ECC-00698

IMPLEMENTATION OF AND COMPLIANCE WITH THE ENVIRONMENTAL MANAGEMENT PLAN FOR THE MINING OF SAND BY NAMIBIA CONSTRUCTION (PTY) LTD ON FARM OSONA NO. 65, OTJOZONDJUPA REGION, NAMIBIA

27 March 2023

Prepared by:

environmental consulting

Prepared for:

Namibia Construction (Pty) Ltd.
CIVIL ENGINEERING & BUILDING CONTRACTORS

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ACRONYMS AND GLOSSARY

The following is a list of the abbreviations, acronyms, technical terms, and definitions used in this Report:

AIDS	Acquired Immunodeficiency Syndrome
EAP	Environmental Assessment Practitioner
EAPAN	Environmental Assessment Professionals of Namibia
ECC	Environmental Clearance Certificate
EIA	Environmental Impact Assessment
EMA	Environmental Management Act
EMP	Environmental Management Plan
GN	Government Notice
GRN	Government of the Republic of Namibia
IEMA	Institute of Environmental Management and Assessment
FEL	Front End Loader
HIV	Human Immunodeficiency Virus
km	kilometre
km/h	kilometre per hour
l	litre
m	metre
mm	millimetre
m^2	square metre
m^3	cubic metre
MAWF	Ministry of Agriculture, Water and Forestry
MAWLR	Ministry of Agriculture, Water and Land Reform
MET	Ministry of Environment and Tourism
MEFT	Ministry of Environment, Forestry and Tourism
MFMR	Ministry of Fisheries and Marine Resources
NC	Namibia Construction (Pty) Ltd
NCE	Namibia Chamber of Environment
SA	South Africa
SLR	SLR Environmental Consulting (Namibia) (Pty) Limited
UK	United Kingdom
UNAM	University of Namibia

1 Introduction

1.1 Background

Namibia Construction (Pty) Ltd (hereinafter referred to as Namibia Construction or NC) is a wholly-owned Namibian Company that was founded in 1949. At the time, the Company was called HH Schulz. In 1977, the name was changed (from HH Schulz) to Namibia Construction (Pty) Ltd.

The Company operates regionally in Namibia, and with major offices in Windhoek and Swakopmund. Divisions in which Namibia Construction (Pty) Ltd operates include: buildings; civil works; mining; roads; reservoirs; concrete; and crushers (see https://www.namibia-construction.com/).

For the period between 2011 and 2014, Namibia Construction mined sand from an area in the upper reaches of the Swakop River, on Farm Osona No. 65, located approximately 20 kilometres (km) south-west of Okahandja town and 6 km east of Gross Barmen (see Figure 1), Otjozondjupa Region, Namibia.

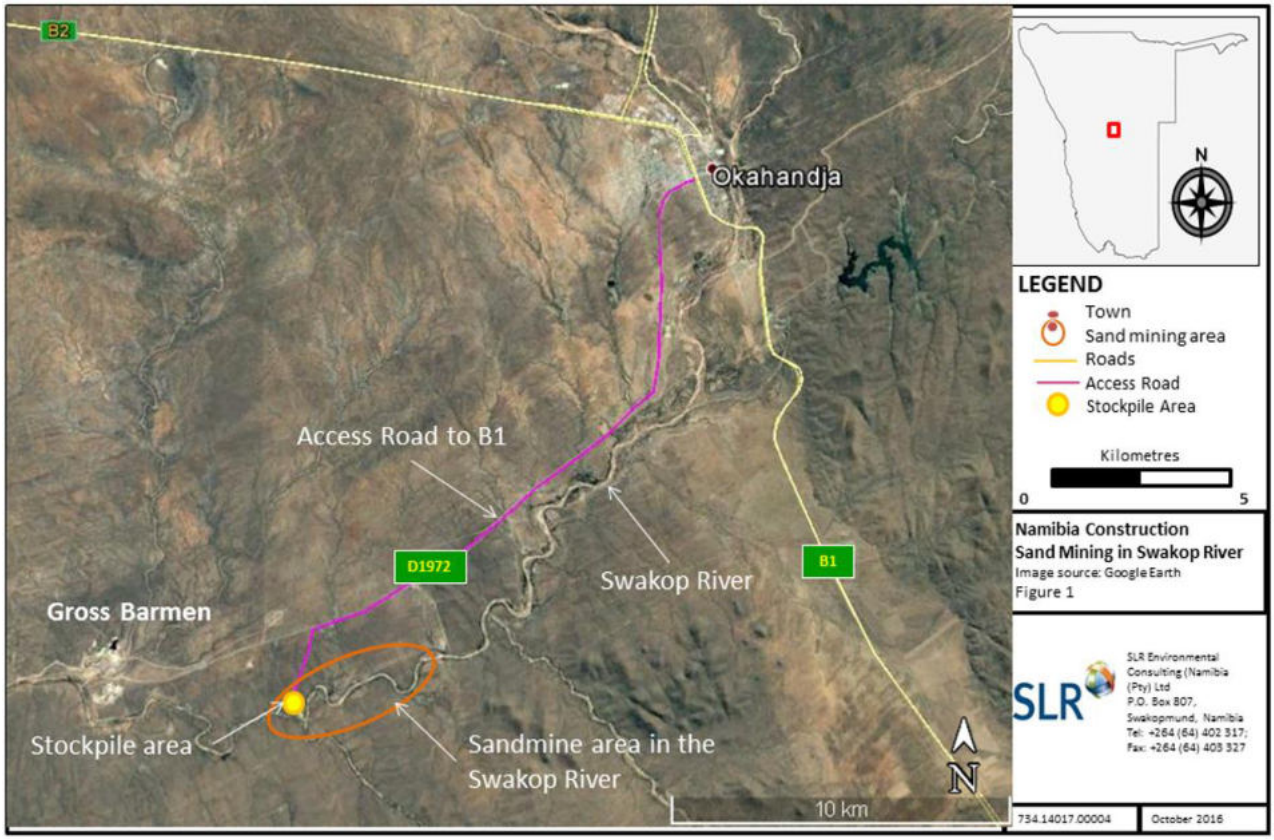


Figure 1: Map showing the regional setting of the sand mine (*Source: SLR Environmental Consulting (Namibia) (Pty) Limited, 2016*).

In 2015, the sand mining resumed after the river flow reinstated the river sand in the mined out areas. At the time, around 36,000 cubic metres (m^3) of sand was mined and used in Windhoek City for construction purposes.

Namibia Construction then proposed to continue with the mining of an additional ~320,000 m^3 of sand from this location and covering an area of about 180,000 square metres (m^2) (Sanzila, 2016).

In line with the Commencement of the Environmental Management Act (EMA), 2007 (Act No. 7 of 2007) (06 February 2012; Government Notice (GN) No. 28), the Listed Activities that may not be undertaken without an Environmental Clearance Certificate (ECC) (GN No. 29), and the Environmental Impact Assessment (EIA)

Regulations (GN No. 30) (Government of the Republic of Namibia (GRN), 2012), Namibia Construction applied to the Environmental Commissioner for an ECC in 2016.

An Environmental Scoping (Including Assessment) and Management Plan (EMP) Report for the Mining of Sand was prepared by SLR Environmental Consulting (Namibia) (Pty) Limited (SLR) and submitted to the Office of the Environmental Commissioner, Ministry of Environment and Tourism (MET), in December 2016. An ECC was received from the Office of the Environmental Commissioner on 27 June 2017.

During the period 2014-2020, NC mined approximately 100,000 m^3 of sand from the Swakop River. Prior to the good rains and river flow in February 2020, NC cleared two more stockpile areas (one of which was an old calcrete borrow pit area), with prior permission from the Farm Owner (Farm Osona No. 65), Mr Johannes Kriel (see Figure 2). An access road to stockpile area (new) was constructed next to the fence by NC, also with permission from Mr Kriel. Access to stockpile area (old borrow pit) is also the access to the Farmhouse.

Even though the river flow reinstated the river sand in the mined out areas, it was proposed to alternate the sand mining activities between the river sections south of the three stockpile areas (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd; see Maartens, 2020).

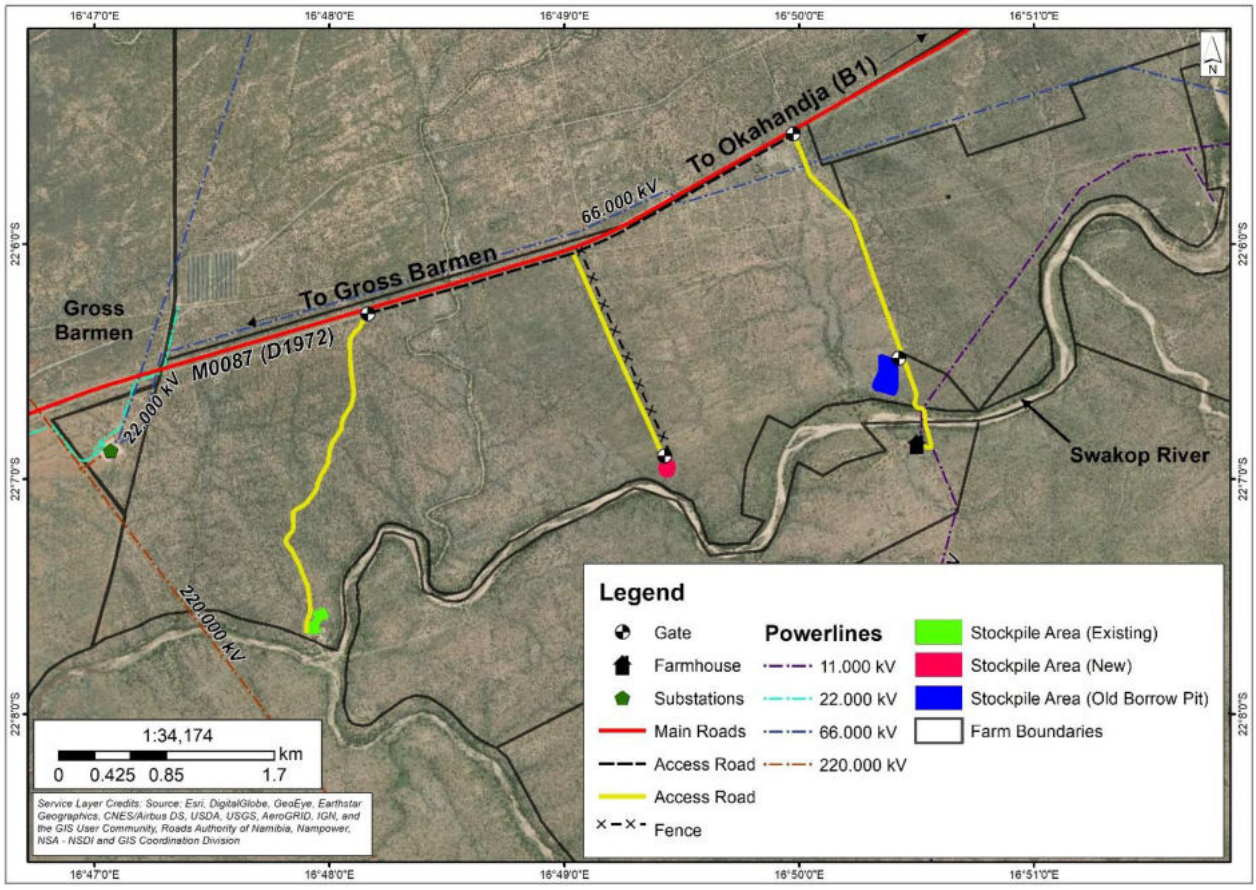


Figure 2: Map showing the location of Namibia Construction (Pty) Ltd's sand mining and related activities, Swakop River, Farm Osona No. 65 (*Source: Miss Maike Prickett, GIS-Specialist, March 2020*).

In February 2020, an application (APP-001145) for the renewal of the ECC was submitted to the Office of the Environmental Commissioner, MET (now Ministry of Environment, Forestry and Tourism (MEFT)). The ECC (**ECC-00698**) was granted by the Office of the Environmental Commissioner on 05 June 2020 and expires on 05 June 2023. The MEFT also attached Conditions to the ECC for Sand and Gravel Mining (see Annexure A to the ECC; 11 June 2020) (see Annexure A).

A second application (**230309001114**) for the renewal of the ECC was submitted to the Office of the Environmental Commissioner, MEFT, on 09 March 2023. The MEFT subsequently verified the application (10 March 2023; **APP-001114**) and requested the submission of the following documents (10 March 2023): i)

updated EMP to effect amendment; ii) *confirmation of screening notice received (through email) in terms of assessment procedures (Section 35 (1)(a)(b) of the Environmental Management Act, No 7 of 2007)*; iii) *preliminary site map with coordinates (decimal degrees) and a legend*; iv) *copy of the previous Environmental Clearance Certificate issued in terms of Section 37(1)(a) of EMA*; and v) *CV of Environmental Assessment Practitioner (EAP)*.

1.2 Terms of Reference

LM Environmental Consulting was appointed by Namibia Construction (Pty) Ltd in February 2023 to prepare a report, illustrating the implementation of and compliance with the EMP, in aid of the application for the renewal of the ECC for the mining of sand in the upper reaches of the Swakop River on Farm Osona No. 65, Otjozondjupa Region, Namibia.

1.3 Environmental Assessment Practitioner

The author of this Report is Dr Lima Maartens who has more than 30 years' experience in natural resource management (*she gained her doctorate (Ph.D.) in Fisheries Science from Rhodes University, South Africa (SA) while working for the Namibian Ministry of Fisheries and Marine Resources (MFMR) in 2000*), lecturing (*University of Namibia (UNAM)*), environmental science and management (*De Beers Marine Namibia and the Canadian Forsys Metals Corp*), and consulting (*LM Environmental Consulting was established by Dr Maartens in October 2009*).

Sectors that she worked in as an Environmental Assessment Practitioner (EAP) include: exploration (including offshore oil and gas); mining and quarrying; renewable energy (solar and wind); tourism; manufacturing; agriculture; aqua- and mariculture; township, property (including medicine storage facilities) and waterfront developments, transport (rail and road), and infrastructure.

Dr Maartens is registered as a Lead Practitioner and Reviewer with the Environmental Assessment Professionals of Namibia (EAPAN) (she served on the Executive Committee during 2016/17), an Associate Member and Environmental Auditor with the Institute of Environmental Management and Assessment (IEMA) in the United Kingdom (UK), a Full Member of the Namibia Chamber of Environment (NCE), and a Member of the Namibia Scientific Society.

She has published five peer-reviewed scientific research articles (and three as co-author), six popular articles (and one as co-author), one book chapter (and one book chapter as co-author), 144 technical reports (LM Environmental Consulting), three technical reports (for De Beers Marine Namibia), and one conference paper.

2 Environmental Management Plan: Implementation and Compliance

2.1 Introduction

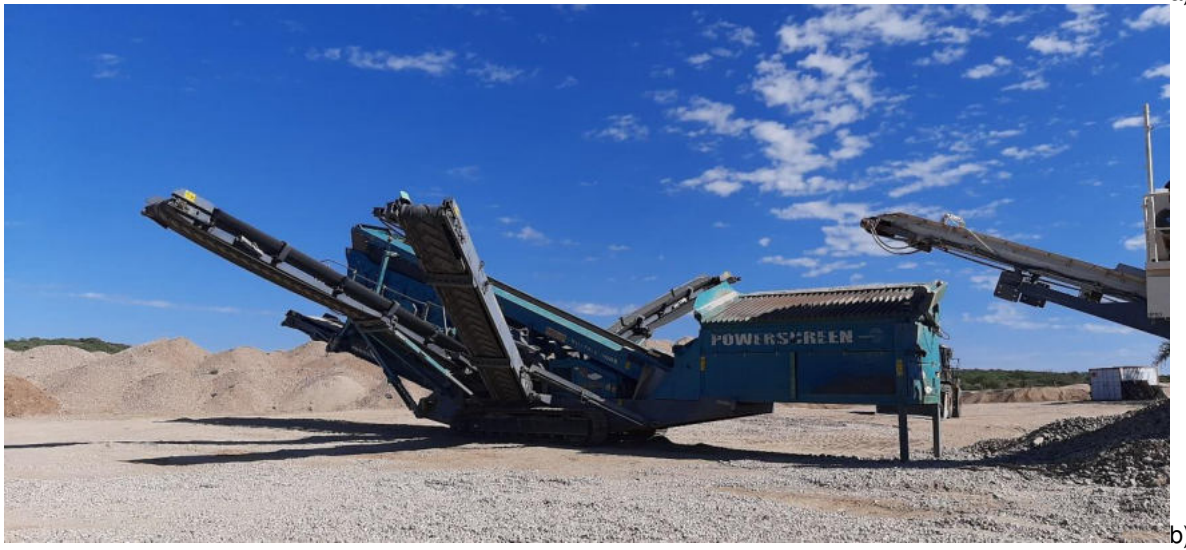
As part of the EMP performance review, the following action was carried out:

- A site visit, together with Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, was undertaken to the area on 08 March 2023.

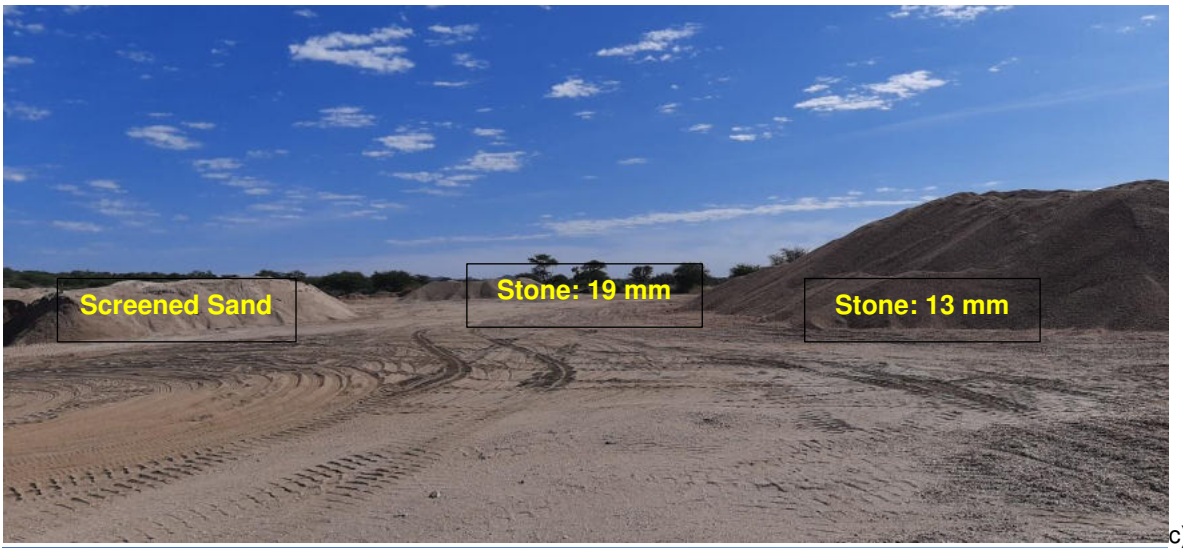
2.2 Activities

Sand is mined from the riverbed (Figure 3a) and then screened (Figure 3b) into: oversize material; 19 millimetre (mm) stone; 13 mm stone; and sand (Figure 3c). The oversize material (5.0 to 7.5% of all the sand mined) is again crushed (Figure 3d) to obtain mainly 19 and 13 mm stone.

a)



b)



c)


d)

Figure 3: Pictures showing: a) junction of the river coming from Windhoek and flowing into the Swakop River; b) PowerScreen (the river sand can be seen in the background); c) the products: sand, 19 mm stone and 13 mm stone; d) an excavator in the process of loading oversize material onto the crusher (*Source: L. Maartens, 08 March 2023)*.

Currently, the 19 mm stone is transported via truck to the Batching Plant in Okahandja, and the 13 mm stone (and sand) is transported via truck to Windhoek. On average, three trucks each transport three loads per day (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).

2.3 Compliance: Environmental Management Plan

In order to illustrate compliance with the EMP (see Table 1), the following colour codes were applied:

	Compliance/Completed
	In Progress/Ongoing
	Non-compliance
	Not (Currently) Applicable
	Changes made to existing EMP

The EMP (see Sanzila, 2016; and Maartens, 2020) is not a static document and the document should be updated as Namibia Construction's activities progresses.

Table 1: Compliance with the Environmental Mitigation Measures and Commitments (*after Sanzila, 2016*).

Environmental Issue	Management and Mitigation Measures	Compliance / Comments (Maartens, 2020)	Compliance / Comments (2023)
Social and third party safety issues	Keep within working hours from 07:00 until 16:00, and sometimes on a Saturday from 07:00 until 13:00. Limit the work on Saturdays as well as after 16:00 on weekdays as far as possible. No working on Sundays and public holidays.	Compliant and ongoing. Working hours are between 07h00 and 17h00 during the week; work on Saturdays is limited to a Front End Loader (FEL) operator loading sand on to semi-tippers for hauling to Windhoek (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	Compliant and ongoing. Working hours are between 07h00 and 17h00 during the week; work on Saturdays is limited to around one Saturday per month (Mr Pieter de Villiers, Foreman, and Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).
	No mining within 500 m of private property.	Compliant and ongoing.	
	Transportation of sand material should follow the D1972 Road to the B1 Road. No other routes should be used apart from the national roads.	Compliant and ongoing. The Farm Owner, Mr Johannes Kriel, gave permission for the material to be transported (to the D1972) using the access roads indicated in Figure 2 (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	
	Poaching and plant theft will not be tolerated and staff found in possession will be prosecuted.	Compliant and ongoing. A security guard employed by the Farm Owner patrols the area. Namibia Construction (Pty) Ltd's (NC) foreman (Mr Koos Steenkamp) and security guard ensure that no poaching and/or plant theft take place (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	Compliant and ongoing. A security guard employed by the Farm Owner patrols the area. Note that there are currently workers gathering/cutting encroacher bush in the area. Mr Steenkamp left the Company end-2021 and was replaced by Mr Pieter de Villiers, who ensures that no poaching and/or plant theft take place. There is a security guard at the entrance gate at the road to the existing stockpile area (see Figure 2) that controls access, and check the loads and cattle in the area (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).
	All staff operating on site will be provided with identification and proof that they are working for NC.	Compliant and ongoing.	
	Smoking is permitted only in designated areas.	Compliant and ongoing. The following Company Policies are in place: Health and Safety; Environmental; HIV/AIDS; General Health and Safety; Alcohol and Drug Zero Tolerance; Fire Arm; Sexual Harassment; Smoking; Information Technology; Cell Phone; Life Threatening Disease; Personal Protective Equipment; and Quality.	
	Have zero tolerance to alcohol in the workplace and on site.		
	Provide appropriate toilet facilities for the workers on the site and workers should be strictly enforced to use these facilities. These facilities (i.e. portable toilets) shall not discharge any effluent into the environment. Sewerage needs to be emptied on a regular basis (to prevent overflowing) and	Compliant and ongoing. There are currently two toilets (longdrops), one to the south of the existing stockpile area and one at the current entrance / access road (see Figure 3 - now Figure 4). Additional toilets will have to be provided at the two new stockpile areas.	Compliant and ongoing. There are three toilets (longdrops): one at the entrance gate at the road to the existing stockpile area; one to the south of the existing stockpile area; and one at the entrance gate at the access road to the Farmhouse (see Figures 2 and 4).

Environmental Issue	Management and Mitigation Measures	Compliance / Comments (Maartens, 2020)	Compliance / Comments (2023)
	discharged at the Okahandja municipal sewerage facility.		
	All NC vehicles to use only the dedicated access road to the sand mine. No NC vehicles shall use other farm roads for access to the sand mine.	Compliant and ongoing. The Farm Owner, Mr Johannes Kriel, gave permission for the material to be transported (to the D1972) using the access roads indicated in Figure 2 (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	
	NC shall liaise with the Roads Authority to ensure the access road turn-off from (and unto) the D1972 (i.e. 'D1972 jution with the access road') used by mine vehicles conform to all the necessary road safety requirements (i.e. roads signs, etc.).	NC liaised with Mr Niklaas Steenkamp from the Roads Authority (RA) in Okahandja and edge beams and road signage were put up at the junction (existing access) (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	
	Ensure that no material is lost during transportation: ❑ The drivers must check the tail gates of the load body after each load that they have tipped to ensure that the tail gate closes properly and no stones are lodged in between the gate and the body. This could otherwise result in sand seeping out whilst travelling. ❑ Also, clean off the back of the load body, to make sure that no loose stones remain lying in these areas e.g.: end of the load body or on the chevron, that could fall off whilst travelling. ❑ The loads must be covered with netting or tarpaulins in order to minimize dust and sand falling material blown off during transportation.	Compliant and ongoing. The tail gates are checked; the loads are covered with shade netting (fines are issued if the loads are not covered). The trucks are also weighed at the weigh bridge at Brakwater (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	Compliant and ongoing. The tail gates are checked; the loads (sand) are covered with shade netting (fines are issued if the loads are not covered). Loads of stone are not covered. The trucks are also weighed at the weigh bridge at Brakwater (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).
	NC will control the movement of all staff on site and prevent staff from leaving designated work areas.	Compliant and ongoing. Sand mining takes place on a private farm; staff, maximum 10 at any time, stays in Okahandja (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	Compliant and ongoing. Sand mining takes place on a private farm; the staff, currently seven people (excluding the truck drivers), stays in Okahandja (Mr Pieter de Villiers, Foreman, Namibia Construction (Pty) Ltd, pers. comm.).

Environmental Issue	Management and Mitigation Measures	Compliance / Comments (Maartens, 2020)	Compliance / Comments (2023)
 a)  b)  c) Figure 4: Pictures showing the toilets: a) at the entrance gate at the road to the existing stockpile area; b) just south of the existing stockpile area (*Source: L. Maartens, 10 March 2020*); and c) at the entrance gate at the access road to the Farmhouse (*Source: L. Maartens, 08 March 2023*).			
Tourism	Ensure the existing access into the river from the plot road is safely maintained.	Compliant and ongoing.	Compliant and ongoing.
Waste management	No litter or waste accumulation will be permitted on site.	Compliant and ongoing.	Compliant and ongoing.
	No burning or burying of waste material will be allowed on site.	Compliant and ongoing.	Compliant and ongoing.
	Suitable receptacles for waste disposal will be provided at appropriate locations on site.	Compliant (see Figure 4a – now Figure 5a) and ongoing. Additional rubbish bins will have to be provided at the two new stockpile areas. Note that waste is limited (maximum of 10 staff that work in the area and stay in Okahandja). The waste, mainly household, is collected and disposed of at the waste disposal site outside Okahandja.	Compliant and ongoing. The rubbish bin is currently stored in the container (see Figure 5c); the waste, mainly household, is collected in bags and disposed of at the waste disposal site outside Okahandja (Mr Pieter de Villiers, Foreman, Namibia Construction (Pty) Ltd, pers. comm.).
	Employees (NC staff) will be shown the importance of correct waste disposal as well as waste minimisation and recycling through training.		

Environmental Issue	Management and Mitigation Measures	Compliance / Comments (Maartens, 2020)	Compliance / Comments (2023)
 a)  b)  c) Figure 5: Pictures showing: a) rubbish bin next to the storage container at the existing stockpile area; b) a small, dedicated area was set aside for the making of a fire for the warming of food / water (*Source: L. Maartens, 10 March 2020*); and c) the area three years later (*Source: L. Maartens, 08 March 2023*).			
Waste management (cont.)	Waste will be removed from site and disposed of at a suitable licensed waste disposal facility.	It is uncertain as to whether the waste disposal site outside Okahandja is licensed?	
	Hazardous (i.e. hydrocarbon contaminated soil) shall be disposed of at the Windhoek Hazardous waste facility.	Hydrocarbon contaminated soil is removed and stored at a dedicated area, until it can be removed and disposed of at the waste disposal site outside Okahandja (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.). It is advised that hazardous waste be disposed of at the licensed, hazardous waste disposal site outside Windhoek.	It is advised that hydrocarbon contaminated soil (see Figure 6b) be removed on a regular basis and stored at a dedicated area, until it can be removed and disposed of at the hazardous waste disposal site outside Windhoek.
	Written evidence of safe disposal of waste will be kept.	It is advised that records of the amount of hazardous waste to be disposed of at the licensed, hazardous waste disposal site outside Windhoek be kept.	It is advised that records of the amount of hazardous waste disposed of at the licensed, hazardous waste disposal site outside Windhoek be kept.
Groundwater and surface water	<u>Managing groundwater resources:</u>		
	A buffer zone of sand of at least 1 m above the water table. This implies mining of maximum 3 m vertically down from original river (i.e. natural ground level) at the current water level. Water levels should be constantly monitored to assure an adequate buffer zone is present.	Compliant and ongoing. Mining ususally takes place up to 1.5 metres (m), maximum 2 m (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	Compliant and ongoing. Mining ususally takes place up to 1 metre (m) (Mr Pieter de Villiers, Foreman, Namibia Construction (Pty) Ltd, pers. comm.).
	After a flood event the water level will have to be reassessed and the vertical extent of the sand pit may need to be decreased.	Compliant and ongoing. Note that there are natural dykes in the river at various angles to the river centre line (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	
	If water levels drop significantly in downgradient boreholes due to sand mining activities (natural	N/A (to date). NamWater has monitoring boreholes in the Swakop River (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	

Environmental Issue	Management and Mitigation Measures	Compliance / Comments (Maartens, 2020)	Compliance / Comments (2023)
	water decline and abstraction by farmers are to be excluded as reason through regular water level and abstraction monitoring) such that it affects pumping capacity of farmer then the Client should provide the farmers with adequate water, potentially by drilling new production borehole(s) or supply from the NamWater pipeline or other sources.		
	Quarterly monitoring upstream and downstream of the sand mine area is recommended.	N/A (to date). Note that there are natural dykes in the river at various angles to the river centre line (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	
	Leave a beach at each bank of the river.	Compliant and ongoing.	Compliant and ongoing.
	Mining of maximum 3 m below the original river bed surface.	Compliant and ongoing. Mining ususally takes place up to 1.5 m, maximum 2 m (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	Compliant and ongoing. Mining ususally takes place up to 1 m (Mr Pieter de Villiers, Foreman, Namibia Construction (Pty) Ltd, pers. comm.).
	Drilling of monitoring borehole in the mining area to determine thickness of the alluvium and saturated thickness in order to assess the relative impact on groundwater storage capacity.	Trial holes were dug to a maximum depth of 2 m on 24 January 2020; no groundwater was encountered. Following the flooding of the river during February and begin-March 2020, the water table is currently situated just below the surface (and will decline in time unless the river flows again during the current rainy season). NC has not previously exposed any groundwater (only at the intersection of the Swakop River and the river coming from Windhoek where a sump was excavated to draw water for dust control and for drinking water for the cattle), not even where the water is trapped between the dykes crossing the riverbed (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	
	Rehabilitation of worked areas should be undertaken, with trimming / shaping / levelling of depleted areas with sand from nearby, to reduce the contrast between excavated and natural river areas, and reduce likely ponding areas for floodwaters and to enhance the natural backfilling of the mine pits with sand during flood events, which are likely every year.	N/A (to date); the mined out area was reinstated with sand following the flooding of the Swakop River in February / begin-March 2020.	N/A (to date). The mined out areas were reinstated with sand following the flooding of the Swakop River in February/March 2021; and the Swakop River and the river coming from Windhoek in 2022 and 2023 (inflow from the river coming from Windhoek was substantially more (vs that from the Swakop River) in January/February 2023) (Mr Pieter de Villiers, Foreman, and Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).
	Additional monitoring upstream and downstream of the sand mine area is recommended.	N/A (to date). Note that there are natural dykes in the river at various angles to the river centre line (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	
	NC will liaise with MAWF to obtain the necessary authorisation.	N/A (to date). A representative from NC followed up with Mr Franciskus Witbooi, Deputy Director Law Administration, Ministry of Agriculture, Water and	The letter dated 14 August 2017 *APPLICATION to MINE SAND from SWAKOP RIVER on FARM OSONA COMMONAGE PORTION 85, PLOT 59 & 60 and REMAINDER PORTION AG, OKAHANDJA DISTRICT* submitted to the

Environmental Issue	Management and Mitigation Measures	Compliance / Comments (Maartens, 2020)	Compliance / Comments (2023)
		Forestry (MAWF) in person on 19 February 2020 and was informed that the MAWF has not been issuing separate Permits for Sand Mining for the last few years (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	Permanent Secretary, Ministry of Agriculture, Water and Forestry (MAWF; now Ministry of Agriculture, Water and Land reform (MAWLR)) (by NC) was made available to LM Environmental Consulting. A representative from NC followed up with Mr Franciskus Witbooi, Deputy Director Law Administration, Ministry of Agriculture, Water and Forestry (MAWF) in person on 19 February 2020 and was informed that the MAWF has not been issuing separate Permits for Sand Mining for the last few years (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).
Groundwater and surface water	<u>Managing groundwater quality:</u>		
	Dedicated storage and refuelling stations for heavy vehicles with ground protection to prevent spillages seeping into the soil and the ground water. Refuelling station should be outside the river area.	N/A. There are no bulk storage facilities on site. Fuel is brought in daily in two, 210 litre (l) drums (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	There are no bulk storage facilities for fuel on site. A fuel tanker (from NC) delivers fuel every second day. Only 60 litres of engine oil and 60 litres of hydraulic oil is kept at the site (in 20 litre drums in the container) (Mr Pieter de Villiers, Foreman, Namibia Construction (Pty) Ltd, pers. comm.).
	Tanks and generators placed in bunded and roofed containments.	N/A.	See above.
	Toilet facilities for workers on site should be standard and workers should be strictly enforced to use these facilities.	Compliant and ongoing. There are currently two toilets (longdrops), one to the south of the existing stockpile area and one at the current entrance / access road used (see Figure 3). Additional toilets will have to be provided at the two new stockpile areas.	Compliant and ongoing. There are three toilets (longdrops): one at the entrance gate at the road to the existing stockpile area; one to the south of the existing stockpile area; and one at the entrance gate at the access road to the Farmhouse (see Figures 2 and 3).
	Additional monitoring of groundwater quality up-gradient and down-gradient and downstream of the sand mining area is recommended.	N/A.	It is advised that a water sample be collected and sent for analysis (from the water in the River coming from Windhoek). *A sample has since been collected and submitted to Analytical Laboratory for analysis (see Annexure B for the results)*.
	Emergency situations: - Diesel spillage. An emergency plan should be compiled and kept on site for implementation. Hydrocarbon spill kits	N/A. There are no bulk storage facilities on site. Fuel is brought in daily in two, 210 l drums (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	There are no bulk storage facilities for fuel on site. A fuel tanker (from NC) delivers fuel every second day.

Environmental Issue	Management and Mitigation Measures	Compliance / Comments (Maartens, 2020)	Compliance / Comments (2023)
	stored on site and staff trained in spill kit operations.	It is advised that absorbent pads and/or spill kits be made available, that personnel are trained in their use, and that any spills are immediately reported and cleaned up.	Only 60 litres of engine oil and 60 litres of hydraulic oil is kept at the site (in 20 litre drums in the container) (Mr Pieter de Villiers, Foreman, Namibia Construction (Pty) Ltd, pers. comm.). It is advised that absorbent pads and/or spill kits be made available, that personnel are trained in their use, and that any spills are immediately reported and cleaned up.
Groundwater and surface water	Managing surface water runoff:		
	A sump must be constructed at the centre of the downstream excavation wall, to enable pumping of impounded water after flood events, with the water being discharged into the undisturbed riverbed downstream of the sand excavation, to allow the runoff to continue downstream towards Swakoppoort Dam.	N/A. Note that there are natural dykes in the river at various angles to the river centre line (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	
	A suitable generator and pump should be stored on site (out of the river channel) during the rainy season to allow pumping to commence soon after the end of the flood event.		
	Maintenance of sump at start of each rainy season.		
	Emergency situations: - Floodwaters will cause flooding to excavations.		
Groundwater and surface water	Managing surface water pollution:		
	Refuelling and overnight parking of equipment, and toilet facilities located out of river channel.	Compliant and ongoing.	Compliant and ongoing.
	Drip pans under parked vehicles.	Oil filters, etc. (from the serviced equipment) are collected and transported to NC's workshop in Windhoek (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	It is advised that drip pans be made available and used by the staff. The waste oil is collected (see Figure 6a) and taken to the NC Workshop in Windhoek (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.). It is advised that oil filters, etc. be removed and disposed of at the hazardous waste disposal site outside Windhoek. It is advised that records of the amount of hazardous waste disposed of at the licensed, hazardous waste disposal site outside Windhoek be kept.

Environmental Issue	Management and Mitigation Measures	Compliance / Comments (Maartens, 2020)	Compliance / Comments (2023)
	Fuel tanks and generators in bunded and roofed containments.	N/A.	The oil drums are stored in the container (Mr Pieter de Villiers, Foreman, Namibia Construction (Pty) Ltd, pers. comm.).
	Hydrocarbon spill kits stored on site and staff trained in spill kit operations.	It is advised that absorbent pads and/or spill kits be made available, that personnel are trained in their use, and that any spills are immediately reported and cleaned up.	It is advised that absorbent pads and/or spill kits be made available, that personnel are trained in their use, and that any spills are immediately reported and cleaned up.
	Collection and analysis of flood water samples for pollutants (baseline).	N/A. Samples were taken at the start of the sand mining activities, but only to determine if the material would be suitable to make concrete from (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	

a)

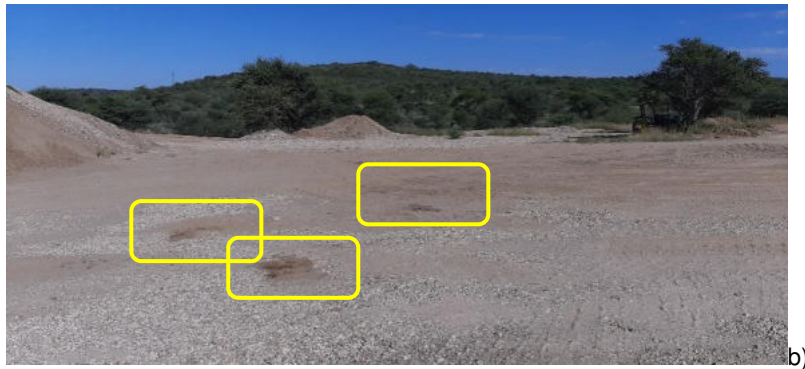

b)

Figure 6: Pictures showing: a) the drum for the collection and storage of the waste oil; and b) areas contaminated with hydrocarbons (*Source: L. Maartens, 08 March 2023*).

Groundwater and surface water	Impact of Surface Water Flood on Sand Mining Equipment and Staff	
	Implement a communication system to alert workers in the Swakop River of arrival of flood waters.	Compliant and ongoing. NamWater informs the Farm Owner prior to the opening of Von Bach Dam's sluices, who then in turn informs NC staff.
	All work to cease when notification of flood, equipment to be removed from excavation, work to only resume when communications indicate flood has passed.	
	Regular communication with early flood warning network (NamWater, farmers, Windhoek Municipality) during rainy season.	
Air quality	Use a water cart to spray water on the access road to the mine (as well as on the roads inside the mine area on the most eastern part) to supress dust.	Compliant and ongoing (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).

Environmental Issue	Management and Mitigation Measures	Compliance / Comments (Maartens, 2020)	Compliance / Comments (2023)
	Consider and investigate any complaints regarding dust from third parties, and where required implement further dust mitigation.	N/A (to date).	
	Vehicles will travel maximum 50 km/h on the access road to the mine.	Compliant and ongoing. Vehicles travel at a speed of no more than 40 kilometres per hour (km/h) on the roads (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	
	Vehicles and equipment will be maintained in good working order.	Compliant and ongoing (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	
Biodiversity	The footprint of the sand mining area will be minimised as far as is practically possible.	Compliant and ongoing.	
	Ensure that all waste generated during activities is removed from the site and disposed of appropriately.	Compliant and ongoing (household waste). It is advised that hazardous waste be disposed of at the licensed, hazardous waste disposal site outside Windhoek.	
	Prevent cutting down protected tree species or trees with a stem diameter over 10 cm as far as practically possible. Also prevent mining too close to the protected trees that could expose their roots and let the trees fall over.	Compliant and ongoing. The stockpile area (old borrow pit) was already devoid of any trees. Swarthaak/blackthorn and sickle bush mainly were cleared in the (new) stockpile area (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	
	Leave a beach at each bank to provide protection to the bankside vegetation.	Compliant and ongoing.	Compliant and ongoing.
	Tree removal permits will be obtained for the removal of all protected tree species (as is required by the Forestry Act).	N/A (to date).	
	Permits will be obtained for cutting, removing or destroying of any tree, bush or shrub growing within 100m of the river (as required by the Forestry Act).		
	NC will implement a zero tolerance policy with regards to the killing or collecting of any biodiversity. This applies to people directly employed by NC as well as any contractors working on their behalf.	Compliant and ongoing.	
	No open fires will be permitted on site.	A small, dedicated area was set aside for the making of a fire for the warming of food / water (see Figure 5b).	
	Employees and contractors will be shown the value of biodiversity and the need to conserve the species and systems that occur on the farm through appropriate training to all staff working at the sand mine.	Ongoing (as part of e.g. the toolbox talks) (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	It is advised that toolbox talks be held more regularly (vs once a month) and that all the different topics are covered (with regards to health, safety, and environment) (possibly by the Health and Safety Officer, Mr Willem Leclus).
	Speed limits will be enforced on the access road to prevent road kills.	Compliant and ongoing. Vehicles travel at a speed of no more than 40 km/h on the roads (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	

Environmental Issue	Management and Mitigation Measures	Compliance / Comments (Maartens, 2020)	Compliance / Comments (2023)
	Ensure guidelines and rules are regularly communicated to workers and visitors.	Ongoing (as part of e.g. the toolbox talks) (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	It is advised that toolbox talks be held more regularly (vs once a month) and that all the different topics are covered (with regards to health, safety, and environment) (and possibly by the Health and Safety Officer, Mr Willem Leclus).
	Any animals that are accidentally killed by sand mining activities (i.e. road kills) need to be immediately reported to the the owner of Farm Osona 65.	N/A (to date).	
Noise	Vehicles will travel maximum 50 km/h on the access road to the mine.	Compliant and ongoing. Vehicles travel at a speed of no more than 40 km/h on the roads (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	
	Restrict sand mining activities to daylight hours. No work shall be conducted on Sundays or public holidays.	Compliant and ongoing (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	
	Document and investigate all registered complaints and make efforts to address the area of concern where possible.	N/A (to date).	N/A (to date).
	Only use the approved access road to the sand mine off the D1972 road.	Compliant and ongoing. The Farm Owner, Mr Johannes Kriel, gave permission for the material to be transported (to the D1972) using the access roads indicated in Figure 2 (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	
	Mining equipment/machinery would be operated in a proper manner with respect to minimising noise emissions for example, no unnecessary engine revving.	Compliant and ongoing (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	
	Equipment & machinery would be subject to regular maintenance.	Compliant and ongoing (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).	
Land use	The existing power line (and related servitude), cutting through the sand mine site needs to be taken into consideration when mining moves close to this area. No work to be undertaken within the servitude of the powerline and remain at allowable and safe working distances from the powerline infrastructure / servitude – NC to confirm these (i.e. safe working distance) with NamPower.	N/A (see Figure 2).	
Closure and Rehabilitation			
Groundwater	Rehabilitation of the mining area should be conducted once the resource has been depleted to avoid negative effects on the aquifer. Rehabilitation should include backfilling (where possible) and trimming/ shaping / levelling of the mining area to avoid ponding of surface water in	N/A (to date); the mined out area was reinstated with sand following the flooding of the Swakop River in February / begin-March 2020.	N/A (to date). The mined out areas were reinstated with sand following the flooding of the Swakop River and the river coming from Windhoek in 2021-2023.

Environmental Issue	Management and Mitigation Measures	Compliance / Comments (Maartens, 2020)	Compliance / Comments (2023)
	the abandoned mine pits as observed in other old sand mining areas, as well as to reduce the risk to wildlife migrating within the river corridor.		
Third party and animals safety issues	The final pit / excavation will be rehabilitated in a manner that they will be made safe (and visually more acceptable) to ensure that there is no risk to the safety of people and animals (i.e. avoid leaving steep/unstable slopes).		
Visual			
Contamination of soils	Refer to management measures relating to contamination of water (Table 9-1; see Sanzila, 2016)		
Air quality deterioration	Vehicle speeds will be limited to 50 km/h on access routes to limit dust.		
Soil erosion	Impacted footprints areas around the pits/excavations to be ripped and raked to encourage re-vegetation.		
Waste management and infrastructure	Remove all infrastructure and equipment from site.		
	Decommission ablution facilities.		
	Ensure that all waste generated during activities is removed from the site and disposed of appropriately.		

2.4 Compliance: Monitoring

Sanzila (2016) proposed certain groundwater monitoring activities, but Maartens (2022) advised that "measurement of rest water level" and "collection and analysis of groundwater samples from selected downstream farm boreholes, drilled into the Swakop River alluvium by a water laboratory for major ions, total metals, hydrocarbons and bacteria such as *E. coli*" be omitted from the EMP.

Namibia Construction (Pty) Ltd (NC) is not abstracting groundwater (as many other users in the area are) and the rest water level will vary over time (depending on e.g. the amount of recharge and abstraction). Also, the results from the analysis of groundwater samples from the area where sand is mined, will not be representative of the groundwater quality in the area (as there are various tributaries to / that drain into the Swakop River).

2.5 Compliance: Conditions Attached to the Environmental Clearance Certificate

In order to illustrate compliance with the Conditions attached to the ECC (see Table 2), the following colour codes were applied:

	Compliance/Completed
	In Progress/Ongoing
	Non-compliance
	Not (Currently) Applicable
	Changes made to existing EMP

Table 2: Compliance with the Conditions Attached to the Environmental Clearance Certificate (Appendix A).

1	In the case of private land not owned by the lease holder an affidavit should be obtained regarding consent of the concerned land owner (s) for carrying out the mining operation.	A Memorandum of Agreement is in place between Swakop River CC and Namibia Construction (Pty) Ltd (NC) (valid until 17 August 2023).
2	Valid permit from the Relevant Competent Authority to be obtained for riverbed sand mining, vegetation clearing of protected plant species and boreholes drilling prior to commencement of the project.	The letter dated 14 August 2017 *APPLICATION to MINE SAND from SWAKOP RIVER on FARM OSONA COMMONAGE PORTION 85, PLOT 59 & 60 and REMAINDER PORTION AG, OKAHANDJA DISTRICT* submitted to the Permanent Secretary, Ministry of Agriculture, Water and Forestry (MAWF; now Ministry of Agriculture, Water and Land reform (MAWLR)) (by NC) was made available to LM Environmental Consulting. A representative from NC followed up with Mr Franciskus Witbooi, Deputy Director Law Administration, Ministry of Agriculture, Water and Forestry (MAWF) in person on 19 February 2020 and was informed that the MAWF has not been issuing separate Permits for Sand Mining for the last few years. No vegetation has been cleared and no boreholes have been drilled by NC (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).
3	All conditions provided by the Relevant Competent Authority with regards to riverbed sanding mining must be complied with.	
4	The Holder shall erect a signboard not smaller than 70 cm in height and 100 cm in width, at the major entrance/s to each of its Sand Mining Site /Area, specifying the duration of the EC validity and the name of the EC holder, and a contact name and number for enquiries.	This has not been done for security reasons (to not attract e.g. persons looking for jobs to the area).
5	Mining shall be done in layers of 1 m depth to avoid ponding effect and after first layer is excavated, the process will be repeated for the next layers; All possible precaution as identified in the Environmental Management Plan shall be complied with to prevent and mitigate potential impacts.	

6	No exposure of groundwater should take place in respect of Sand mining activities undertaken within a riverbed.	
7	Depending upon the location, thickness of sand, deposition, agricultural land/river bed, the method of mining may be manual, semi-mechanized or mechanized; however, manual method of mining shall be preferred over any other method.	The method of mining is mechanised.
8	The EC holder shall keep a correct account of quantity of sand mined out, dispatched from the site, mode of transport, registration number of vehicle, person in-charge of vehicle and site plan. This should be produced before inspectors at any time.	Up to June 2020, 103,812 cubic metres (m^3) of river sand were mined; up to February 2023, 158,004 m^3 of river sand were mined (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).
9	Restricted working hours: Sand mining operation has to be carried out between 7 am to 5 pm.	
10	Pollution due to dust, exhaust emission or fumes during mining and processing phase should be controlled and kept in permissible limits specified under environmental laws.	
11	Restoration of flora affected by mining should be done immediately. Twice the number of trees destroyed by mining be planted preferably of indigenous species;	N/A
12	No overhangs shalt be allowed to be formed due to mining and mining shall not be allowed in areas where subsidence of rocks is likely to occur due to steep angle of slope.	N/A
13	No extraction of stone / boulder / sand in landslide prone areas.	N/A
14	Dumping of waste shall be done in earmarked places as approved in the plan;	
15	Sand mining sites should not be located within 100 meters from the edge of National Highway and railway line, water reservoir, canal and building; 60 meter from the edge of other roads except on special exemption from relevant authority.	N/A
16	Junction at take-off point approach road with main road be properly developed with proper width and geometry required for safe movement of traffic own cost.	The one access point to the east (near the farmhouse) is an official turn off, to the various farms. The road is also tarred. At the westerly turn off, an edge beam had to be installed (request from the Roads Authority District Supervisor, Mr Niklaas Steenkamp). The edge beam prevents the road edge from breaking away. Here, temporary road signs (yellow instead of a white background) have been erected, as it is not a permanent turn off (Mr Wilfried Schmidt, Contract Manager, Civil Division, Namibia Construction (Pty) Ltd, pers. comm.).

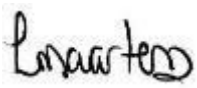
3 Conclusions and Recommendations

The housekeeping at the site, apart from small areas where contaminated soil was observed, is of a very high standard.

The following recommendations are made:

1. That all hazardous waste, including hydrocarbon contaminated soil, be removed and stored at a dedicated area and then be disposed of at the licensed, hazardous waste disposal site outside Windhoek (vs the waste site outside Okahandja); and
2. That absorbent pads and/or spill kits be made available, that personnel are trained in their use, and that any spills are immediately reported and cleaned up.

It is advised that Namibia Construction (Pty) Ltd and their employees and contractors should implement and observe the Environmental Management Plan on an ongoing basis. Environmental performance should be regularly monitored (so that the lessons learnt can be incorporated into the improvement of the Environmental Management Plan over time) and corrective measures taken as or when required.



Dr Lima Maartens
LM Environmental Consulting

4 References

Government of the Republic of Namibia (GRN). 2012. Ministry of Environment and Tourism. Government Notice No. 28. *Commencement of the Environmental Management Act, 2007*. Government Notice No. 29. *List of activities that may not be undertaken without Environmental Clearance Certificate: Environmental Management Act, 2007*. Government Notice No. 30. *Environmental Impact Assessment Regulations: Environmental Management Act, 2007*. Government Gazette of the Republic of Namibia. No. 4878. 6 February 2012.

Maartens, L. (LM Environmental Consulting). 2020. *Implementation of and Compliance with the Environmental Management Plan for the Mining of Sand by Namibia Construction (Pty) Ltd in the Upper Reaches of the Swakop River on Farm Osona No. 65, Otjozondjupa Region, Namibia*. Prepared for Namibia. Namibia Construction (Pty) Ltd. 21 pp.

Sanzila, M. (SLR Environmental Consulting (Namibia) Proprietary Limited). 2016. *Scoping (Including Assessment) Report and EMP for Sand Mining project- 20km South West of Okahandja*. 96 pp. (plus 8 Appendices).

5 Annexure A

ECC – 00698 Serial: oJPAxl698

REPUBLIC OF NAMIBIA

MINISTRY OF ENVIRONMENT, FORESTRY AND TOURISM

OFFICE OF THE ENVIRONMENTAL COMMISSIONER

ENVIRONMENTAL CLEARANCE CERTIFICATE

ISSUED

In accordance with Section 37(2) of the Environmental Management Act (Act No. 7 of 2007)

TO

Namibia Construction (Pty) Ltd
P.O. Box 5092, Windhoek,

TO UNDERTAKE THE FOLLOWING LISTED ACTIVITY

Sand Mining Activities in the Upper Reaches of the Swakop River on Farm Osona No. 65, Otjozondjupa Region

MINISTRY OF ENVIRONMENT, FORESTRY AND TOURISM
Private Bag 13306
WINDHOEK NAMIBIA
11 JUN 2020
ENVIRONMENTAL COMMISSIONER
REPUBLIC OF NAMIBIA

ENVIRONMENTAL COMMISSIONER

Issued on the date: 2020-06-05
Expires on this date: 2023-06-05

(See conditions printed over leaf)

Reduce
Reuse
Recycle

NAMIBIA TRASH BIN

This certificate is printed without erasures or alterations

ECC –

CONDITIONS OF APPROVAL

1. This environmental clearance is valid for a period of 3 (three) years, from the date of issue unless withdrawn by this office
2. This certificate does not in any way hold the Ministry of Environment and Tourism accountable for misleading information, nor any adverse effects that may arise from these activities. Instead, full accountability rests with the proponent and its consultants
3. This Ministry reserves the right to attach further legislative and regulatory conditions during the operational phase of the project
4. Conditions for sand mining applies

APPENDIX A - CONDITIONS ATTACHED TO ENVIRONMENTAL CLEARANCE CERTIFICATE FOR SAND AND GRAVEL MINING

1. In the case of private land not owned by the lease holder an affidavit should be obtained regarding consent of the concerned land owner (s) for carrying out the mining operation.
2. Valid permit from the Relevant Competemt Authority to be obtained for riverbed sand mining, vegetation clearing of protected plant species and boreholes drilling prior to commencement of the project.
3. All conditions provided by the Relevant Competemt Authority with regards to riverbed sanding mining must be complied with.
4. The Holder shall erect a signboard not smaller than 70 cm in height and 100cm in width, at the major entrance/s to each of its Sand Mining Site /Area, specifying the duration of the EC validity and the name of the EC holder, and a contact name and number for enquiries.
5. Mining shall be done in layers of 1 m depth to avoid ponding effect and after first layer is excavated, the process will be repeated for the next layers; All possible precausion as identified in the Environmental Management Plan shall be complied with to prevent and mitigate potential impacts.
6. No exposure of groundwater should take place in respect of Sand mining activities undertaken within a riverbed.
7. Depending upon the location, thickness of sand, deposition, agricultural land/river bed, the method of mining may be manual, semi-mechanized or mechanized; however, manual method of mining shall be preferred over any other method.
8. The EC holder shall keep a correct account of quantity of sand mined out, dispatched from the site, mode of transport, registration number of vehicle, person in-charge of vehicle and site plan. This should be produced before inspectors at any time.
9. Restricted working hours: Sand mining operation has to be carried out between 7 am to 5 pm.
10. Pollution due to dust, exhaust emission or fumes during mining and processing phase should be controlled and kept in permissible limits specified under environmental laws.
11. Restoration of flora affected by mining should be done immediately. Twice the number of trees destroyed by mining be planted preferably of indigenous species;
12. No overhangs shall be allowed to be formed due to mining and mining shall not be allowed in areas where subsidence of rocks is likely to occur due to steep angle of slope.
13. No extraction of stone / boulder / sand in landslide prone areas.
14. Dumping of waste shall be done in earmarked places as approved in the plan;
15. Sand mining sites should not be located within 100 meters from the edge of National Highway and railway line,water reservoir, canal and building;60 meter from the edge of other roads except on special exemption from relevant authority.
16. Junction at take-off point approach road with main road be properly developed with proper width and geometry required for safe movement of traffic by lease holder at his own cost.

6 Annexure B

Analytical Laboratory Services
OUR QUALITY IS IN THE DETAIL

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PO Box 86782, Windhoek, Namibia

TEST REPORT I230561/1

To: **Namibia Construction (Pty) Ltd**
P.O.Box 5092
Windhoek

Date received: 13/Mar/23
Date analysed: 16-23 March 2023
Date reported: 24/Mar/23

Attn: Wilfried
e-mail: ncoffice@africaonline.com.na
Tel: 081-124 1660

Client Reference no.: PO-0259 90
Quotation no.: None
Lab Reference: I230561
Enquiries: Mrs Imogen Carew

Sample details	Water Sample
Location of sampling point	Swakop river, Osona
Description of sampling point	Water
Date of sampling	2023/03/09; 08h00
Test item number	I230561/1

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	7.4		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	117.0	mS/m	A	150	300	400	
Turbidity	1.6	NTU	B	1	5	10	
Total Dissolved Solids (calc.)	685	mg/l					6000
P-Alkalinity as $CaCO_3$	<10	mg/l					
Total Alkalinity as $CaCO_3$	295	mg/l					
Total Hardness as $CaCO_3$	182	mg/l	A	300	650	1300	
Ca-Hardness as $CaCO_3$	120	mg/l	A	375	500	1000	2500
Mg-Hardness as $CaCO_3$	62	mg/l	A	290	420	840	2057
Chloride as Cl^-	147	mg/l	A	250	600	1200	1500-3000
Fluoride as F^-	0.3	mg/l	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	92	mg/l	A	200	600	1200	1000
Nitrate as N	<0.5	mg/l	A	10	20	40	100
Nitrite as N	<0.01	mg/l					10
Sodium as Na	182	mg/l	B	100	400	800	2000
Potassium as K	24	mg/l	A	200	400	800	
Magnesium as Mg	15	mg/l	A	70	100	200	500
Calcium as Ca	48	mg/l	A	150	200	400	1000
Manganese as Mn	0.13	mg/l	B	0.05	1.0	2.0	10
Iron as Fe	0.02	mg/l	A	0.1	1.0	2.0	10
Stability pH, at 25°C	7.3						
Langelier Index	0.1	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	7.3	stable		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	1.0	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

Approved Technical Signatory
Ms. Helena Daniel

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TEST REPORT I230561/1

Remark: Overall classification of water, considering only constituents that have been tested for:
Group B: good quality water

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
The highest group assigned to any of the constituents determines the classification of the water as a whole.
Group A: excellent quality water
Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

Approved Technical Signatory
Ms. Helena Daniel

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TEST REPORT I230561/1

Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
0-1.0 mg/l fluoride: no adverse health effects or tooth damage occurs

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
0-6 mg/l nitrate as N: no adverse health effects

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

Approved Technical Signatory
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Summary of test methods - Water Quality

Determinant	Unit	DL	Technique	Method reference
Absorbed oxygen	mg/l O_2	2	titrimetric	SANS 5220:2005
Acidity	mg/l $CaCO_3$	10	titrimetric	AWWA 2310 B
Alkalinity	mg/l $CaCO_3$	10	titrimetric	AWWA 2320 B
Ammonium	mg/l N	0.02	colorimetric	AWWA 4500-NH_3 F / modified Berthelot
Bicarbonate & Carbonate	mg/l $CaCO_3$	1	by calculation	
Biological oxygen demand, 5-day	mg/l O_2	2	electrometric	AWWA 5210 B
Biological oxygen demand, carbonacious	mg/l O_2	2	electrometric	AWWA 5210 B
Bromide & Iodide	mg/l Br^-	0.05	iodometric	P. Höfer
Chloride	mg/l Cl^-	1	argentiometric	AWWA 4500-Cl^- B
Chlorine, free and total	mg/l Cl_2	0.05	colorimetric	AWWA 4500-Cl G
Chlorophyll a	µg/L	0.01	spectrophotometric	ISO 10260:1992 E
Chemical oxygen demand	mg/l O_2	1	colorimetric	AWWA 5220 D
Colour	Pt	10	colorimetric	AWWA Pt-Co-2120 B
Cyanide	mg/l CN	0.02	colorimetric	AWWA 4500-CN E
Density	mg/l g/ml	-	gravimetric	METH W 016
Dissolved oxygen	mg/l O_2	0.1	electrometric	AWWA 4550-O G
Electrical conductivity	mS/m	0.1	electrometric	AWWA 2510 B
Fat, oil & grease	mg/l	2	extraction/gavimetric	AWWA 5520 B
Fixed and volatile solids, ignited at 550°C	mg/l	1	gravimetric	AWWA 2540 E
Fluoride	mg/l F^-	0.1	electrometric	AWWA 4500-F C
Hardness	mg/l $CaCO_3$	1	by calculation	AWWA 2340 B
Hexavalent chromium	mg/l Cr	0.01	colorimetric	AWWA 3500-Cr B
Hydrolysable phosphates	mg/l P	0.01	digestion, PO4	AWWA 4500-P B.2 + E
Kjeldahl nitrogen	mg/l N	0.5	by calculation	
Molybdosilicate	mg/l SiO_2	0.4	colorimetric	AWWA 4500-Si C
Nitrate	mg/l N	0.5	colorimetric	Spectroquant / AWWA 4500-NO_3 E
Nitrite	mg/l N	0.01	colorimetric	AWWA 4500-NO2 B
Oxidation reduction potential (Redox)	mV	-	electrometric	AWWA 2580 B
pH		-	electrometric	AWWA 4500-H^+ B
Phenols	mg/l Phenol	0.05	colorimetric	ASTM D1783-01, B
Reactive phosphorous	mg/l PO_4	0.03	colorimetric	AWWA 4500-P E
Settable solids	mg/l	1	gravimetric	AWWA 2540 F
Sulfide	mg/l S^{2-}	0.05	colorimetric	AWWA 4500-S^{2-} D
Sulfite	mg/l SO_3^{2-}	2	iodometric	AWWA 4500-SO_3^{2-} B
Sulphate	mg/l SO_4	1	nephelometric / colorimetric	AWWA 4500-SO4 E / F
Total dissolved solids	mg/l	1	gravimetric	AWWA 2540 C
Total nitrogen	mg/l N	0.5	digestion, NO3	EN ISO 11905-1:1997
Total phosphorous	mg/l P	0.01	digestion, PO4	AWWA 4500-P B.5 + E
Total solids	mg/l	1	gravimetric	AWWA 2540 B
Total suspended solids	mg/l	1	gravimetric	AWWA 2540 D
Turbidity	NTU	0.05	nephelometric	AWWA 2130 B
UV absorbing organic constituents at 254nm	cm^{-1}	-	colorimetric	AWWA 5910 B

Aluminium	mg/l Al	0.01	ICP-OES	AWWA ICP-3500-Al C
Antimony	mg/l Sb	0.01	ICP-OES	AWWA ICP-3500-Sb C
Arsenic	mg/l As	0.01	ICP-OES	AWWA ICP-3500-As D
Barium	mg/l Ba	0.01	ICP-OES	AWWA ICP-3500-Ba C
Beryllium	mg/l B	0.01	ICP-OES	AWWA ICP-3500-Be
Bismuth	mg/l Bi	0.01	ICP-OES	AWWA ICP-3500-Bi
Boron	mg/l B	0.01	ICP-OES	AWWA ICP-3500-B D
Cadmium	mg/l Cd	0.01	ICP-OES	AWWA ICP-3500-Cd C

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Calcium	mg/l Ca	0.1	ICP-OES	AWWA ICP-3500-Ca C
Chromium (total)	mg/l Cr	0.01	ICP-OES	AWWA ICP-3500-Cr C
Cobalt	mg/l Co	0.01	ICP-OES	AWWA ICP-3500-Co C
Copper	mg/l Cu	0.01	ICP-OES	AWWA ICP-3500-Cu C
Gold	mg/l Au	0.01	ICP-OES	AWWA ICP-3500-Au
Iron	mg/l Fe	0.01	ICP-OES	AWWA ICP-3500-Fe C
Lead	mg/l Pb	0.01	ICP-OES	AWWA ICP-3500-Pb C
Lithium	mg/l Li	0.01	ICP-OES	AWWA ICP-3500-Li C
Magnesium	mg/l Mg	0.1	ICP-OES	AWWA ICP-3500-Mg C
Manganese	mg/l Mn	0.01	ICP-OES	AWWA ICP-3500-Mn C
Mercury	mg/l Hg	0.01	ICP-OES	AWWA ICP-3500-Hg
Molybdenum	mg/l Mo	0.01	ICP-OES	AWWA ICP-3500-Mo C
Nickel	mg/l Ni	0.01	ICP-OES	AWWA ICP-3500-Ni C
Potassium	mg/l K	0.1	ICP-OES	AWWA ICP-3500-K C
Rubidium	mg/l Rb	0.01	ICP-OES	ICP-OES
Selenium	mg/l Se	0.01	ICP-OES	AWWA ICP-3500-Se I
Silica	mg/l Si	0.01	ICP-OES	ICP-OES
Silver	mg/l Ag	0.01	ICP-OES	AWWA ICP-3500-Ag
Sodium	mg/l Na	0.1	ICP-OES	AWWA ICP-3500-Na C
Strontium	mg/l Sr	0.01	ICP-OES	AWWA ICP-3500-Sr C
Thallium	mg/l Th	0.01	ICP-OES	AWWA ICP-3500-Tl C
Tellurium	mg/l Te	0.01	ICP-OES	AWWA ICP-3500-Te
Tin	mg/l Sn	0.01	ICP-OES	AWWA ICP-3500-Sn
Titanium	mg/l Ti	0.01	ICP-OES	AWWA ICP-3500-Ti
Uranium	mg/l U	0.01	ICP-OES	AWWA ICP-3500-U
Vanadium	mg/l V	0.01	ICP-OES	AWWA ICP-3500-V C
Zinc	mg/l Zn	0.01	ICP-OES	AWWA ICP-3500-Zn C

Lower reporting limit
These are estimated values only; accurate lower levels of detection (LLDs) (measurement as part of a method) and method detection levels (MDLs) (measurement for the whole method) still have to be established
Given the varied matrices submitted to the laboratory and divers quality needs method and/or reagent blanks, performance evaluation samples and duplicate results may be included to assist in appropriate use of laboratory data.

All submitted samples are initially run undiluted unless sample dilutions are required in order to reduce or eliminate known matrix / interference effects. When an analyte concentration exceeds the calibration or linear range, the sample is re-analysed after appropriate dilution. The analyst will use the least dilution necessary to bring the analyte within the range. In both cases, a loss of sensitivity is experienced. All sample dilutions result in an increase in the lower reporting limit by a factor equal to the dilution. The less than symbol "<" is used for qualified data below the lower reporting limit.