

**PRELIMINARY EFFLUENT REPORT  
TEMPORARY PLANT**



for  
**Royal HaskoningDHV / Frontier**  
**2 JULY 2013**



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## 1 INTRODUCTION

Veolia Water Solutions & Technologies South Africa (Pty) Ltd (VWS South Africa) has been approached by SSI Engineers & Environmental Consultants (PTY) LTD to provide input to the Volwaterbaai Seawater Desalination Plant for Sedex Minerals.

Sedex Minerals (Pty) Ltd a subsidiary of Frontier Rare Earths Limited is in process of developing the Zandkopsdrift Rare Earth Element mine. The proposed Zandkopsdrift mine site is located on the farm Panvlei in the Northern Cape Province, about 39 kilometres north of Bitterfontein in the Western Cape Province and about 43 kilometres south of Garies in the Northern Cape Province.

Sedex Desalination (Pty) Ltd appointed Royal HaskoningDHV (Pty) Ltd (RHDHV) previously SSI Engineers and Environmental Consultants (Pty) Ltd to provide a feasibility study design at an overall accuracy of  $\pm 15\%$  for capital and operating cost estimates with respect to establishing the Zandkopsdrift seawater desalination scheme of approximately 5.5 Ml/day (2.0 Mm<sup>3</sup>/a) product capacity, sited at Volwaterbaai on the West Coast

During the construction of the desalination plant construction water will be required but with no other sources of fresh water available it is envisaged that a containerised reverse osmosis plant to be utilised for the production of fresh water. This document relates to the effluent produced from the temporary plant.



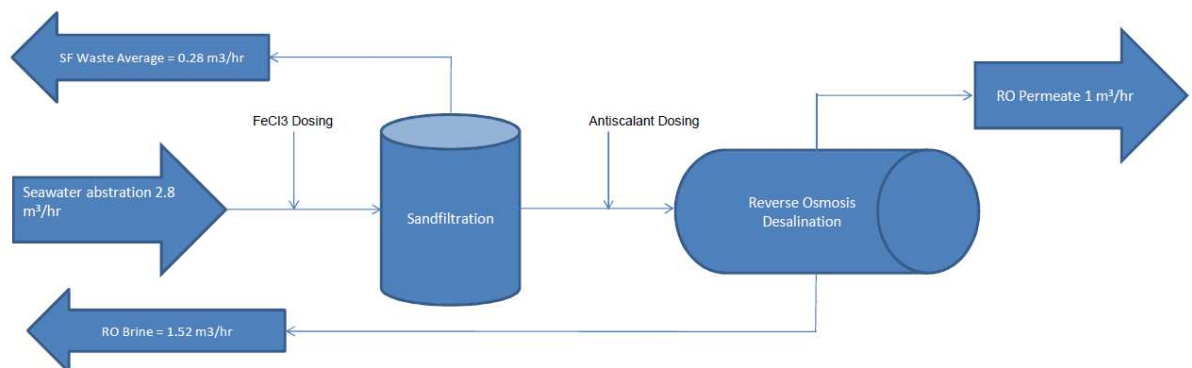
## 2 EFFLEUNT & CHEMICAL DETAILS FOR THE TEMPORARY PLANT

### 2.1 Temporary desalination plant design

Below is a summary of the process steps and key design figures of the temporary reverse osmosis desalination plant.

The process steps comprise the following:

- Seawater abstraction
- FeCl<sub>3</sub> dosing
- Sand filtration
- Antiscalant dosing
- Reverse Osmosis Desalination



### 2.2 Effluent details

The environmental impact assessment is performed by SRK and the potential effluents need to be considered including effluent from the temporary desalination plant. Only one effluent stream would be returned back to the ocean and the following streams will make-up this stream under normal operation.

Waste stream under normal operation:

- RO brine, this will be the bulk of the waste stream. See below an estimated composition. The RO brine will contain membrane antiscalant of maximum 3 mg/l.



Concentrate (mg/l as Ion)	
Stage 1	
NH4	0.00
K	790.83
Na	19077.43
Mg	2141.10
Ca	699.82
Sr	12.50
Ba	0.00
CO3	11.64
HCO3	256.10
NO3	14.58
Cl	33638.45
F	1.66
SO4	5165.79
SiO2	4.33
Boron	7.43
CO2	3.66
TDS	61856.67
pH	7.71

Brine flow = 1.52 m<sup>3</sup>/h continuous  
Antiscalant concentration = 3.0 mg/l

- Sandfilter backwash waste, this will make out a low % of the total waste volume and will consist mainly of suspended solids, organic matter, algae etc. Ferric-chloride will be used in the flocculation process.

Sand filter waste flow = 0.28 m<sup>3</sup>/h continuous  
Ferric Chloride dosage = 5.0 mg/l as Fe in the seawater feed.  
Suspended solids backwash waste = 200 mg/l in backwash waste  
Suspended solids combined effluent = 30 mg/l in combined effluent.

*Note: The 200 mg/l is only in the sand filter waste stream during a filter backwash, the 30 mg/l concentration is blending the DMF waste continuously with the RO brine to be discharged.*

*The suspended solids concentrations above are based on a feed SS concentration of 15 mg/l and it includes the ferric addition.*

- CIP chemicals used for membrane cleaning. Chemicals will be stored on site in tanks and disposed of after construction as low volumes are anticipated.



Potential waste stream under abnormal operation / conditions:

- Feedwater (seawater) spillage due to tank overflow or pipe burst.
- Product water (permeate) spillage due to tank overflow or pipe burst.

### **2.3 Chemical details**

Typically the following chemicals will be used in the plant:

- Ferric Chloride, dosed prior DAF & DMF for flocculation, see attached MSDS.
- Antisclant, dosed prior RO membranes as scale inhibitor, see attached MSDS.

Bulk storage of the above chemicals will be in bunded areas and any spillage will therefore be contained and handled on a case by case basis and will not be directed to the effluent stream returned to sea.