Azerbaijan).

Project experience.

Period	Country	Client	Project, Tasks
2016	South Africa	ACC Agriculture	Risk assessment for introduction of *Camelina savitina* as a commercial crop into South Africa
2015	Liberia	Conservation International	Identification and profiling of priority mangrove sites in Liberia through remote sensing and field surveys and identification and delineation of two coastal and marine protected areas
2015	South Africa	AquaTech	Risk assessment for in-water hull cleaning operations in the Port of Durban, South AFrica
2015	Tanzania	Aurecon, Schlumberger	Environmental impact assessment for a supply base for Schlumberger in Mtwara port, Tanzania
2015	South Africa	Cape Nature	Environmental flows assessment for the Klein River estuary, South Africa
2015	South Africa	Mossel Bay Municipality	Preparation an estuary management plan for the Hartenbos Estuary
2015	South Africa	Department of Environmental Affairs	Development of an assessment framework for management of effluent discharged from land-based sources to the marine environment in South Africa
2015	Seychelles	Raffles Hotel, Aurecon	Assessment of impacts of diesel spill on mangrove forest community on Praslin Island, Seychelles
2014-2015	South Africa	Transnet National Ports Authority	Design and implementation of a water and sediment quality monitoring programme in the Port of Durban
2014-2015	South Africa	Oceana/SRK	Application for a coastal water discharge permit for the Lucky Star Fish Processing Plant, St Helena Bay
2014-2015	South Africa	Coega Development Corporation	Assessment of impacts of waste water discharge from Coega Industrial Development Zone, Algoa Bay
2014-2015	Namibia	DeBeers Marine Namibia	Benthic macrofauna and sediment quality monitoring programme for the Atlantic 1 Mining Licence Area, Namibia
2014-2015	South Africa	Cape Nature	Environmental flow assessment for the Heuningnes estuary, South Africa
2014-2015	South Africa	South African Pelagic Fishing Industry Association	Assessment of the socio-economic impacts of a reduction in the sardine minimum Total Allowable Catch (TAC)
2014-2015	South Africa	Nelson Mandela Bay Metro, GIBB	Assessment of impacts of waste water discharge from a new WWTW at Cape Recife, Algoa Bay

Period	Country	Client	Project, Tasks
2014	Seychelles	USAID	Implementation of the "reef gardening" approach for restoration of coral reefs on Praslin Island, Seychelles, lost as a result of El Nino and global warming induced bleaching events. Project included establishment of rope and net nurseries for growing out coral fragments and subsequent transplantation to degraded reef sites
2014	South Africa	Molapong Aquaculture	Risk Assessment for culture of King and Coho salmon in South Africa
2014	South Africa	NWJ Environmental	Impact assessment for a proposed sand mining operation on the Umzumbe Estuary, KwaZulu-Natal
2014	Mozam-bique	Marine Stewardship Council	Scoping study to assess potential impacts of upgrading the cruise liner facilities at Portuguese Island, Mozambique
2014	South Africa	Bayside Aluminium, WSP	Environmental impact assessment for the decommissioning of the Bayside Aluminium Smelter, Richards Bay
2014	South Africa	Tronnox Namaqua Sands, SRK	Assessment of impacts of a seawater intake for the Tronnox Namaqua Sands mineral processing facility, Northern Cape
2014	South Africa	AquaConcepts	Risk assessment for import of ornamental marine fish species into South Africa
2014	South Africa	Dormac, WSP	Assessment of impact associated with the development of a floating dry dock in the Port of Durban, South Africa
2014	South Africa	Transnet National Ports Authority	Assessment of potential impacts of the proposed Durban Dig Out Port of the annual sardine migration up the East coast of South Africa
2014	South Africa	WWF-SA	Design and development of a Fisheries Improvement Project for Small Scale Fisheries in the Kogelberg
2014	South Africa	Tronnox Namaqua Sands, Matzikamma Municipality, SRK	Environmental impact assessment for an aquaculture facility at Doringbaai, Northern Cape
2014	Tanzania	Aurecon	Development of a Spatial Development Framework for the coastal environment in the Mtwara/Mikandani Municipal area, Tanzania
2014	South Africa	WSP/ Engen	Assessment of the impacts of an oil spill on mangrove forest communities in the Port of Richards Bay, South Africa
2014	South Africa	Frontier Rare Earths, Coastal Environmental Services	Assessment of impacts of a seawater intake for the Frontier Rare Earths mineral processing facility, Northern Cape
2014	South Africa	Cape Nature	Rezoning and realignment of borders for Betty's Bay, Goukamma and Robberg marine protected areas in South Africa

1.2.2 Curriculum vitae: Vera Massie

Academic qualifications:

- MSc Conservation Biology, 2013, University of Cape Town
- BSc (Hons) Environmental Management, 2011, University of Cape Town
- BSc Marine Biology and Environmental Science, 2010, University of Cape Town

Language proficiency: English (excellent), Afrikaans (basic), German (first language), Japanese (second language, basic)

Employment history:

- 2010-2012 –Research laboratory assistant (water quality analysis)
- 2012 – Marine ecology research field assistant
- 2013-Present – Consultant, Anchor Environmental Consultants

Summary profile:

Vera earned degrees in marine biology, environmental management and conservation biology from the University of Cape Town. Her training has equipped her to consult on research projects incorporating the maintenance and conservation of marine and estuarine ecosystems. She also consults on the biophysical, socio-economic and legal aspects in the assessment of human impacts on coastal and terrestrial environments in the temperate and tropical regions of South Africa. Working at Anchor Environmental Consultants, she has gained experience in drafting environmental legislation, preparing guidelines and developing frameworks to facilitate successful implementation of legislation. Many of her projects involve the monitoring and evaluation of compliance with environmental laws and their associated regulations across varying economic sectors.

Table 1: Project experience at Anchor Environmental Consultants (Pty) Ltd.

Period	*Client*	*Project*	*Tasks*	*Aspects*
2014-2016	Saldanha Bay Water Quality Trust	The State of Saldanha Bay and Langebaan Lagoon	• Ongoing annual ecological monitoring of Saldanha Bay and Langebaan Lagoon	• Compliance monitoring (water quality) • Environmental law and management • Field research • Data analysis
2014-2016	Transnet	Baseline environmental monitoring study for the expansion of Berth 203-205 in the Port of Durban	• Ongoing quarterly ecological monitoring of the Port of Durban	• Field research • Data analysis • Statistical analysis
2016	SIROCCON Consulting Engineers & Project Managers; Atlantic Salmon	Prepare a marine specialist study and impact assessment and application for a Coastal Waters Discharge Permit for a land-based salmon farm	• Prepare a Marine Specialist Study and Impact Assessment • Prepare an application for a Coastal Waters Discharge Permit in terms of ICMA	• Assess the impacts of a land-based salmon farm on the marine environment (water quality and ecology) • Ensure compliance with ICMA
2016	ACC South Africa	Preparation of a permit application and associated risk assessment for the introduction and growing of *Camelina sativa* in South Africa	• Prepare a risk assessment in terms of the NEMBA Alien and Invasive Species Regulations • Submit an application for a permit in terms of NEMBA Section 65(1)	• Alien invasive species research • Ensure compliance with NEMBA
2016	Abagold Ltd	Prepare and guide application for amendment of Environmental Authorisation	• Prepare a Risk Assessment to assess environmental impacts due to changes to the Abagold combined abalone and seaweed facility since the EA was granted in 2009 • Prepare application for amendment of Environmental Authorisation in terms of NEMA • Conduct public participation	• Compliance in terms of NEMA • Stakeholder liaison
2016	Overstrand	Preparation of an	• Compile Situation	• Legislation review

Period	*Client*	*Project*	*Tasks*	*Aspects*
	Municipality and Onrus Lagoon Preservation Trust	estuary management plan for the Onrus Estuary	Assessment Report • Compile Estuary Management Plan • Conduct public participation • Assist in setting up an Estuary Management Forum • Stakeholder consultation report	and application • Management strategies • Zonation plans • Stakeholder liaison
2015-2016	Mossel Bay Municipality	Preparation of an estuary management plan for the Hartenbos Estuary	• Compile Situation Assessment Report • Compile Estuary Management Plan • Conduct public participation • Assist in setting up an Estuary Management Forum • Stakeholder consultation report	• Legislation review and application • Management strategies • Zonation plans • Stakeholder liaison
2015	AquaTech	Risk assessment for in-water hull cleaning operations in the Port of Durban, South Africa	• Establish the environmental risks associated with the in-water diver operated vessel hull cleaning device (water quality and biological invasion)	• Risk assessment • Compliance in terms of NEMBA
2015	Chevron	Prepare a marine specialist study for a Coastal Waters Discharge Permit Application	• Describe the receiving environment • Assess impacts on receiving environment	• Compliance in terms of ICMA
2015	Department of Environmental Affairs	Development of an assessment framework for management of effluent discharged from land-based sources to the marine environment in South Africa	• Review of international legislation, guidelines and management practice • Design an assessment framework tailored to the South African context • Workshop with government departments and I&APs	• Review of international legislation • Research on effluent and contaminant types and their impacts on the environments • Research technical aspects of near-field and far-field modelling of effluent in the receiving environment

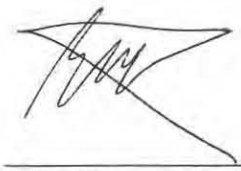
Period	*Client*	*Project*	*Tasks*	*Aspects*
				• Implementation of the Integrated Coastal Management Act
2014	Molapong Aquaculture	Risk Assessment for culture of King and Coho salmon in South Africa	• Prepare a risk assessment in terms of the NEMBA Alien and Invasive Species Regulations	• Alien invasive species research • Ensure compliance with NEMBA
2014	AquaConcepts	Risk assessment for import of ornamental marine fish species into South Africa	• Provide assistance in obtaining relevant licenses and rights and ensure that the business is in compliance with the MLRA and NEMBA. • Complete a Risk Assessment for the facility.	• Ensure compliance with various environmental legislation
2014	CapeNature	Rezoning and realignment of borders for Betty's Bay, Goukamma and Robberg marine protected areas in South Africa	• Manage the stakeholder participation process • Produce a stakeholder consultation report	• Stakeholder liaison • Implementation of environmental legislation
2013	Department of Environmental Affairs and Development Planning	Develop Norms and Standards for land-based abalone and trout aquaculture and implementation guidelines	• Prepare Norms and Standards for both sectors • Prepare implementation guidelines for both sectors	• Drafting of legislation • Identify all environmental impacts associated with land-based abalone and trout aquaculture • Develop norms and standards for the management of these sectors

2 A declaration that the specialist is independent in a form as may be specified by the competent authority;

2.1 Barry Clark

I Barry Clark, 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/to be performed in terms of this application, have no business, financial, personal or other interest in the activity or application and that there are no circumstances that may compromise my objectivity; or
  - am not independent, but another specialist that meets the general requirements set out in Regulation 13 have 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, am fully aware of and meet all of the requirements and that failure to comply with any the requirements may result in disqualification;
- have disclosed/will disclose, to the applicant, the Department and interested and affected parties, all material information that have 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;
- have ensured/will ensure that information containing all relevant facts in respect of the application was/will be distributed or was/will be made available to interested and affected parties and the public and that participation by interested and affected parties was/will be facilitated in such a manner that all interested and affected parties were/will be provided with a reasonable opportunity to participate and to provide comments;
- have ensured/will ensure that the comments of all interested and affected parties were/will be considered, recorded and submitted to the Department in respect of the application;
- have ensured/will ensure the inclusion of inputs and recommendations from the specialist reports in respect of the application, where relevant;
- have kept/will keep a register of all interested and affected parties that participate/d in the public participation process; and
- am aware that a false declaration is an offence in terms of regulation 48 of the 2014 NEMA EIA Regulations.



Signature of the specialist

Name of company: Anchor Environmental Consultants (Pty) Ltd.

Date: 7 September 2016

2.2 Vera Massie

I Vera Massie, 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/to be performed in terms of this application, have no business, financial, personal or other interest in the activity or application and that there are no circumstances that may compromise my objectivity; or
  - am not independent, but another specialist that meets the general requirements set out in Regulation 13 have 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, am fully aware of and meet all of the requirements and that failure to comply with any the requirements may result in disqualification;
- have disclosed/will disclose, to the applicant, the Department and interested and affected parties, all material information that have 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;
- have ensured/will ensure that information containing all relevant facts in respect of the application was/will be distributed or was/will be made available to interested and affected parties and the public and that participation by interested and affected parties was/will be facilitated in such a manner that all interested and affected parties were/will be provided with a reasonable opportunity to participate and to provide comments;
- have ensured/will ensure that the comments of all interested and affected parties were/will be considered, recorded and submitted to the Department in respect of the application;
- have ensured/will ensure the inclusion of inputs and recommendations from the specialist reports in respect of the application, where relevant;
- have kept/will keep a register of all interested and affected parties that participate/d in the public participation process; and
- am aware that a false declaration is an offence in terms of regulation 48 of the 2014 NEMA EIA Regulations.

Note: The terms of reference of the review specialist must be attached.

Signature of the specialist

Name of company: Anchor Environmental Consultants (Pty) Ltd.

Date: 9 July 2016