

**FINAL ENVIRONMENTAL MANAGEMENT
PROGRAMME
FOR
UTILITY SERVICES DEVELOPMENT : PROPOSED
SOLAR ENERGY GENERATION PLANT AND WATER
& WASTEWATER TREATMENT PLANTS AND
ASSOCIATED INFRASTRUCTURE ON PORTIONS OF
PORTION 15 OF THE FARM TWEEFONTEIN 360-KT,
STEELPOORT AREA FETAKGOMO TUBATSE LOCAL
MUNICIPALITY SEKHUKUNE DISTRICT**

PERSONAL DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER

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PERSONAL DETAILS OF THE DEVELOPER

Developer:	<i>Kadoma Investments (Pty) Ltd</i>
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FRAMEWORK FOR ENVIRONMENTAL MANAGEMENT

The Environmental Management Programme (EMP) is recognised as the tool that can provide the assurance that the project developer has made suitable provision for mitigation of predicted impacts as specified within the environmental impact assessment report and it provides a link to the implementation of such mitigation measures during the planning, construction, operation and decommissioning of a development project.

DUTY OF CARE

Section 28 of the National Environmental Management Act 1998, requires provision for duty of care and remediation of environmental damage during construction of development projects. The Environmental Management Programme is a tool to accomplish such care and duty.

The Environmental Management Programme provides a framework for environmental project management during the following project phases:

The planning phase of the project

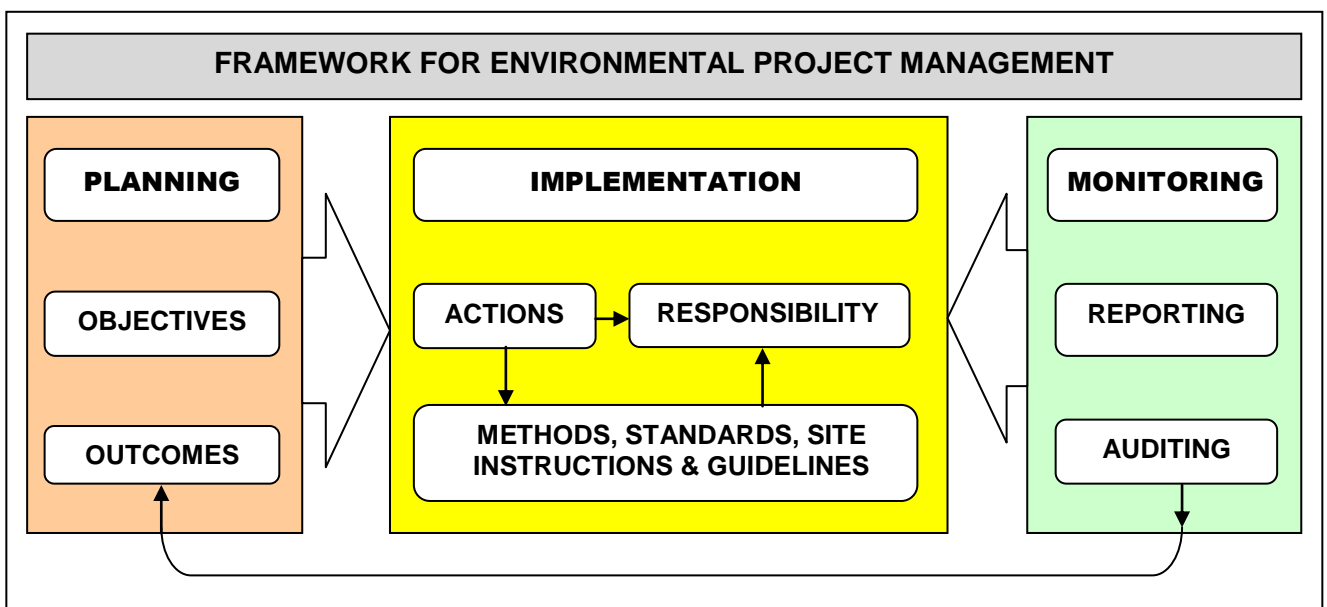
The EMP identifies planning objectives and outcomes which the project developer needs to achieve to reduce or eliminate negative impacts.

The implementation phase of the project

The EMP provides for actions and practical measures of achieving management outcomes during the construction and operational phases of the project and allocates responsibilities to the parties involved with implementing the project. Actions are also supplemented by methods, standards and guidelines. The EMP document remains relevant throughout the project lifecycle and can be updated to be aligned with the progress of the project from construction to operation and with regulatory amendments.

Monitoring of the project during the above phases

The EMP provides for compliance monitoring and reporting on the implementation of mitigation actions during the planning and implementation / construction phases and for post-construction auditing on the achievement of the desired impact mitigation outcomes.



PROJECT DESCRIPTION

2.1 DEVELOPMENT OBJECTIVE

The property was historically used for agricultural purposes (crop production and livestock farming) and as such the property holds an "Agriculture" land use zoning in terms of the Fetakgomo Tubatse Local Municipal Land Use Scheme (2019). Despite the primary land use zoning, agricultural activities ceased due to increasing mining activities in the surrounding area since the mid 1990's and therefore the property laid vacant and unused for the past 25 years.

The objective is to provide a range of utility services to surrounding industrial and mining land uses by developing the following utility infrastructure on a portion, 155.16 ha in size on Portion 15 of the farm Tweefontein 360 KT (the property):

- Solar (Photovoltaic) energy generation plant (SEGP) for local electricity supply and associated infrastructure.
- Wastewater treatment plant (WWTP) for local industrial water supply (re-use of treated wastewater).
- Raw water treatment works (WTW) and water reservoir for storage of treated water for local water supply.
- An in-stream storm water management system including storm water detention dam and erosion protection structures to prevent existing land degradation and potentially additional land degradation due to the proposed development.
- An off-stream storm water management system including collection and conveyance of storm water from the SEGP and roads towards two off-stream water storage dams to be constructed in an existing mine quarry.
- Land reclamation and rehabilitation of an existing mine quarry to make land available for future development.
- Internal roads, water pipelines and electricity distribution infrastructure in support of the main land uses.

2.2 DESCRIPTION OF THE SELECTED PRIMARY LAND USES (UTILITY SERVICES)

Proposed Solar Energy Generation Plant (SEGP)

Portion A (± 79.25 ha) and the Remaining portion (± 40.91 ha) of the subdivided property are proposed for the development and operation of a solar energy generation plant :

- Planned electricity generation capacity: ± 40 MVA (MW).
- Development footprint comprising of four blocks of ± 12.5 ha, 16.2 ha, 28.2 ha and 11.06 ha, totalling 67.96 ha.
- Internal service roads, perimeter fencing and buildings for a control centre, electronic equipment and guards.

Proposed Water Treatment Works (WTW) and Wastewater Treatment Plant (WWTP)

A portion of the Portion C (± 35 ha) of the subdivided property is proposed for the development and operation of a raw water treatment works, water storage reservoir and a wastewater treatment plant and associated infrastructure:

- Planned water treatment works capacity : $900\text{m}^3/\text{day}$.
- Planned water storage reservoir capacity: 1600m^3 .
- Wastewater treatment plant capacity: Initial capacity of $50\text{m}^3/\text{day}$ and planned future expansion of $150\text{m}^3/\text{day}$.
- Combined development footprint of the WWTP and WTW: $\pm 8000\text{m}^2$ and $\pm 2000\text{m}^2$ (totalling $\pm 10000\text{m}^2$).

2.3 DESCRIPTION ASSOCIATED INFRASTRUCTURE IN SUPPORT OF THE LAND USES

EXTERNAL ENGINEERING SERVICES / TECHNOLOGIES

ACCESS TO DISTRICT ROAD D1261

The property obtains access via a right-of-way gravel road from District Road D1261 which is located $\pm 900\text{m}$ west of the property. It is proposed to formalise this road of $\pm 7.5\text{m}$ wide by way of registering a servitude over this road with a road reserve of 15m and also to upgrade the intersection with road D1261 (this road and intersection is located outside the application property and the formalisation and upgrading does not require environmental authorisation).

BULK ELECTRICITY SUPPLY

The SEGP on portions A and Re of the property will require an electricity load estimate of 96kVA and the WTW and WWTP on Portion C will require 28kVA. The total electricity demand of 124kVA can be provided from an existing ESKOM electricity distribution connection at the adjacent Kadoma Industrial Park. The existing electricity network has sufficient capacity to provide in the demand. A 22kV medium voltage bulk supply will be installed from the existing Eskom connection to a switching station on Portion A for further distribution to the intended land uses.

BULK WATER SUPPLY

The project land uses are not dependent on raw water from the Lebalelo Water Supply Scheme, however adjacent mining and industrial land uses do require water from the scheme. The demand for water from the Scheme is thus determined by the end-user (mine or industry) that holds an allocation from the Lebalelo Water Supply Scheme. The aim is to channel the raw water through the proposed WTW on Portion C for supply of treated water to the relevant mine or industry. A new pipeline connection (200mm Ø) is planned from the existing Lebalelo underground raw water pipeline that runs along District Road D1261 ($\pm 900\text{m}$ west of the property) to the proposed WTW on Ptn C.

WASTE REMOVAL SERVICES

The municipality does not provide external waste removal services to the area and such services will be outsourced to approved services providers for disposal at the Licenced Municipal Waste Site at Burgersfort.

INTERNAL ENGINEERING SERVICES/TECHNOLOGIES AND ENGINEERING WORKS

INTERNAL ROADS

Access roads with a reserve of 15m and road widths of 7.5m is planned to provide access to each of the proposed subdivided land portions. Internal service roads, $\pm 7\text{m}$ wide are planned where necessary on each land portion.

STORM WATER SYSTEMS

The proposed storm water system consist of the following components (more detailed description in App G12):

- One in-stream storm water detention dam to buffer peak storm water flows from up-stream and off-site areas. Dam dimensions: Capacity : $\pm 31000\text{m}^3$, Surface area $\pm 12000\text{m}^2$, dam wall length $\pm 70\text{m}$ and dam wall height $\pm 4.5\text{m}$.
- Two off-stream storm water storage dams to be constructed within the existing quarry. One storm water storage dam with a dam wall height of $\pm 4.5\text{m}$, capacity of $\pm 51800\text{m}^3$ and surface area of $\pm 30000\text{m}^2$. One storm water storage dam with a dam wall height of $\pm 4.5\text{m}$, capacity of $\pm 62400\text{m}^3$ and a surface area of $\pm 26000\text{m}^2$.
- Surface run-off will be collected within the solar energy generation plant area by way of surface channels that discharge towards 12 field inlets and into an underground storm water pipe system (600mm Ø). The pipeline of $\pm 1400\text{m}$ in length will discharge in the two of-stream storm water storage dams.
- Both dam basins will be lined with a HDPE geo-membrane liner to prevent sub surface seepage into underlying soil formation resulting in loss of water storage and possible contamination of sub surface groundwater.

INTERNAL WATER SUPPLY / RETICULATION

It is planned to supplement bulk raw water with groundwater from three on-site boreholes with a combined yield of $265\text{ m}^3/\text{d}$ to be treated at the water treatment works (capacity of $900\text{ m}^3/\text{d}$) and to store the treated water in a concrete reservoir of 1600 m^3 . The internal water reticulation / distribution will follow the conventional method of underground piping (160 mm Ø) along the road reserves of internal service roads.

SEWER SYSTEM

Domestic wastewater generated at staff ablution facilities at the central control facilities of the SEGP and of the WWTP will be linked to a conventional water borne sewer system with a conservancy (suction) tank or by way of a gravity pipeline (depending on topography) towards the wastewater treatment plant on the proposed Portion C.

EROSION PREVENTION STRUCTURES AND LAND RECLAMATION

The existing degraded natural watercourse on Portion A and the old quarry on Portion C require significant intervention by way of erosion protection structures in order to prevent their ongoing erosion and degradation. An area of $\pm 6\text{ha}$ in the watercourse and $\pm 12\text{ha}$ of the quarry will require extensive earth works, infilling and soil conservation / erosion prevention structures to ultimately enhance and reclaim the currently degraded land.

IMPACT MANAGEMENT OUTCOMES

This Section of the EMP provides a description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development.

3.1 IMPACT MANAGEMENT OBJECTIVE

The objectives are the overall environmental goals for this project which need to be achieved by way of avoiding, preventing, preserving and minimising adverse environmental impacts associated with the project or specific activities thereof and where applicable rehabilitate and restore aspects associated with this project that may result in environmental damage.

3.2 IMPACT MANAGEMENT OUTCOMES

The environmental impact management outcomes indicated below are performance orientated, where possible quantifiable, verifiable and measurable and applicable to the activities and mitigation measures, that arises from the environmental objectives. Performance measurement during the planning and construction periods of the project can be achieved by way of verifying the implementation of plans, guidelines and standards as well as monitoring, reporting and auditing compliance to the EMPR and EA. Performance measurement during the operational period will need to determine the success and the efficiency of the implemented plans and guidelines by way of operational audits and compliance to regulatory norms and standards.

3.3 IMPACT MANAGEMENT STATEMENT : PLANNING AND DESIGN PHASE	
<i>The development planning shall be finalised to achieve the objectives of sustainable development.</i>	
OUTCOMES	PERFORMANCE MEASURE
3.3.1 <i>The administrative requirements for the documentation of the Heritage Site that is located within the property shall be commissioned before demolishing of the site.</i>	<i>The Applicant shall appoint an independent Environmental Control Officer (ECO) before the commencement of construction or phased construction, who shall verify together with the Project Planner and Project Engineer that the relevant planning objectives and outcomes have been met and where relevant shall report to the Compliance and Enforcement Section of the competent authority on these matters before the commencement of a construction phase.</i>
3.3.2 <i>All above-ground and sub-surface structural and buildings designs shall include the findings and recommendations of the Geotechnical Report with regard to excavations, fills, footings and foundations.</i>	
3.3.3 <i>All the planning for development of services infrastructure design and construction work shall incorporate a site rehabilitation plan to prevent soil erosion and shall form part of a contractual agreement.</i>	
3.3.4 <i>The planning of all the construction phases must ensure that the storm water infrastructure including the proposed storm water attenuation dams and erosion prevention structures are constructed first, together with the site preparation for the SEGP and WWTP.</i>	
3.3.5 <i>The detailed designs of the storm water attenuation dams shall be approved by the relevant authorities.</i>	
3.3.6 <i>The WWTP design must include temporary waste storage facilities.</i>	

3.4	IMPACT MANAGEMENT STATEMENT : PRE-CONSTRUCTION PHASE	
	<i>Comply with regulatory requirements pre-construction.</i>	
	OUTCOMES	PERFORMANCE MEASURE
3.4.1	<i>The applicant shall obtain approval in terms of other laws applicable to the proposed development</i>	<i>Obtain permits for removal and relocation of protected plants (if applicable). Obtain permit/authorisation for demolishing of the Heritage Site.</i>
3.4.2	<i>Permanent and temporary employees and contractors shall be made aware of the relevant provisions of the Environmental Authorisation and EMPR, sensitive environmental features and security arrangements.</i>	<i>Obtain written confirmation of obligations and compliance to the EMPR by contractors with hand-over of the site or at the first project meeting.</i>
3.4.3	<i>The Applicant/Developer shall finalise any administrative requirements as laid down in the Environmental Authorisation. A notice of the intention to commence with construction shall be submitted to relevant organs of state and a complaints register shall be opened for the duration of the construction/establishment period.</i>	<i>All complaints will be acknowledged within five (5) working days and must be addressed within 10 working days of receipt, unless additional information and / or clarification are required.</i>

3.5	IMPACT MANAGEMENT STATEMENT: PRE-CONSTRUCTION PHASE	
	<i>The construction site shall be prepared to prevent environmental impacts before the commencement of construction or any phase thereof.</i>	
	OUTCOMES	PERFORMANCE MEASURE
3.5.1	<i>Protected plants / trees within the development footprint area shall be rescued / removed (where possible) before clearing of vegetation.</i>	<i>A thorough search for resident fauna and protected flora shall be executed and such species be shall relocated to a safe open space areas on- or off-site.</i>
3.5.2	<i>The construction areas and haul roads shall be demarcated and prepared to prevent the potential occurrence of damaging activities before and during the commencement of construction.</i>	<i>The development footprint, sensitive areas, lay-down areas, haul roads construction yard and batching areas shall be marked on the ground. The site plan shall be used to verify the correct demarcation.</i>
3.5.3	<i>The construction staff shall be informed of the environmental consequences of all construction activities and awareness training shall be conducted before commencement of construction.</i>	<i>The Contractors shall conduct awareness training and shall be monitored and report on any incident that may result in environmental degradation, with remedial actions. Written confirmation is required to the ECO.</i>

3.6	IMPACT MANAGEMENT STATEMENT: CONSTRUCTION PHASE	
	<i>A main objective during the construction period or any phase thereof shall be to prevent undue environmental damage during site preparation and construction, to control waste generation and to prevent pollution.</i>	
	OUTCOMES	PERFORMANCE MEASURE
3.6.1	<i>Activities that may result in a nuisance to adjacent land owners shall be limited and managed during the construction period.</i>	<i>Respond to noise and dust complaints received during the construction period and if necessary verify against norms and standards.</i>
3.6.2	<i>Solid waste emanating from construction activities shall be managed to prevent contamination of natural veld and watercourses.</i>	<i>Monitor and report on the occurrence of litter and verify the manner of storage and disposal of solid waste during the construction period.</i>
3.6.3	<i>Liquid waste emanating from construction activities shall be managed to prevent contamination of soil and water resources.</i>	<i>Monitor and report evidence of liquid contamination and verify the manner of storage and disposal of liquid waste during the construction period.</i>

3.7	IMPACT MANAGEMENT STATEMENT: CONSTRUCTION REHABILITATION	
	<i>The main objective after completion of construction of the development project or any phase thereof is to ensure that the required site rehabilitation aims have been achieved as part of the construction period.</i>	
	OUTCOMES	PERFORMANCE MEASURE
3.7.1	<i>Ensure clean-up, waste removal, earth shaping, apply soil conservation methods, construct erosion protection structures and re-vegetate the sites upon completion of construction.</i>	<i>Monitor all areas where construction work occurs and report thereon until completion and before the project becomes operational.</i>
3.7.2	<i>Ensure that site rehabilitation is completed as part of the construction phase according to a site rehabilitation plan.</i>	<i>Commission an Environmental Audit after completion of all construction work and site rehabilitation (per construction phase).</i>

3.8	IMPACT MANAGEMENT STATEMENT: OPERATIONAL PHASE	
	<i>The main objective during the operational phase is to maintain the infrastructure, prevent any form of pollution and maintain and improve the storm water management system and erosion prevention / soil conservation measures.</i>	
	OUTCOMES	PERFORMANCE MEASURE
3.8.1	<i>Maintain open areas free of alien invading plant species and maintain and improve the natural vegetation within the watercourse area, rehabilitated areas and within the buffer zones.</i>	<i>Institute a seasonal program for eradication of declared alien and invader plants on the site Institute a seasonal program to clear fire breaks without impacting on the effectiveness of the vegetated buffers. Institute a seasonal program to replace any damaged lost vegetation within the watercourse, rehabilitated areas and buffer zones.</i>
3.8.2	<i>Maintain and enhance the storm water system as well as all soil conservation measure and erosion protection structures as to ensure their effective functioning.</i>	<i>Compile a maintenance plan for the scheduled cleaning of the storm water systems and outlets as well as the periodic removal of deposited silt, sand and debris from the dam basins and where applicable also from the watercourse.</i>
3.8.3	<i>Maintenance of the water and wastewater treatment plant to ensure good quality wastewater re-use on-site / off-site.</i>	<i>Compile a maintenance plan for the scheduled servicing of the water and wastewater treatment plant and scheduled water quality reporting to DWS.</i>

3.9	IMPACT MANAGEMENT STATEMENT: DECOMMISSIONING PHASE	
	<i>The main objective during the decommissioning of infrastructure for repair, replacement or closure is to prevent pollution and soil and water contamination.</i>	
	OUTCOMES	PERFORMANCE MEASURE
3.9.1	<i>Provide a plan for scheduled maintenance / repair to the wastewater treatment plant and describe the manner in which pollution shall be avoided.</i>	<i>Appoint an ECO to monitor the decommissioning of any infrastructure in order to report thereon to the Competent Authority.</i>
3.9.2	<i>Provide a plan for closure / decommissioning of the SEGP and describe the manner in which pollution shall be avoided.</i>	<i>Appoint an ECO to monitor the decommissioning of any infrastructure in order to report thereon to the Competent Authority.</i>

IMPACT MANAGEMENT ACTIONS : PLANNING PHASE

This Section of the EMP provides a description of proposed impact management actions for the planning phase of the project, identifying the manner in which the impact management outcomes contemplated in Section 3 will be achieved, and include where applicable, actions to —

- (i) avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; and
- (ii) comply with any prescribed environmental management standards, methods and guidelines.
- (iii) comply with any applicable provisions of the Act regarding closure, where applicable; and
- (iv) comply with any provisions of the Act regarding financial provision for rehabilitation, where applicable.

RESPONSIBILITY ASSIGNMENT	PM = Project Manager	PE =Project Engineer	AR =Architect
	ECO = Environmental Control Officer	HS - Heritage Specialist	CO =Contractor

4.1	IMPACT MANAGEMENT STATEMENT
	<i>The development planning shall be finalised to achieve the objectives of sustainable development.</i>

4.1.1	IMPACT MANAGEMENT OUTCOME	RESPONSIBLE PERSON
	IMPACT MANAGEMENT ACTIONS	
	<i>The administrative requirements for the heritage site shall be finalised.</i>	
a.	<i>Maintain a 15m buffer area around the HIA site with the final design of the SEGP. If the site requires destruction to make way for development then a permit must be obtained from SAHRA. In case of the above, commission detailed mapping & drawing of the heritage site and limited archaeological excavations in order to recover information and cultural material from the site to assist with interpreting and dating the site.</i>	PM / HS
b.	<i>During the construction period, any visible sign of heritage resources must be reported immediately. All work in such area must stop immediately and a heritage specialist must investigate the find and make recommendations before proceeding with construction work in the affected area.</i>	PM / HS

4.1.2	IMPACT MANAGEMENT OUTCOME	RESPONSIBLE PERSON
	IMPACT MANAGEMENT ACTIONS	
	<i>All above-ground and sub-surface structural and buildings designs shall include the findings and recommendations of the Geotechnical Report with regard to excavations, fills, footings and foundations.</i>	
a.	<i>The actual predicted allowable bearing capacities to prevent compression and settlement of foundations of all the material horizons can be mitigated by following the indicated founding depths and foundation recommendations as recommended in the Geotechnical report.</i>	AR/ PE
b.	<i>The eastern area (Zone 1A) will need elevation modifications to reduce grades to less than 30° depending on the type of foundation and panels used. Construction material may be sourced from mine discard available in the surrounding area.</i>	AR/ PE
c	<i>All areas will need some improvement and remedial measures if high loads are envisaged and to improve subgrades for the service roads.</i>	AR/ PE
d	<i>The design engineers and other competent persons calculate the best economical foundation option for the proposed development including the roads, service buildings, power distribution structures and PV panel installation.</i>	AR/ PE
e	<i>The SEGP platforms shall be planned in accordance with such method and laid out in such a manner that run-off water is managed and directed to the formal storm water management system with the aim of preventing soil erosion. In this regard soil conservation terraces must be aligned along the natural terrain contours (at right angle to the slope). This layout will assist to retain run-off for longer periods that will promote soil-water absorption and prevent high velocity run-off over the site that may otherwise result in sheet erosion.</i>	AR/ PE

f	<i>Grassed waterways or swales must be planned along the edges of the SEGP to safely convey runoff collected from in-field areas to the formal storm water management system.</i>	AR/ PE
4.1.3	IMPACT MANAGEMENT OUTCOME <i>All the planning for development of services infrastructure construction work shall incorporate a site establishment plan and site rehabilitation plan. The site rehabilitation planning and construction shall form part of a contractual agreement.</i>	RESPONSIBLE PERSON
	IMPACT MANAGEMENT ACTIONS	
a.	<i>All contractors shall provide a site establishment plan that indicates storage space, ablutions, and separate type of waste storage sites as a minimum.</i>	AR/CO/PE
b.	<i>Distinction must be made in the planning stage between construction actions and the rehabilitation actions. Both aspects must be planned and budgeted for by way of presenting site rehabilitation plans and landscaping plans to the developer and the ECO for consideration.</i>	AR/CO/PE
c.	<i>The final planning of the SEGP and associated infrastructure shall include a 15m wide development restriction buffer measured from the eroded outer edge of the watercourse.</i>	AR/CO/PE
d.	<i>Plan that site preparation work within or over watercourse only commence when it can immediately be followed by the construction and subsequent site rehabilitation.</i>	
4.1.4	IMPACT MANAGEMENT OUTCOME <i>Final engineering planning of storm water attenuation structures and the detailed designs of the storm water attenuation dams shall be approved by the relevant authorities according to the WRC Report (TT558/13).</i>	RESPONSIBLE PERSON
	PLANNING AND DESIGN ACTIONS	
a.	<i>Any earth works within the watercourse for the construction of a storm water detention dam and the construction of erosion protection structures must be executed according to a plan and a design as compiled by a suitably qualified person in combination with an EAP to achieve the objective of minimum environmental impact and maximum effectiveness in order to rehabilitate the currently degraded watercourse so that it will be able to receive storm water from the proposed development and prevent further damage on-site and down-stream.</i>	PE
b.	<i>The earth works within the eroded mine quarry for the construction of two water storage dams must be executed according to a plan and a design as compiled by a suitably qualified person in combination with an EAP to achieve the objective storm water control.</i>	PE
c.	<i>The earth works and back-filling of the existing mine quarry must be executed according to a plan and a design as compiled by a suitably qualified person in combination with an EAP to achieve the objective of land restoration for future development use.</i>	PE
d.	<i>Finalise a storm water management plan that provides for on-site storm water attenuation to reduce the peak discharge and prevent damage. A storm water management system that consist of a combination of surface run-off diversion channels, surface run-off detention as well as sub-surface drainage and flow buffering at storm water outlets and at storm water detention dams must be incorporated into the planning and design of the development area.</i>	PE
e.	<i>The planning of all the construction phases must ensure that the storm water infrastructure including the proposed dams is constructed first, together with the commencement of development of any other project component. This measure is of utmost importance to prevent adverse impacts of erosion and sediment deposition, flooding of downstream properties, and contamination of downstream sensitive watercourses.</i>	PE
f.	<i>The design of the detention dams and instream storm water management and erosion prevention structures must be finalised for authorization purposes. Adequate flood spillway and erosion prevention structures must be incorporated in the dam design.</i>	PE
g.	<i>Plan that site preparation work within or over watercourses only commence when it can immediately be followed by the construction and rehabilitation.</i>	PE

h.	<i>Plan that all sites within watercourses where earth moving and excavation will take place for construction must be limited to clearly demarcated and marked areas. No earthmoving or excavation may take place outside of demarcated areas.</i>	PE
i.	<i>Plan that the flow of the watercourse must not be impeded during construction but may be temporarily diverted and channelled.</i>	PE
j.	<i>Plan that the dam walls of the storm water dams must be layered and compacted, taking into account the soil properties as indicated in the Geo-technical report.</i>	PE
k.	<i>Steeply sloped excavated cuts and fills must either be battered back to a 1:3 slope (vertical : horizontal) or must be stabilised by using suitable retaining material such as rock, logs, geo-membranes, gabion retaining walls or similar and vegetating with suitable endemic grass and shrub species to ensure long term resilience.</i>	PE
l.	<i>The outlet structures into the buffer zone and towards the watercourses must be designed that storm water discharge without the risk of erosion. The bed and banks of the watercourse at pipe and culvert inlets and outlets must be protected from erosion by making use of rock pitching, rock gabion, rock mattress or other suitable method and structure.</i>	PE
m.	<i>The storm water management design must include one or a combination of the following: the installation of grassed swales, rock mattresses or stone pitching at the point of discharge to prevent soil erosion</i>	PE
n.	<i>The eroded mine quarry is suitable for rehabilitation by way of back-filling with inert building waste and inert waste rock from surrounding mining activities. Plan for the rehabilitation of the quarry according to an engineering design and standard in order to be able to utilise the filled areas for future development purposes.</i>	PE
o.	<i>Construction work within the watercourse must be planned and executed during the dry winter months. If necessary the flow of the watercourse must not be impeded during construction but may be temporarily diverted and channelled.</i>	PE

IMPACT MANAGEMENT OUTCOMES		RESPONSIBLE PERSON
4.1.5	<i>The building design of the WWTP must be according to relevant standards and must include integrated waste separation and storage facilities.</i>	
IMPACT MANAGEMENT ACTIONS		
a.	<i>The overall design of the WWTP shall comply with relevant regulations, norms, standards, policies and plans. The wastewater treatment plant must be able to treat wastewater effectively to the required standard as indicated in the Special Wastewater Limit Values (DWA 2013). The system must also be adaptable to any future changes of these values (to be updated and published by DWA from time to time).</i>	AR / PE
b.	<i>Plan for the safe storage and separation of waste by integrating waste management facilities within the architectural design of buildings and facilities, including general waste and hazardous waste. Plan such facilities to include a safe enclosure and safe drainage towards integrated sumps and oil separators that are connected to the sewer system.</i>	AR / PE
c.	<i>The planning and design of the underground tanks and pipework must employ the latest technologies that includes impermeable membranes, and physical, visual and electronic monitoring to prevent any leaks and spills of wastewater on surface and underground to avoid the risk of contamination.</i>	AR / PE
d.	<i>Although the WWTP technology includes the reactivating of sludge and no sludge removal, the design must allow for the safe removal of sludge by way of suction to a mobile tanker for safe disposal off-site.</i>	AR / PE
e.	<i>Adequate storm water management structures must be designed around and on the WWTP site to ensure that run-off is directed away from the site.</i>	AR / PE
f.	<i>Emergency power supply for pumps at the WWTP must be made by the provision of alternative energy provision in case of an emergency or loss of ESKOM electricity supply.</i>	AR / PE

IMPACT MANAGEMENT ACTIONS : PRE-CONSTRUCTION PHASE

This Section of the EMPr provides a description of proposed impact management actions for the pre- phase of the project, identifying the manner in which the impact management outcomes contemplated in Section 3 will be achieved, and include where applicable, actions to —

- (i) avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;
- (ii) comply with any prescribed environmental management standards or practices.

RESPONSIBILITY ASSIGNMENT	DE = Developer	CO = Contractors	PM = Project Manager
	ECO = Environmental Control Officer		EC = Ecologist

5.1	IMPACT MANAGEMENT STATEMENT: <i>THE DEVELOPMENT SHALL COMPLY WITH REGULATORY AND ADMINISTRATIVE REQUIREMENTS.</i>
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5.1.1	IMPACT MANAGEMENT OUTCOME : <i>Obtain permits and commence with administrative requirements as stipulated in the conditions of authorisation before commencement of construction.</i>	RESPONSIBLE PERSON
	IMPACT MANAGEMENT ACTIONS	
a.	<i>Obtain a permit for removal and relocation of protected plants.</i>	PM / ECO / EC
b.	<i>Obtain authorisation from the Municipal Fire Protection Services of the relevant Fire Protection Agency before making use of fire to clear vegetation or to burn removed vegetation matter.</i>	DE / PM / CO
c.	<i>Provide a notice of the intention to commence with construction to relevant organs of state.</i>	DE / PM / ECO
d.	<i>Submit the approved development plans and storm water plan to the Environmental Compliance Monitoring Case Officer for record purposes.</i>	DE / PM / ECO
e.	<i>Obtain written confirmation of obligations and compliance to the EMPr by contractors with hand-over of the site or at the first project meeting.</i>	DE / PM / ECO
f.	<i>Open and maintain a complaints register for the duration of the construction/ period.</i>	ECO
g.	<i>For security purposes all construction staff must be registered with the contractors / project manager.</i>	DE / PM / CO

5.1.2	IMPACT MANAGEMENT OUTCOME : <i>Permanent and temporary employees and contractors shall be made aware of the relevant provisions of the Environmental Authorisation and EMPr to prevent environmental degradation.</i>	RESPONSIBLE PERSON
	IMPACT MANAGEMENT ACTIONS	
a.	<i>All personnel and contracting personnel must be informed of environmental issues and specifically with regard to littering, the use of toilets, the use of hazardous materials, the prevention of pollution, the prohibition of clearing and defacing of natural vegetation and the prohibition of poaching or snaring of wildlife.</i>	DE / PM / CO / ECO
b.	<i>All construction staff must be made aware of the boundaries of the development site and must understand that trespassing on to adjacent properties is illegal and any incident in this regard can result in criminal charge and dismissal.</i>	DE / PM / CO
c.	<i>All drivers of the proposed development project must be informed to confine vehicle movement is to identified and marked routes.</i>	DE / PM / CO
d.	<i>All personnel and contracting personnel must be sensitised to the requirements of the South African Heritage Resources Act. Should any material of cultural or archaeological significance be encountered during construction, all activities must cease immediately and the South African Heritage Resources Agency (SAHRA) must be informed accordingly.</i>	DE / PM / CO

e.	<i>All personnel and contracting personnel shall be made aware of the prohibition of the unauthorised use of fire on site. Adequate fire-fighting equipment must be on site during construction and construction staff must be instructed how to use the equipment effectively.</i>	DE / PM / CO
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5.2	IMPACT MANAGEMENT STATEMENT: <i>THE CONSTRUCTION SITE SHALL BE PREPARED TO PREVENT UNDUE ENVIRONMENTAL DAMAGE BEFORE COMMENCEMENT OF CONSTRUCTION.</i>	
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5.2.1	IMPACT MANAGEMENT OUTCOME : <i>Wildlife, protected plants and other natural resources within the development footprint area shall be removed before bulk clearing of vegetation and earth works.</i>	RESPONSIBLE PERSON
	IMPACT MANAGEMENT ACTIONS	
a.	<i>Delineate and clearly mark the development footprints before construction commences and prevent any removal of vegetation on areas where development will not occur.</i>	CO
b.	<i>After completion of pegging out the development footprint, perform a survey of the site in advance of clearing activities to mark protected plant species and obtain a permit in advance for the removal or re-location of such species. Where possible important plant species that occur within the development footprint must be relocated to the future “open space” areas before construction commences. Obtain the necessary permits for the relocation or destruction of protected plants. It will be necessary that an appointed Landscaper take care of the actual removal and relocation of rescued plants before the commencement of construction.</i>	CO / ECO / EC
c.	<i>All trees with a stem diameter of more than 100mm shall be marked for cutting into logs before mass clearing of vegetation commence. Such trees must be cut into suitably sized logs (±3m in length) and must be stacked at the construction yard for later use in site rehabilitation and erosion control actions.</i>	ECO / EC / CO
d.	<i>Vegetation or other litter emanating from the vegetation clearing may not be disposed of within the drainage lines or other natural areas in or around the development site.</i>	CO
e.	<i>The necessary procedures, preparations and preventative measures in terms of the relevant regulations must be made if fire is to be used on the site during the site clearing activity.</i>	CO
f.	<i>Collection of firewood or any other plant resources on the site areas other than those to be cleared for purposes of development is prohibited.</i>	CO

5.2.2	IMPACT MANAGEMENT OUTCOME : <i>The construction areas / activities shall be demarcated to avoid undue damage to the environment.</i>	RESPONSIBLE PERSON
	IMPACT MANAGEMENT ACTIONS	
a.	<i>The site must be cleared and prepared only when the Developer is ready to commence immediately, as prolonged periods of inactivity after clearing of vegetation can result in uncontrolled run-off, sheet erosion, loss of topsoil and spread of alien invasive species.</i>	DE / PM / CO
b.	<i>The contractors’ yard, material lay-down areas, site for temporary topsoil and spoil storage, heaps for logs and vegetation waste storage, solid waste storage, inert waste storage and concrete batching areas shall be marked on the ground. These areas may not be located within 50m the edge of a natural watercourse.</i>	PM / CO / ECO
c.	<i>Identify existing tracks and dirt roads to be used as access and haul roads and where necessary identify and mark new access and haul roads in areas where the impact on natural vegetation shall be minimised.</i>	PM / CO / ECO
d.	<i>Routes for temporary access and haul roads to construction sites must be identified and vehicle movement must be confined to these roads. Haul roads must be monitored and regularly upgraded where necessary. Only two (2) dedicated haul roads may be developed within and across the watercourse, one haul road to be located within the footprint area of</i>	CO

	<i>the proposed storm water detention dam and the other along the already disturbed eastern property boundary where it crosses over the watercourse. The latter haul road will require the temporary installation of a pipe to allow unimpeded water flow if a run-off event occurs due to rain during the construction period. Haul roads must be removed and rehabilitated after completion of bulk earth works.</i>	
e.	<i>A specific area shall be demarcated for cooking purposes by fire within the Contractor's yard.</i>	CO
f.	<i>All demarcation lines must be maintained for all construction work that occur within sensitive sites and no staff or vehicle conduct any unauthorised activity outside of the demarcated work site boundaries.</i>	CO
g.	<i>Linear routes for pipelines and roads that need to be cleared of natural vegetation as well as the degree of clearing required must be determined and must be demarcated and marked and the clearing activity must remain within the demarcated footprint.</i>	CO
h.	<i>Only clear, the areas that will immediately be developed, where installation of services can occur immediately as to prevent uncontrollable soil erosion over large areas.</i>	CO
i.	<i>Any alien and invasive vegetation that occur on the development property must be removed making use of mechanical methods in combination of minimal and selective chemical application to specific alien species.</i>	CO
j.	<i>All sites where earthmoving, blasting, and excavation will take place must be clearly demarcated and marked. No earthmoving or excavation may take place outside of demarcated areas.</i>	CO
k.	<i>Clearly indicate which activities are to take place in which areas within the site e.g. the mixing of cement, stockpiling of materials etc.</i>	CO
g.	<i>Adequate fire-fighting equipment must be on site during construction and construction staff must be instructed how to use the equipment effectively. No open fires for heating or cooking will be permitted on site outside of a demarcated construction camp. The use of fire as part of vegetation clearing must be fully controlled and must be authorised by the local Fire Prevention Agency.</i>	CO
h.	<i>Delineate the natural vegetation within the watercourse and a 15m development restriction buffer area around the watercourse must be maintained.</i>	CO

IMPACT MANAGEMENT ACTIONS : CONSTRUCTION PHASE

This Section of the EMP provides a description of proposed impact management actions for the construction or project implementation phase, identifying the manner in which the impact management outcomes contemplated in Section 3 will be achieved, and include where applicable, actions to —

- (i) avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; and
- (ii) comply with any prescribed environmental management standards or practices.

RESPONSIBILITY ASSIGNMENT	DE = Developer	CO = Contractors	PM = Project Manager
	ECO = Environmental Control Officer		

6.1	IMPACT MANAGEMENT STATEMENT:	
	<i>REDUCE AND CONFINE CONSTRUCTION IMPACTS</i>	

6.1.1	IMPACT MANAGEMENT OUTCOME	RESPONSIBLE PERSON
	IMPACT MANAGEMENT ACTIONS	
	<i>Vegetation clearing, earth moving activities and construction activities must be confined to within demarcated areas.</i>	
a.	<i>The natural vegetation within the watercourse and a 15m buffer area around the watercourse must be maintained as well as other natural areas outside of the development footprint.</i>	CO
b.	<i>Where possible maintain the natural grass cover within the project area to assist with prevention of soil erosion but subject to consideration of fire hazards, specifically within a proposed 15m development restriction buffer to be applied along the edges of the watercourse.</i>	CO
c.	<i>Apply selective stripping of topsoil only in those areas within the actual development footprint. Strip topsoil together with grass / groundcover from all demarcated areas and stockpile the topsoil separately at the predefined stockpile area for later site rehabilitation use. Preserve topsoil during the construction period for later re-use in rehabilitation and landscaping on all areas that becomes disturbed during the construction period.</i>	CO
d.	<i>Gather cleared vegetation matter in small heaps for removal or for “permitted” burning within the demarcated development footprint or otherwise dispose of at an approved landfill.</i>	CO
e.	<i>Excavated material from service trenches must be stockpiled along the length of the trench for immediate backfilling directly after service infrastructure has been installed. Ensure in situ compactions of backfill according to the geo-technical recommendations.</i>	CO
f.	<i>Excess spoil material must be stockpiled at the predefined stockpile area for later reuse.</i>	CO
g.	<i>All sites within the watercourse where earth moving and excavation will take place for dam construction and erosion prevention structures must be limited to clearly demarcated and marked areas. No earthmoving or excavation may take place outside of demarcated areas.</i>	CO
h.	<i>Allocate trained staff to remove invasive species during the construction period.</i>	CO

6.1.2	IMPACT MANAGEMENT OUTCOME	RESPONSIBLE PERSON
	IMPACT MANAGEMENT ACTIONS	
	<i>Activities that may result in a nuisance to adjacent land owners shall be limited and managed during the construction period.</i>	
a.	<i>Continuous use of haul roads and earth works on site will result in excessive dust. All construction areas and roads in use on any particular day must be wetted as required to suppress dust.</i>	PM / CO
b.	<i>Construction work that may result in a noise nuisance must be confined to work day agreed between the developer and direct neighbours.</i>	PM / CO

6.1.3	IMPACT MANAGEMENT OUTCOME	RESPONSIBLE PERSON
	<i>Site hazards on the construction site shall be clearly marked.</i>	
	IMPACT MANAGEMENT ACTIONS	
a.	<i>All potentially hazardous work areas during the construction phase must be demarcated and staff must be made aware of the potential dangers to such site/activity. Specifically deep trench excavations must be visibly marked until such excavations have been backfilled.</i>	PM / CO
b.	<i>Allow for escape routes in trench excavations so that animals that may become trapped in a trench can exit easily.</i>	PM / CO
c.	<i>Hazardous materials such as chemicals for alien vegetation control and fuels for earth moving vehicles and equipment that are required for development, must be stored in a secure facility and shall be handled in a manner to prevent site contamination and ignition according to the relevant Standard and Regulations.</i>	PM / CO
d.	<i>Handling of hazardous liquids such as oil and fuels may cause pollution through spillage and requires that a drip tray be used at a specific area of the contractor's yard.</i>	PM / CO
6.1.4	IMPACT MANAGEMENT OUTCOME	RESPONSIBLE PERSON
	<i>Natural run-off during rain events shall be managed during the construction period to prevent sheet and gully erosion and resultant contamination of water resources due to silting.</i>	
	IMPACT MANAGEMENT ACTIONS	
a.	<i>Grass cover and topsoil should remain within the development area up to the stage where construction on that area is eminent. This will retain some measure of soil cohesion that will minimise the potential loss of topsoil due to sheet erosion. In order to achieve this apply light shaving and shallow soil shaping of topsoil within the development site. Only clear those areas of grass cover and topsoil that will immediately be developed such as roads and trenches for service infrastructure.</i>	PM / CO
b.	<i>Suitable soil conservation works shall be implemented on all areas of the development site that is subject to sheet or gully erosion. Such work shall aim to restrict the concentration, volume and speed of run-off by employing relevant methods as indicated in the relevant guidelines.</i>	PM / CO
6.2	IMPACT MANAGEMENT STATEMENT: AVOID AND CONFINE POLLUTION DUE TO CONSTRUCTION ACTIVITIES	
6.2.1	IMPACT MANAGEMENT OUTCOME	RESPONSIBLE PERSON
	<i>Solid waste emanating from construction activities shall be managed during the construction period to prevent contamination of natural veld and watercourses.</i>	
	IMPACT MANAGEMENT ACTIONS	
a.	<i>During both the construction and operational period of the development the overall impact of general and hazardous waste generation can be mitigated effectively by the implementation of waste hierarchy management principles as recommended in the Municipal Waste Management Strategy as follows:</i> <ul style="list-style-type: none"> ▪ <i>Plan for the separation, containment, re-use or correct disposal of construction waste.</i> ▪ <i>Re-use where possible inert solid waste during the construction period.</i> ▪ <i>Remove unusable construction waste with reputable service providers for re-cycling, or for disposal to approved municipal waste disposal facilities.</i> 	PM / CO
b.	<i>All refuse, solid waste and non-inert building waste generated at all work sites, shall be removed from the work sites and shall be deposited in containment vessels at the relevant site or at the construction camp by the end of each work day.</i>	PM / CO
c.	<i>Above-mentioned solid waste shall be temporarily stored at the construction camp before for regular removal and disposal to the Municipal Landfill site by the Contractor or by approved service providers.</i>	PM / CO

d.	<i>The Contractor or approved service provider shall upon request by the Project Manager or ECO, provide proof / evidence that solid waste that was removed from site, was disposed at the Municipal Landfill site or Municipal Waste Transfer Site.</i>	PM / CO / ECO
e.	<i>It is known that contractors and service providers locally dispose of building waste at unauthorised areas, along roadsides, in the natural veld and in watercourses. No waste shall be disposed of on site or surrounding areas, by burning, or by burying. Any littering and unauthorised waste disposal shall be brought to the attention of the local and provincial authorities who can impose official warnings and fines to the Developer.</i>	PM / CO
f.	<i>Inert building waste (a mix of half bricks, concrete aggregate, concrete spills and slurry and spoil material) must be contained separately from glass, plastic, timber and other construction waste as inert building waste may be re-used on site for filling and stabilising under road and parking areas as well as under-floor filling.</i>	PM / CO
g.	<i>Excess inert waste can be delivered / collected for the same use as indicated above at another approved building site. The Contractor shall provide the details of such site to the Project Manager for record purposes.</i>	PM / CO
h.	<i>Inert (non-toxic) mine rock/residue that was discarded as waste from surrounding mines may be used to back-fill the old mine quarry. Such waste may be used for this purpose subject to contractual agreement and certification with the supplier that the waste rock and soil is inert waste and uncontaminated (non-toxic and non-leaching).</i>	PM / CO

6.2.2	IMPACT MANAGEMENT OUTCOME	RESPONSIBLE PERSON
	IMPACT MANAGEMENT ACTIONS	
	Liquid and waste emanating from construction activities shall be managed during the construction period to prevent contamination of soil and water resources.	
a.	<i>A demarcated concrete batching area shall be determined at each development site which area shall be bunded by a soil berm to contain concrete mixing at a single area on site. Such site shall not be closer than 30m from the edge of the watercourse.</i>	PM / CO
b.	<i>During the installation of roads, concrete mixing may be done within the road surface areas which will be paved over after completion. Similarly, during building construction, concrete mixing other than in the batching yard may be done within the building footprint area.</i>	PM / CO
c.	<i>A dedicated shallow sump must be located at the batching yard where excess concrete slurry and washings of concrete mixing machinery and equipment can be done. The sump must be lined with plastic to catch cement solids and clear effluent can drain into the sub-soil. The plastic lining that holds the cement solids can be cleaned weekly by depositing the cement solids onto the inert waste heap on site.</i>	PM / CO
d.	<i>No liquid waste shall be disposed of on site or surrounding areas or by burning or by burying.</i>	PM / CO
e.	<i>All visible remains of excess concrete and building waste must be deposited onto an inert waste heap that may be used later for filling purposes.</i>	PM / CO
f.	<i>Adequate ablution facilities shall be provided at each construction site as well as at the construction camp, conveniently located near to work areas to avoid localised water pollution from camp sewerage. Any service provider that shall remove and dispose of sewer waste shall be pre-approved and registered with the Project Manager with the required approval to dispose of effluent waste at an authorised private or municipal sewer treatment plant.</i>	PM / CO
g.	<i>Re-fuelling of construction vehicles on site shall be done by way of a dedicated fuel truck/trailer with the required pumping and piping mechanisms that will ensure effective, safe and leak free transfer of fuel.</i>	PM / CO
h.	<i>Any stationary fuel tank on site shall be located at least 100m from the edge of the watercourse. Upon installation of a static fuel tank on site, such installation shall be bunded by a brick / sandbag wall and shall have an impermeable floor of appropriate synthetic</i>	PM / CO

	<i>material up to the height of the top edge of the bund wall. The required pumping and piping mechanisms shall ensure the safe and leak free transfer of fuel.</i>	
i.	<i>All emergency servicing of construction vehicles on site shall include the necessary drip trays underneath the serviced vehicle in order to retain dripping oil and soiled/replaced parts. Oil and fuel shall be drained into containers and shall be discharged at an approved oil recycling depot or to be removed by approved service providers.</i>	PM / CO
j.	<i>Any soiled area contaminated by a liquid spill that may result in pollution of soil and water resources must be excavated to the depth of contaminant penetration. Such contaminated material must be stored in drums for treatment with an appropriate chemical applicable for this purpose before replacing such back on-site.</i>	PM / CO
k.	<i>The Contractor or approved service provider shall upon request by the Project Manager or ECO, provide proof / evidence that liquid waste that was removed from site and was disposed at an approved oil recycling depot, or Municipal Landfill Site or Municipal Waste Transfer Site or Municipal Sewerage Treatment Plant (where appropriate).</i>	PM / CO / ECO

IMPACT MANAGEMENT ACTIONS : REHABILITATION PHASE

This Section of the EMP provides a description of proposed impact management actions for the construction completion phase of the project, identifying the manner in which the impact management outcomes contemplated in Section 3 will be achieved.

RESPONSIBILITY ASSIGNMENT	PE =Project Engineer	CO = Contractors	PM = Project Manager
	ECO = Environmental Control Officer		

7.1.1	IMPACT MANAGEMENT OUTCOME	RESPONSIBLE PERSON
	IMPACT MANAGEMENT ACTIONS	
a.	<p><i>Upon completion of any part of the project, ensure that all temporary structures, materials, waste and facilities used for construction activities are removed from the site. It is unacceptable to leave foreign material behind with the knowledge that it will become hidden amongst the rejuvenating vegetation with time.</i></p>	PM / CO
b.	<p><i>All cut and fill surfaces need to be stabilized with appropriate material or measures when major civil works are complete by making use of the methods indicated by the relevant guidelines. Slopes must be designed to prevent soil erosion, and must be re-vegetated to create aesthetically acceptable landscapes. Near vertical slopes (1:1 or 1:2) must be stabilised using hard structures following specifications as indicated in the relevant guidelines. Site with a 1:3 – 1:6 slope must be logged or stepped – secured logs must be placed in continuous lines following the contours and spaced appropriately depending on the steepness of the slope as indicated in more detail in the relevant guidelines.</i></p>	PM / CO
c.	<p><i>Soils that become compacted through the activities of the development must be loosened to an appropriate depth to allow seed germination.</i></p>	PM / CO
d.	<p><i>Where shaping of the land resulted in bare areas denuded of natural grass cover, such areas must be re-vegetated (seeding) with natural grass directly after completion of surface shaping and topsoil replacement by employing methods as indicated in the relevant guidelines.</i></p>	PM / CO
e.	<p><i>After completion of shaping of the land erosion protection structures must be constructed such as grassed waterways, stone pitching, miter drains and use of logs and re-vegetation for all areas subject to erosion.</i></p>	PM / CO
f.	<p><i>With regard to rehabilitation after completion of development it is important that re-introduction of indigenous vegetation within and around the edges of the development site conforms to the species composition that currently occur within the area. The re-establishment of vegetation biodiversity must be complimented by only considering endemic plants for site rehabilitation. No alien, invasive or exotic ornamental species may be considered for site rehabilitation or landscaping purposes.</i></p>	PM / CO
g.	<p><i>It is therefore important to maintain a 15m buffer zone around the eroded edges of the watercourse and to supplement vegetation in these zones with endemic vegetation. The buffer zone, therefore, becomes an important part of the impact mitigation planning to address erosion control and water purification.</i></p>	PM / CO
h.	<p><i>Protected tree species that was removed as a result of the development must be replaced at a ratio of 1 : 3 at suitable places along road reserves and on open spaces.</i></p>	PM / CO

IMPACT MANAGEMENT ACTIONS : OPERATIONAL PHASE

This Section of the EMPr provides a description of proposed impact management actions during the operational phase in order to maintain specified mitigation measures throughout the life cycle of the proposed development.

RESPONSIBILITY ASSIGNMENT	MC = Management Company	CO = Contractors	
	ECO = Environmental Control Officer		

8.1.1	IMPACT MANAGEMENT OUTCOME	RESPONSIBLE PERSON
	<i>Ensure maintenance of the storm water management system.</i>	
	IMPACT MANAGEMENT ACTIONS	
a.	<i>A maintenance programme must be introduced to maintain and upgrade all storm water structures and erosion control structures seasonally within the SEGP, WWTP, WTW dams and watercourse area.</i>	MC / CO
b.	<i>Maintain storm water structures by regular removal of debris and silt. Pipes, cut-off drains or culverts will need to be cleaned regularly of any debris to prevent water impoundment and possible water channeling which may lead to erosion.</i>	MC / CO
c.	<i>The dam wall structures must be kept void of tree growth. Tree growth allows large roots to penetrate the dam wall which in future can lead to tunneling of water and collapse of the wall.</i>	MC / CO
d.	<i>A low-level outlet pipe will allow water entering the dam to be discharged at a reduced flow volume. This discharge pipe must be kept clean and open at all times.</i>	MC / CO
e.	<i>The emergency overflow spillway structure must be kept open and unobstructed at all times.</i>	MC / CO
f.	<i>The dam must be cleaned during the winter times. All sediment deposited during the rainy season must be removed and spoiled at a safe designated location.</i>	MC / CO
g.	<i>Erosion protection structures including gabion, rock mattresses, rock pitching and log structures must regularly be inspected and any damage and must be repaired seasonally.</i>	MC / CO
h.	<i>Any scouring of soils along stream channels must be prevented and repaired on a regular basis.</i>	MC / CO
i.	<i>Check soil conservation structures seasonally for their optimal functioning and maintain and improve such structures throughout the life of the project. Repairs to the storm water management structures must be initiated as soon as possible after damage to any of the structures has been detected.</i>	MC / CO
j.	<i>It is important to maintain stabilised banks of the watercourse. As soon as erosion has been detected along the banks of the watercourse in the area between the introduced storm water management structures, action must be taken to stabilise that section of the bank of the watercourse to prevent further erosion.</i>	MC / CO
k.	<i>During the operational period the dam basins and dam walls of the in-stream storm water detention dam and off-stream water storage dams must be maintained by way of routine removal of deposited debris, sand, silt and rock to ensure its ongoing function to buffer storm water peaks and to trap sediment. The design of the dams must allow access for future maintenance and removal of silt and debris within the dam basins.</i>	MC / CO

8.1.2	IMPACT MANAGEMENT OUTCOME	RESPONSIBLE PERSON
	<i>Ensure maintenance of the open spaces to promote indigenous biodiversity.</i>	
	IMPACT MANAGEMENT ACTIONS	
a.	<i>A maintenance programme must be implemented at least for the first 12 months after construction to ensure that all vegetation that was introduced to re-vegetate disturbed areas takes root and becomes well established.</i>	MC / CO

b.	<i>An ongoing alien control programme must be introduced to prevent the colonisation of alien and invasive plants on previously disturbed areas and within the watercourse bed and banks.</i>	MC / CO
c.	<i>A long term maintenance program must be instituted to ensure a good condition of the vegetated buffers around the storm water dams and to prevent bush encroachment by unwanted species.</i>	MC / CO
d.	<i>No exotic plants, amphibian or fish species may be released in the watercourse and dams. Planting on-site should be complimented with locally occurring or compatible indigenous plants and no alien, invasive or exotic ornamental species should be considered for gardens or any landscaping.</i>	MC / CO
e.	<i>Maintain a 15m buffer zone around the eroded edges of the watercourse and supplement vegetation in these zones with endemic vegetation. This is important as vegetation is considered extremely efficient in reducing the velocity of water flow entering a stream system and in trapping and utilisation of sediment, nutrients and attached pollutants contained in both surface runoff and sub-surface flow. The buffer zone, therefore, becomes an important part of the impact mitigation planning to address erosion control and water purification.</i>	MC / CO
f.	<i>Maintain and upgrade all erosion protection and storm water structures within the watercourse and quarry areas. As gabion (or other) retaining wall structures trap sediment these will fill over time. The narrow shape of the watercourse will be naturally broadened and flattened to change the flow of water over a wider area that will create favourable conditions for the establishment of vegetation and will assist in reducing flow velocity within the watercourses. This progressive enhancement of the watercourse must be maintained during the operational period by way of periodic upgrading of storm water management structures within the watercourse to ultimately achieve a fully rehabilitated natural waterway.</i>	MC / CO

8.1.2	IMPACT MANAGEMENT OUTCOME <i>The wastewater treatment plant must be maintained.</i>	RESPONSIBLE PERSON
	IMPACT MANAGEMENT ACTIONS	
a.	<i>An ongoing maintenance programme must be introduced to maintain the wastewater treatment plant and water treatment works to function effectively and thus preventing environmental contamination.</i>	MC / CO
b.	<i>The operator should be fully conversant with the recommended operating procedures as stipulated in the operation and maintenance manual of the WWTP and WTW. The wastewater treatment plant staff must be trained to monitor wastewater treatment plant levels on a scheduled monitoring and reporting basis. Monitoring of the WWTP and WTW for efficient operation must be a daily routine and sampling and effluent quality analysis must be done according to the DWS licensing conditions.</i>	MC / CO
c.	<i>The Operator shall ensure that the WWTP and WTW comply throughout the operational life with all applicable national norms and standards, all existing and new legislation and regulations and the applicable Wastewater Limit Values as published from time to time</i>	MC / CO
d.	<i>Any indication of inefficient wastewater treatment must be identified and must be corrected immediately by the operator.</i>	MC / CO
e.	<i>A program for the safe and authorised removal and disposal of brine and wastewater sludge must be included in the operation and maintenance plan. All tanks must be emptied of sludge and effluent to be disposed of at a registered site.</i>	MC / CO
f.	<i>All reasonable emergency measures must be taken to provide for the mechanical, electrical, operational, or process failures and malfunctions of the WWTP and WTW.</i>	MC / CO
g.	<i>Establish a downstream monitoring borehole and rehabilitate borehole GT-03019 (by installing a uPVC liner) Water quality monitoring is the systematic collection of samples and observations on a regular basis to identify changes in a water body. Additional site specific monitoring boreholes might be required.</i>	MC / CO

h.	<i>Commissioning of a monitoring program (this includes routine quarterly and annual monitoring) of groundwater qualities – on site and surrounding privately owned boreholes</i>	MC / CO
i.	<i>The Operator shall ensure that the WWTP and treated wastewater comply throughout the operational life with all applicable national norms and standards, all existing and new legislation, regulations, and the applicable Wastewater Limit Values as published from time to time.</i>	MC / CO
j.	<i>Maintain good housekeeping practises, adequately trained personnel in emergency wastewater spill response procedures and storage/handling of materials as per industry specification.</i>	MC / CO
k.	<i>Wastewater spills on soil would require the determination of the lateral and vertical extent of the contamination and then based on the risk that the contamination pose to the receiving environment, remedial actions will be implemented.</i>	MC / CO
l.	<i>Any significant spillages that occur on soil must be dealt with in terms of NEMA Section 30 and contaminated soil must be remediated according to the National Norms and Standards for the Remediation of Contaminated Land and Soil (NEMWA 2014).</i>	MC / CO

8.1.2	IMPACT MANAGEMENT OUTCOME	RESPONSIBLE PERSON
	IMPACT MANAGEMENT ACTIONS	
	<i>Maintain groundwater levels and groundwater quality during operation.</i>	
a.	<i>Maintain and do not exceed sustainable safe yield and dynamic water level determinations for proposed abstraction boreholes.</i>	MC / CO
b.	<i>Water level monitoring is essential to ensure that the boreholes are and continues to be a sustainable source Commission a monitoring program (this includes routine monthly monitoring) of abstraction rates/volumes and groundwater levels on site and periodically on surrounding privately owned boreholes.</i>	MC / CO
c.	<i>It will be mandatory to monitor the water level and record the data on a monthly basis to ensure boreholes GT-03014, GT-013016 and GT-03017 recover to their initial static waters level and critical water levels as indicated in the geo-hydrological report (see Appendix G9).</i>	MC / CO
d.	<i>Production boreholes should be subjected to a full aquifer testing program every 4-5 years to ensure continued sustainability.</i>	MC / CO
e.	<i>Establish a downstream monitoring borehole and rehabilitate borehole GT-03019 (by installing a uPVC liner) for groundwater monitoring purposes. Water quality monitoring is the systematic collection of samples and observations on a regular basis to identify changes in a water body. Additional site specific monitoring boreholes might be required.</i>	MC / CO
f.	<i>Commission a monitoring program of groundwater quality on site and surrounding privately owned boreholes.</i>	MC / CO

IMPACT MANAGEMENT ACTIONS : DECOMMISSIONING PHASE

This Section of the EMPr provides a description of proposed impact management actions during the operational phase in order to maintain specified mitigation measures throughout the life cycle of the proposed development.

RESPONSIBILITY ASSIGNMENT	MC = Management Company	CO = Contractors	PA = Project engineer
	ECO = Environmental Control Officer		

9.1.1	IMPACT MANAGEMENT OUTCOME	RESPONSIBLE PERSON
	Closure of wastewater treatment plant for repairs and replacement.	
	IMPACT MANAGEMENT ACTIONS	
a	All gravitational pipes and pump lines that connect to the components to be removed or replaced must be sealed to prevent accidental sewerage spills.	MC / CO
b	All pipes, pumps and tanks must be flushed to ensure that when the system is disassembled there is a lower risk of potential sewage spillage from any elements.	MC / CO
c	All tanks must be emptied by a suitable sump/pump and the effluent shall be transferred to a suitable tanker truck for removal to the Municipal Sewer Treatment Plant for treatment and disposal.	MC / CO
d	During decommissioning, a thorough inspection is required for any foundational cracks and defects on tanks and underground pipes.	MC / CO
e	If any spillages occur on soil such spillage must be dealt with in terms of NEMA Section 30 and contaminated soil must be remediated according to the National Norms and Standards for the Remediation of Contaminated Land and Soil (NEMWA 2014).	MC / CO
f	All open pipes or tanks must be closed off during decommissioning or replacement to prevent odours.	MC / CO
g	No fire or sparks may be present at the initial opening or closing of pipes and tanks, as the methane gas that may emanate from the tanks can be explosive.	MC / CO

9.1.2	IMPACT MANAGEMENT OUTCOME	RESPONSIBLE PERSON
	Closure of the solar energy generation plant for repairs and replacement.	
	IMPACT MANAGEMENT ACTIONS	
a.	The SEGP will be de-energized from the utility power grid. The infrastructure connecting the facility to the utility power grid will be removed unless the landowner determines that the electrical service line will be beneficial for future use of the site, in which case the line may remain after decommissioning.	MC / CO
b.	All wirings, cables, conduits, panel boards, inverters, transformers and associated equipment will be uninstalled and recycled as applicable.	MC / CO
c.	PV modules will be uninstalled and recycled as applicable. The steel racking system will be disassembled and recycled as applicable. Steel pilings which supported the module racking will be mechanically removed and recycled as applicable.	MC / CO
d.	The demolition debris and removed equipment may be cut or dismantled into smaller pieces that can be safely lifted or carried by the deconstruction equipment being used. Most of the glass and steel and aluminium will be processed for transportation and delivery to an off-site recycling plant. Minimal non-recyclable materials are anticipated and; these will be properly disposed of at a licenced disposal facility.	MC / CO

e.	<i>Any resulting holes from the removal of the steel piles will be backfilled with locally imported soil to match existing site soil conditions.</i>	MC / CO
f.	<i>The concrete transformer and interconnection equipment pads will be broken up and removed.</i>	MC / CO
g.	<i>The on-site access roads servicing the Project and the security fencing around the Project will remain in place during decommissioning activities to support the removal of equipment. Once removal activities are completed, discussion with the landowners will occur to determine if the roads or security fencing will be beneficial for future use of site. If the access roads or security fencing is determined to be beneficial for future use of site, these facilities may remain in place.</i>	MC / CO
h.	<i>Access roads that will not be utilized to support future use of the site will be restored to preconstruction conditions.</i>	MC / CO
i.	<i>If the security fencing is not to be used, it will be removed and transported to the nearest recycling facility.</i>	MC / CO
j.	<i>Once all Project equipment has been removed, additional activities will occur to return the property back to conditions similar to pre-construction. Reclamation will restore vegetative cover and hydrological function after the closure of the facility.</i>	MC / CO
k.	<i>Storm water dams and erosion protection measures will remain.</i>	MC / CO
l.	<i>Once landform features and soils are restored, a seed mix will be applied to match the existing onsite groundcover.</i>	MC / CO

MONITORING AND REPORTING

This Section complies with Appendix 6, Sections (g) to (m) with regard to monitoring and reporting on compliance to the environmental authorisation and environmental management programme.

10.1 The method of monitoring the implementation of the impact management actions.

- *The method and requirements for environmental monitoring and reporting is contained in the conditions of Environmental Authorisation.*
- *Environmental monitoring and reporting in terms of NEMA during the pre-construction and construction phase will be done by an Environmental Control Officer (ECO) as required in terms of the EIA Regulations and as appointed by the Developer and agreed by the competent Authority.*
- *Monitoring shall also be done by way of a complaints register. All verbal and written complaints received during the construction period shall be entered into the register and shall be investigated for corrective action and shall be reported to the Environmental Authority.*
- *The Provincial Environmental Compliance and Enforcement Inspectorate, constituted under NEMA shall monitor the environment during the operational phase.*
- *Where actions indicated in this programme are regulated by laws, regulations, norms and standards, the compliance monitoring and enforcement of such actions shall be the responsibility of the relevant Government Department that administers the relevant laws, regulations, norms and standards.*

10.2 The frequency of monitoring the implementation of the impact management actions.

- *An unscheduled monitoring programme shall be followed during the planning and pre-construction phases.*
- *During the construction phase, monitoring of the implementation of impact management actions shall be done monthly.*

10.3 The persons who will be responsible for the implementation of the impact management actions.

Pre-construction compliance

- *The Developer must ensure that specified planning outcomes are considered and actions performed during the planning of the development layout and civil services plans*

Construction and rehabilitation phase

- *The Developer and appointed Project Manager shall ensure that all Contractors and Sub-contractors as well as own staff are familiar with, understand and adhere to the EMPr for the duration of all construction operations.*
- *The Contractor/s referred to in this document includes the Sub-contractors involved with earth moving, infrastructure construction and maintenance actions listed in this EMPr.*
- *The contractor must provide a list of any amount of hazardous substances that will be used in the construction. The contractor must provide a description of the storage, handling and control of such substance.*
- *In addition, during construction the Contractors and Sub-contractors must ensure that all personnel under their employment are fully aware of any environmental issues relating to the construction and maintenance activities that are being undertaken on site and of the related environmental precautions that need to be taken.*

Operational phase

- *The obligations for implementing the Environmental Authorisation and approved EMPr must be transferred by way of Application in terms of the EIA regulations, from the Developer to the Management Company of the proposed development.*
- *The Environmental Authority may from time to time perform random inspections to determine compliance and may act on any complaint received.*

10.4 The time periods within which the construction must be implemented.

A 10-year period is allowed from date of Environmental Authorisation for completion of the development during which construction impact management actions can be phased until full implementation has been achieved.

10.5 The time periods within which the operational management must be implemented.

The implementation of the operational maintenance requirements is permanent and remains applicable in perpetuity.

10.6 The mechanism for monitoring compliance.

- *The appointed ECO shall conduct compliance monitoring as stipulated by the Environmental Authorisation.*
- *Throughout the construction period a systematic and structured approach will be followed to record whether the environmental objectives of the Environmental Authorisation and EMPr are being met.*
- *The following minimum monitoring actions will be implemented:*
 - *A checklist will be used, based on the objectives and outcomes as indicated in the EMPr.*
 - *Monitoring inspections will be performed every second week and photos will be taken when necessary to illustrate certain identified aspects that require rectification.*
 - *Monitoring reports will be distributed to the project manager and contractors after each monitoring inspection. All identified aspects of potential non-compliance will be reported for scheduled rectification.*
 - *Project meetings will be held once a month during which environmental aspects will be discussed.*
- *During the operational period, the Environmental Authority may from time to time perform random inspections to determine compliance and may act on any complaint received.*

10.7 A program for reporting on compliance.

- *A compliance report shall be submitted to the Provincial Environmental Compliance and Enforcement Directorate according to an agreed schedule.*
- *A compliance audit shall be performed after completion of the construction phase according to the requirements of the Provincial Environmental Compliance and Enforcement Directorate.*

10.8 Environmental awareness

Information to employees of any environmental risk which may result from their work.

The Developer / Project Manager and Contractors shall ensure that an environmental awareness program is initiated before construction and maintenance commence as follows:

- *All Contractors and employees must be informed formally of any environmental risk which may result from their work specifically with regard to heritages resources, vegetation clearing, liquid and solid wastes, material handling and fire prevention including site hazards such as open trenches and overhead powerlines.*
- *The awareness program must include the risks and how it must be dealt with in order to avoid injury, pollution or the degradation of the environment.*
- *The method of reporting an incident as well as immediate remedial action must also be communicated to all employees.*
- *A copy of the EMPR must be provided to all Contractors and Sub-contractors and a copy must be available at the Site Office for reference purposes.*

Information to employees on how risks must be dealt with in order to avoid pollution or the degradation of the environment.

The process for managing any environmental incident, damage or pollution during the construction period :

- *The Contractor/ Employee must immediately report the incident to the Developer.*
- *Identify the cause and extent of the problem and immediately stop the cause of any further environmental damage.*
- *Determine if the incident is reportable in terms of the definition of a NEMA Section 30 incident. If "yes" follow the steps as outlined below:*
 - *Initial reporting of the incident to the Relevant Authorities by way of an alarm report.*
 - *Containing and minimising the effects of the incident to the environment, health, safety and property of persons.*
 - *Undertaking clean-up procedures.*
 - *Await a Directive from the Relevant Authorities that will indicate any further action in terms of Section 30 of NEMA or other relevant laws.*
- *If the incident is not reportable in terms of NEMA Section 30, proceed as outlined below:*
 - *Determine a plan of action to provide a remedy to the problem.*
 - *Implement the remedial action as a matter of urgency, monitor the remedial action and maintain the remedial action where applicable.*
 - *Rehabilitate the affected area if required.*

GUIDELINES / METHODS / NORMS / STANDARDS

The following practical guidelines, methods, norms and standards as published by relevant Government Departments and Government Institutions have been found credible and suitable for implementation, where applicable wholly or partially, as supplement to environmental management actions.

	PUBLISHER	YEAR	TITLE	RELEVANCE TO THE PROJECT
a.	<i>Department of Environmental Affairs</i>	2008	<i>Best Practice Guideline: Alien vegetation management.</i>	<i>Control methods, herbicide use, bark application, ring barking, bark stripping, frilling. Using labour intensive methods: hand pulling, chopping/cutting/slashing. Using mechanical methods: felling, bark stripping. Using chemical control: injection, foliar spray, use and disposal of plant material.</i>
b.	<i>Department of Water & Forestry</i>	2005	<i>Environmental Best Practice Specifications : Planning, Construction of structures within watercourses</i>	<i>Construction mitigation actions, site rehabilitation, shaping, topsoil replacement, ripping and scarifying, planting, grassing, maintenance, erosion control.</i>
c.	<i>Water Research Commission</i>	2013	<i>The South African Guideline for sustainable drainage systems</i>	<i>Planning and design of sustainable storm water management systems.</i>
d.	<i>University of KwaZulu-Natal</i>	2005	<i>Caring for Natural Rangelands.</i>	<i>Soil erosion control: planning, design, implementation & monitoring</i>

The above lists of guidelines / methods / standards are not definitive or exhaustive and current publications may be replaced by newer publications and additional publications may be added in future as supplement to environmental management actions.