Waste Assessment Specialist Study for the proposed Concentrated Solar Power Plant (Parabolic Trough) on the farm Sand Draai 391, Northern Cape

Final Waste Impact Report

19 February 2016

DOCUMENT DESCRIPTION

Client:
Solafrica Energy (Pty) Ltd

Project Name:
Waste Impact Assessment Report for the proposed Concentration Solar Power Plant (Parabolic Trough) on the Farm Sand Draai 391, Northern Cape

Royal HaskoningDHV Reference Number:
T01.JNB.000565

Authority Reference Number:

14/12/16/3/3/3/205 – Parabolic Trough

Compiled by:
Siva Chetty and Seun Oyebode

Date:
February 2016

Location:
Durban

Reviewer:

_____
Signature

Approval:

_____
Signature

TABLE OF CONTENTS

TABLE OF CONTENTS III

DEFINITIONS V

ACRONYMS IX

1 INTRODUCTION AND BACKGROUND 1

2 SCOPE OF WORK 3

3 LEGISLATION, STANDARDS, GUIDELINES AND CRITERIA 3

3.1 NATIONAL LEGISLATION 3

3.1.1 CONSTITUTION OF SOUTH AFRICA (ACT NO.108 OF 1996) 3

3.1.2 NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT NO. 107 OF 1998) (AS AMENDED)

3.1.3 NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT (ACT NO. 59 OF 2008) (AS AMENDED)

3.1.4 NATIONAL WATER ACT (ACT NO. 36 OF 1998) 8

3.1.5 OCCUPATIONAL HEALTH AND SAFETY ACT (ACT NO. 85 OF 1993) 9

3.2 OTHER POLICIES, REGULATIONS AND STANDARDS 9

3.2.1 WHITE PAPER ON INTEGRATED POLLUTION AND WASTE MANAGEMENT (2000) 9

3.2.2 DRAFT NATIONAL WASTE MANAGEMENT STRATEGIES AND ACTION PLANS (NWMS) (NOVEMBER 2011)

3.2.3 DEPARTMENT OF WATER AFFAIRS: MINIMUM REQUIREMENTS 12

3.2.4 SANS 10228 13

3.2.5 NEM:WA : GOVERNMENT NOTICE 636 GAZETTE NO. 36784 OF 2013 14

3.2.6 NEM:WA : GOVERNMENT NOTICE 635 GAZETTE NO. 36784 OF 2013 15

3.2.7 NEM: WA, 2008 (ACT NO. 59 OF 2008) - NATIONAL NORMS AND STANDARDS FOR THE ASSESSMENT OF WASTE FOR LAND DISPOSAL 15

3.2.8 NATIONAL NORMS AND STANDARDS FOR THE STORAGE OF WASTE: GOVERNMENT NOTICE 926 GAZETTE NO. 37088 OF 2013 17

4 ACTIVITY DESCRIPTION AND WASTE STREAM IDENTIFICATION 18

4.1 CONSTRUCTION RELATED ACTIVITY 18

4.2 OPERATIONAL ACTIVITY 19

4.2.1 PARABOLIC TROUGH 19

4.2.2 ANCILLARY FACILITIES 21

4.2.3 WASTE STREAMS AND REJECTIONS 21

5 WASTE ASSESSMENT 29

5.1 THE CSP WASTE MANAGEMENT PROCESS/PRINCIPLES 29

5.2 WASTE GENERATION FROM THE CSP DEVELOPMENT 29

6 WASTE IMPACT ASSESSMENT 34

7 ENVIRONMENTAL MANAGEMENT PROGRAMME 47

8 ASSUMPTIONS AND LIMITATIONS 47

9 CONCLUSION AND RECOMMENDATION 47

List of Tables

TABLE 1: SANS 10228 14
TABLE 2: EXCERPT FROM GOVERNMENT NOTICE 635 GAZETTE NO. 36784 OF 2013 15
TABLE 3: EXCERPT FROM NEM: WA, 2008 (ACT NO. 59 OF 2008) 16
TABLE 4: EXCERPT FROM REGULATION 634 OF 2013, SECTION 10 17
TABLE 5: PLANT SPECIFICATIONS 27
TABLE 6: WASTE STREAMS AND BY-PRODUCTS PRODUCED BY THE CSP SYSTEM DURING CONSTRUCTION AND OPERATIONS 30
TABLE 7: IMPACT ASSESSMENT 35

List of Figures

FIGURE 1: LOCALITY MAP SHOWING THE FARM SAND DRAAI, CONSIDERED FOR THE CONSTRUCTION OF THE CSP PLANT USING PARABOLIC TROUGH TECHNOLOGY 2
FIGURE 2: WASTE HIERARCHY, NWMS 2010 (DEA, 2011A) 10
FIGURE 3: PROCESS FLOW DIAGRAM FOR CSP (PARABOLIC TROUGH) PLANT 20
FIGURE 4: WASTE MANAGEMENT PROCESS FOR THE CSP (PARABOLIC TROUGH) PLANT 26
FIGURE 5: KEY EMISSIONS FROM THE CSP (PARABOLIC TROUGH) PLANT 29

Definitions

Constitution	Means the Constitution of the Republic of South Africa, 1996.
Container	Means a disposal or re-usable vessel in which waste is placed for the purposes of storing, accumulating, handling, transporting, treating or disposal of that waste, and includes bins, bin-liners and skips.
Decommissioning	In relation to waste treatment, waste transfer or waste disposal facilities, means the planning for and management and remediation of the closure of a facility that is in operation or that no longer operates;
Disposal	Means the burial, deposit, discharge, abandoning, dumping, placing or release of any waste into, or onto any land.
Environment	Means the surroundings within which humans exist and that are made up of- (i) The land, water and atmosphere of the earth; (ii) Micro-organisms, plant and animal life; (iii) Any part or combination of (i) and (ii) and the interrelationship among and between them; and (iv) The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.[1]
Extended producer responsibility measures	Means measures that extend a person's financial or physical responsibility for a product to the post-consumer stage of the product that includes – (a) Waste minimisation programmes (b) Financial arrangements for any fund that has been established to promote the reduction, re-use, recycling and recovery of waste. (c) Awareness programmes to inform the public of the impacts of waste emanating from the product on health and the environment; and (d) Any other measures to reduce the potential impact of the product on health and the environment.
General waste	Means waste that does not pose an immediate hazard or threat

[1] National Environmental Management Act 107 of 1998

	to health or to the environment, and includes- (a) Domestic waste; (b) Building and demolition waste; (c) Business waste; (d) Inert waste; or (e) Any waste classified as non-hazardous waste in terms of the regulations made under section 69, and includes non-hazardous substances, materials or objects within business, domestic, inert, building and demolition wastes as outlined in the Waste Act.
Hazardous waste	Means any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment and includes hazardous substances, materials or objects within business waste, residue deposits and residue stockpiles as outlined in the Waste Act.
Inert waste	Means waste that- (a) Does not undergo any significant physical, chemical or biological transformation after disposal; (b) Does not burn, react physically or chemically biodegrade or otherwise adversely affect any other matter or environment with which it may come into contact; and (c) Does not impact negatively on the environment, because of its pollutant content and because the toxicity of its leachate is insignificant; and which include: - discarded concrete, bricks, tiles and ceramics - discarded glass - discarded soil, stones and dredging spoil
Landfill	The waste body created by landfilling. This may be above or below grade, or both.[2]
Minimisation	When used in relation to waste, means the avoidance of the amount and toxicity of waste that is generated and, in the event where waste is generated, the reduction of the amount and toxicity of waste that is disposed of.
Pollution	Means any change in the environment caused by- (i) Substances;

[2] Department of Water Affairs and Forestry, Second Edition, 1998. Waste Management Series. Minimum Requirements for waste disposal by Landfill

	(ii) Radioactive or other waves; or (iii) Noise, odours, dust or heat, emitted from any activity, including the storage or treatment of waste or substances, construction and the provision of services, whether engaged in by any person or an organ of state, where that change has an adverse effect on human health or well-being or on the composition, resilience and productivity of natural or managed ecosystem, or on materials useful to people, or will have such an effect in the future.[3]
Recovery	Means the controlled extraction or the retrieval of any substance, material or object from waste to produce a product.
Recycle	Means a process where waste is reclaimed for future use, which process involves the separation of waste from a waste stream for further use and the processing of that separated material as a product or raw material.
Residue deposit	Means any residue stockpile remaining at the termination, cancellation or expiry of a prospecting right, mining right, mining permit, exploration right or production right;
Residue stockpile	Means any debris, discard, tailings, slimes, screening, slurry, waste rock, foundry sand, mineral processing plant waste, ash or any other product derived from or incidental to a mining operation and which is stockpiled, stored or accumulated within the mining area for potential re-use, or which is disposed of, by the holder of a mining right, mining permit or, production right or an old order right, including historic mines and dumps created before the implementation of the Waste Act.
Re-use	Means to utilise the whole, a portion of or a specific part of any substance, material, or object from the waste stream for a similar or different purpose without changing the form or properties of such substance, material or object.
Storage	Means the accumulation of waste in a manner that does not constitute treatment or disposal of that waste.
Treatment	Means any method, technique or process that is designed to- (a) Change the physical, biological or chemical character or composition of a waste; or (b) Remove, separate, concentrate or recover a hazardous or toxic component of a waste; or

[3] National Environmental Management Act 107 of 1998

	(c) Destroy or reduce the toxicity of a waste, in order to minimise the impact of the waste on the environment prior to further use or disposal.
Waste	"waste" means - (a) any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to this Act; or (b) any other substance, material or object that is not included in Schedule 3 that may be defined as a waste by the Minister by notice in the Gazette, but any waste or portion of waste, referred to in paragraphs (a) and (b), ceases to be a waste- (i) once an application for its re-use, recycling or recovery has been approved or, after such approval, once it is, or has been re-used, recycled or recovered; (ii) where approval is not required, once a waste is, or has been re-used, recycled or recovered; (iii) where the Minister has, in terms of section 74, exempted any waste or a portion of waste generated by a particular process from the definition of waste; or (iv) where the Minister has, in the prescribed manner, excluded any waste stream or a portion of a waste stream from the definition of waste.

Acronyms

BoP	Balance of Plant
CSP	Concentrating Solar Panel
DEA	Department of Environmental Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EEC	Estimated Environmental Concentration
EIA	Environmental Impact Assessment
EPR	Extended Producer Responsibility
HTF	Heat Transfer Fluid
I&AP	Interested and Affected Parties
IEM	Integrated Environmental Management
IndWMP	Industry Waste Management Plan
IPWM	Integrated Pollution and Waste Management
IWM (P)	Integrated Waste Management (Plan)
LWMA	Listed Waste Management Activities
MSW	Municipal Solid Waste
MW	Megawatt
NEMA	National Environmental Management Act 107 0f 1998
NEMWA	National Environmental Management: Waste Act 59 of 2008
NWMS	National Waste Management Strategy
PSV	Pressure Safety Valve
SANS	South African National Standards
ST	Steam Turbine

1 INTRODUCTION AND BACKGROUND

Increasing focus on climate change, sustainable economic growth and social development within South Africa is placing a growing demand on renewable energy supply.

Whilst South Africa relies heavily on coal to meet its energy needs, the country is well endowed with renewable energy resources that offer sustainable alternatives to fossil fuels. Renewable energy means harnessing all naturally occurring sources of energy, such as solar, wind, biomass, hydro, tidal, wave, ocean current and geothermal, to produce electricity, gaseous and liquid fuels, heat or a combination of these energy types. The successful use of renewable energy technology in South Africa still requires extensive investigation, however, Concentrating Solar Power (CSP) technologies have demonstrated to be economically and environmentally viable and capable of being employed on a large scale.

Solafrica Energy (Pty) Ltd (Solafrica) is currently assessing the feasibility of constructing a CSP plant based on Parabolic Trough technology including the associated infrastructure with a maximum generation capacity of 150 MW on the farm Sand Draai 391 in the Northern Cape Province of South Africa (Figure 1). The proposed plant is required to be sited on a technically and environmentally feasible site and to this end, Solafrica has considered land availability, land use capability, fuel availability and costs, grid connection capacity and strengthening effects, and other related aspects in the consideration of feasible sites. With consideration of the aforementioned aspects, Solafrica has identified a site in the Northern Cape Province as a feasible locality for the establishment of the CSP plant.

The CSP plant using parabolic trough technology will consist of the following components:

- A solar field
- A heat transfer fluid system
- A power block;
- A cooling system;
- A molten salt energy storage system

In addition to the power plant, associated infrastructure including roads, water pipelines, electricity distribution lines, storerooms and temporary waste storage facilities will be required.

A waste assessment needs to be undertaken to define the nature and scale of the potential waste related environmental impacts associated with the project, specifically in terms of the amount and type of wastes generated during construction and options to avoid and manage the wastes. Both construction and operational phase impacts will be considered and assessment of these in terms of waste management mitigation will be identified to determine whether any residual impacts can be reduced. A review of the legal requirements is also included.

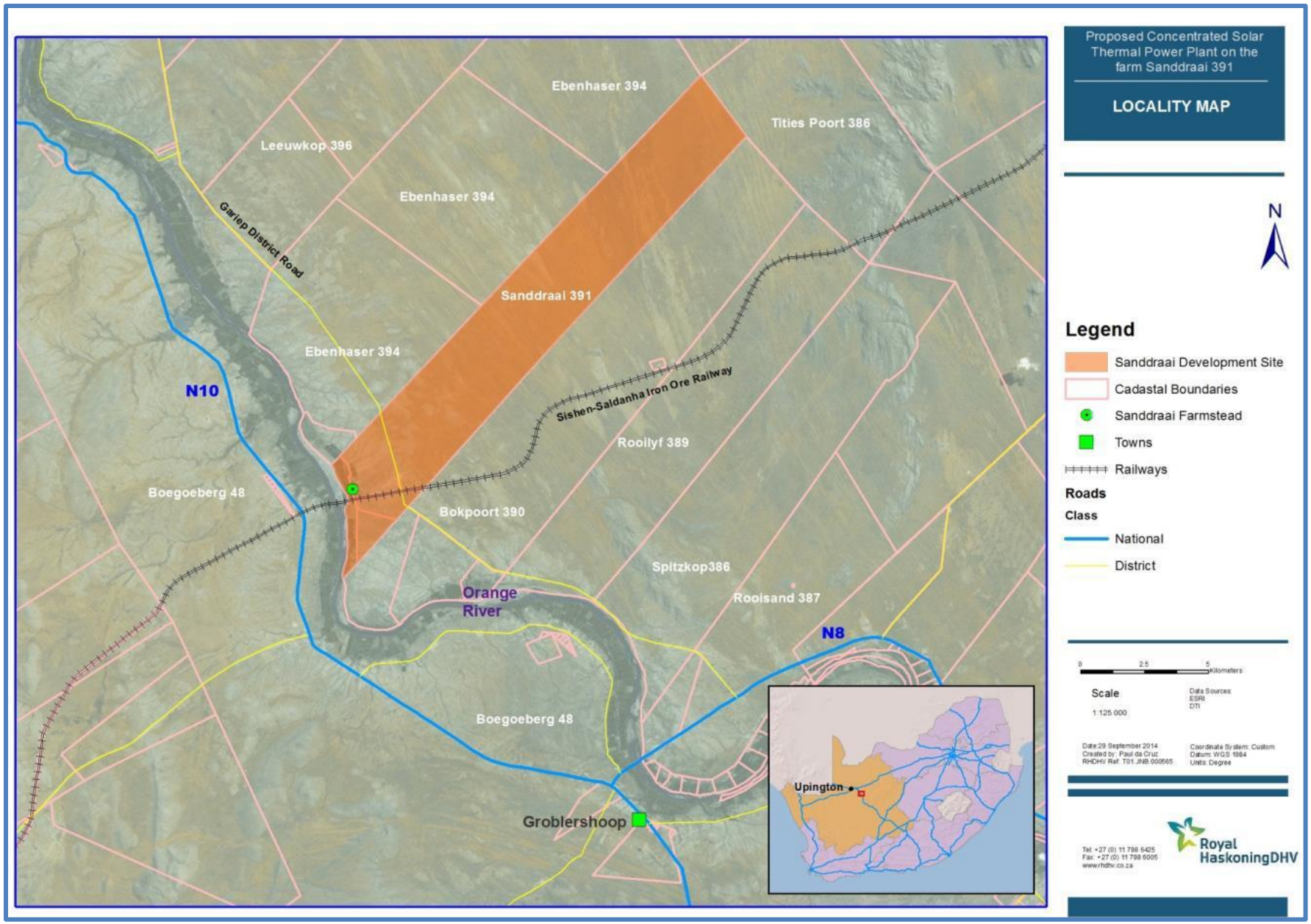

Figure 1: Locality map showing the farm Sand Draai, considered for the construction of the CSP plant using parabolic trough technology

2 SCOPE OF WORK

The waste impact assessment will focus on the key waste generating activities during construction, and operation phases of the proposed development.

Each stream will be assessed in terms of the legislative context nationally.

Through the process of considering the various activities on site during construction and operation, waste streams will be generated. Each of these waste streams has been identified as part of the scoping exercise. These waste streams will now be assessed in terms of the waste management protocol, onsite treatment, re-use, recovery and disposal strategy.

3 LEGISLATION, STANDARDS, GUIDELINES AND CRITERIA

A legal review was conducted to ensure that the latest legislation is included as well as to achieve compliance with the requirements of the DEA. This review gives a brief overview of the sections of the respective legislation pertaining to and the relevance thereof on the proposed Sand Draai Concentrated Solar Power Plant and the permitting thereof, are contained below. The following legislation has been included for review:

- The Constitution of the Republic of South Africa (Act No.108 of 1996);
    - Environmental Rights
    - Local Government Provisions
    - Schedules 4 and 5
- National Environmental Management Act (Act No. 107 of 1998);
- National Environmental Management: Waste Act (as amended) (Act No. 59 of 2008);
- National Environmental Management: Air Quality Act (Act No. 39 of 2004);
- National Water Act (Act No. 36 of 1998); and
- Occupational Health and Safety Act (Act No. 85 of 1993).

3.1 National Legislation

3.1.1 Constitution of South Africa (Act No.108 of 1996)

The constitution is the supreme law of South Africa. Section 24 of the Constitution states that everyone has a right to an environment that is not harmful to their health or well-being, and to have the environment protected for the

benefit of the present and future generations. In terms of Section 32 everyone has the right of access to information held by the state as well as by another person for the exercise and protection of any rights.

Section 33 states that everyone has the right to administrative action that is lawful, reasonable and procedurally fair. This section will have an impact on the way in which local authorities carry out their responsibilities.

In terms of Section 36 the rights granted in the Bill of Rights may be limited only in terms of laws of general application that results in limitations that are reasonable and justifiable in an open and democratic society.

Section 38 of the Constitution states that anyone alleging an infringement of their constitutional rights may approach a competent court who may grant appropriate relief.

3.1.1.1 Environmental Rights

Section 24 of the Constitution's Bill of Rights states that:

Everyone has the right- to an environment that is not harmful to their health or well-being; and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that - prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

3.1.1.2 Local Government Provisions

Local government matters are dealt with in Chapter 7 of the Constitution, and the following provisions must be highlighted:

Section 151 – Status of municipalities

(3) A municipality has the right to govern, on its own initiative, the local government affairs of its community, subject to national and provincial legislation, as provided for in the Constitution.

Section 152 – Objects of local government

(1) The objects of local government are -

(b) to ensure the provision of services to communities in a sustainable manner;

(d) to promote a safe and healthy environment

(2) A municipality must strive, within its financial and administrative capacity, to achieve the objects set out in subsection (1).

Section 156 – Powers and functions of municipalities

(1) A municipality has executive authority in respect of, and has the right to administer -

(a) the local government matters listed in Part B of Schedule 4 and Part B of Schedule 5; and

(b) any other matter assigned to it by national or provincial legislation.

(2) A municipality may make and administer by-laws for the effective administration of the matters which it has the right to administer.

(3) Subject to section 151(4), a by-law that conflicts with national or provincial legislation is invalid.

(5) A municipality has the right to exercise any power concerning a matter reasonably necessary for, or incidental to, the effective performance of its functions.

Section 162 – Publication of municipal by-laws

(3) Municipal by-laws must be accessible to the public.

3.1.1.3 Schedules 4 and 5

Schedules 4 and 5 to the Constitution are highly relevant as they clearly set out the legislative, functional and executive competences of national, provincial and local government respectively. The Schedules are divided into Parts A and B respectively. Part B of both Schedules lists those areas over which local government has some executive authority.

Schedule 4 describes the functional areas of concurrent national and provincial legislative competence. Of importance for present purposes are the following areas, set out under Part A of Schedule 4:

- Agriculture
- Environment
- Pollution control

Schedule 4 Part B contains amongst others this functional area of local government:

- Air pollution
- Municipal planning
- Water and sanitation services limited to potable water supply systems and domestic wastewater and sewage disposal systems.

Schedule 5 lists functional areas of exclusive provincial legislative competence. Schedule 5 Part B contains, inter alia, these functional areas of local government:

- Cleansing
- Control of public nuisances
- Refuse removal, refuse dumps and solid waste disposal

Municipalities have executive authority over and the right to administer those local government matters listed in Part B of Schedules 4 and 5 respectively or which were assigned to them in terms of national or provincial legislation (e.g. certain health and environmental health functions). To this end municipalities may pass and administer by-laws for the effective administration of those matters. This process is governed by section 156.

These functional distinctions are of vital importance as any by-law or function of a municipality will always have to be evaluated against the provisions of Schedules 4 and 5. Should there be a conflict or contravention then such by-law or function may be found to be unconstitutional (Section 156(3)).

Solafrica therefore needs to ensure that they are aware of their responsibilities as well as the Municipalities responsibilities' with respect to waste management.

The impact of the proposed project on the environment and citizens of the Republic must be determined "through reasonable legislative and other measures". In order to give effect to Section 24 numerous environmental laws, of which the National Environmental Management Act is but one, were instituted to protect and manage the environment and to promote sustainable development.

3.1.2 National Environmental Management Act (Act No. 107 of 1998) (as amended)

A detailed description has been provided in the Draft ESR which was compiled by Royal HaskoningDHV. The review below focuses on the waste management aspects.

This Act (hereafter referred to as NEMA) is the framework legislation governing environmental matters and all other related legislation must be read subject to its provisions. Any functions and actions carried out by organs of state must follow the general principles (section 2) and spirit of this law due to the fact that these organs are bound by the Act (section 48).

While NEMA does not deal much with waste management per se as it is detailed in the NEM: Waste Act, it nonetheless sets out some important provisions which will be discussed below.

Sustainable development requires the consideration of, amongst other factors:

that waste is avoided, or where it cannot altogether be avoided, minimised and re-used or recycled where possible and otherwise disposed of in a responsible manner (section 2(4)(a)(iv)).

NEMA also defines "pollution" as

any change in the environment caused by-

(i) substances;

(ii) noise, odours, dust or heat,

emitted from any activity, including the storage or treatment of waste or substances, construction and the provision of services, whether engaged in by any person or an organ of state, where that change has an adverse effect on human health or well-being or on the composition, resilience and productivity of natural or managed ecosystems, or on materials useful to people, or will have such an effect in the future (section 1).

There is a duty on persons to take reasonable measures to prevent pollution or degradation of the environment from occurring, continuing or recurring, or in so far as such harm is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment (section 28(1)). This duty rests on, amongst others, the landowner, the person in control or user thereof (section 28(2)). State organs are also subject to these provisions.

Chapter 5 of the Act also requires the application of integrated environmental management principles and objectives.

3.1.3 National Environmental Management: Waste Act (Act No. 59 of 2008) (as amended)

The Act is the product of the National Waste Management Strategy as well as the White Paper on Integrated Pollution and Waste Management (IPWM). It sets the framework for integrated waste management for the entire country. Future policies and legislation will need to follow its provisions and as such it will become a key law.

The Act gives legal effect to the waste management hierarchy and the MEC has the right to set waste minimization norms and targets. Importantly the Act aims to ensure the minimising of natural resources and hence promotes sustainable practices in the waste management arena. It therefore promotes and enforces improved prevention of pollution and ecological degradation. The Act will achieve integrated waste management reporting and direct the licensing of waste management facilities.

Specific sections in the Act that the Solafrica should be cognisant of include:

Part 1 which deals with the National Waste Management Strategy.

Section 16 refers to the generator of waste's responsibilities. A generator of waste has a general duty to take all reasonable measures to adhere to the waste management hierarchy. The generator of waste must ensure that the management of the waste is carried out to cause the least or no harm to the environment or human beings.

Section 18 refers to the extended producer responsibility (EPR) which may be imposed for certain products or classes of products, alternatively certain classes of persons (i.e. industries). A category or an industry may be required to produce industry waste management plans.

Section 19 refers to listed waste management activities (LWMA). Government Notice no 718 of 3 July 2009 lists the waste management activities that have, or are likely to have a detrimental effect on the environment. Category A activities are those LWMA which require a basic assessment as stipulated in the EIA regulations made under section 24(5) of the NEMA as part of the waste management licence application process. Category B activities are those LWMA which require a full EIA as stipulated in the EIA regulations made under section 24(5) of the NEMA as part of the waste management licence application process (Government of South Africa, 2008b)[4]

Industry Waste Management Plans (IndWMPs) are the main co-regulatory instruments within the waste management system. They describe the waste related issues within an industry, and specify how the industry will address these issues, giving specific actions, targets and timeframes.

Part 7 of the Waste Act, section 28 to section 34, sets out the requirements for IndWMPs, which may be prepared on a mandatory or voluntary basis. The Minister may request an IndWMP for waste generating activities that affect more than one province or which occur in more than one province. The provincial MEC may request an IndWMP for waste generating activities within the province, provided that such a plan has not already been requested by the Minister. Industry may also prepare and submit plans on a voluntary basis.

The current system does not require Solafrica to compile a waste management plan, however best practice should be adopted which is achieved through the implementation of the waste management hierarchy and waste management planning.

3.1.4 National Water Act (Act No. 36 of 1998)

In terms of the Water Act 54 of 1956 water pollution was controlled through the setting of water control standards. This particular practice is still in force in terms of Section 21 of the National Water Act of 1998. The National Water Act 36 of 1998 combines the prevention of pollution approach with the control of pollution. This is done through the regulation of waste standards, the monitoring of waste discharged and prescribing the outcome of effect which must be achieved through management practices for the treatment of waste or any class of waste before it is discharged or deposited into or allowed to enter a water resource (Glazewski, 2005).

[4] National Environmental Management: Waste Act 59 of 2008

3.1.5 Occupational Health and Safety Act (Act No. 85 of 1993)

This Act has relevance for environmental matters as it governs and regulates the health and safety of employees and the public in general. Employers, self-employed persons and employees are under a duty not to endanger or risk the health of others and to maintain a safe (working) environment (see e.g. sections 8, 9 and 15).

In addition, several Regulations promulgated in terms of the Act contain provisions dealing with the handling or disposal of hazardous substances/chemicals or waste in general. Examples are:

- Asbestos Regulations – disposal of asbestos (Regulation 20) (GN R 155 of 10 February 2002)
- Lead Regulations – disposal of lead waste (Regulation 17) (GN R 236 of 28 February 2003)
- Hazardous Chemical Substances Regulations - disposal of hazardous chemical substances (Regulation 15) (GN R 1179 of 25 August 1995
- Environmental Regulations for Workplaces – housekeeping (Regulation 6) (GN R 2281 of 16 October 1987)

The first three Regulations require an employer to control exposure of employees by investigating the use of alternative substances, to the extent that this is possible, and furthermore, to recycle such substances (in the case of lead and hazardous chemical substances).

3.2 Other Policies, Regulations and Standards

3.2.1 White Paper on Integrated Pollution and Waste Management (2000)

One of the fundamental approaches in terms of the White Paper's policy is to prevent pollution, minimise waste and to control and remediate impacts. Waste management is to be implemented in a holistic and integrated manner, extending over the entire waste cycle.

The White Paper advocates a shift from the present focus on waste disposal and impact control (i.e. end of pipe) to integrated waste management, prevention as well as minimisation.

The White Paper defines "waste" (see Glossary to White Paper) as

"an undesirable or superfluous by-product, emission, or residue of any process or activity which has been discarded, accumulated or been stored for the purpose of discharging or processing. It may be gaseous, liquid or solid or any combination thereof and may originate from a residential, commercial or industrial area." This definition includes industrial wastewater, sewage, radioactive substances, mining, metallurgical and power generation waste.

As is apparent from the above, the White Paper (quite correctly so) adopts a much broader and integrated definition of waste in that it does not limit the definition to solid waste only. The focus of this Review is, however, legislation dealing largely with solid waste and its management. This was already pointed out in 3.1.

The following waste management hierarchy is to be adopted in the NEMWA:

- Waste avoidance, minimisation and prevention
- Recycling and reuse
- Treatment and handling
- Storage and final disposal

As can be seen, the avoidance, minimisation and prevention of waste are accorded absolute priority. However NEM:WA now also emphasises the adoption of Reclamation in the waste hierarchy and this needs to be enforced through all government structures.

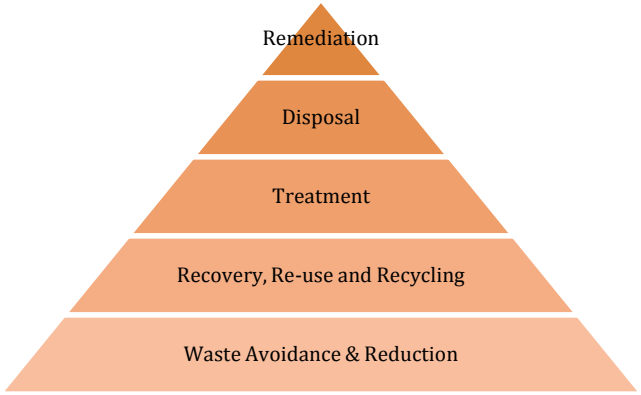

Figure 2: Waste Hierarchy, NWMS 2010 (DEA, 2011a)

A functional approach to integrated pollution and waste management is to be adopted by putting in place:

- Source-based controls
- Management of the receiving environment (impact management)
- Remediation

3.2.2 Draft National Waste Management Strategies and Action Plans (NWMS) (November 2011)

- The 1999 National Waste Management Strategy (NWMS) has laid the foundations for a coherent waste management regime with:
- The development of a comprehensive Waste Information System;
- The development of an integrated waste management planning system;
- The development of draft regulations and guidelines;
- Significant advances in approaches to waste minimisation and recycling;

- Innovations in the sphere of waste collection; and
- Improvements in the way in which different forms of waste are disposed of and the regulation thereof.
- The greatest challenge to its successful implementation was the absence of a coherent regulatory framework, a factor that has now been addressed through the promulgation of the Waste Act (No 59. of 2008) (the Waste Act).
- The Department of Environmental Affairs (DEA) has commenced with the process for the development of the strategy. A framework for the strategy has been prepared, stakeholders have been consulted, baseline research on the main themes has been commissioned to inform the drafting process, and the findings of the research have been debated by government and stakeholders in the sector.
- The Polokwane Declaration at the National Waste Management Summit in 2002 set targets for waste generation to decrease by 50% by 2012, and
- Waste disposal to decrease by 25% by 2012, with the ultimate aim of developing a plan for zero waste to landfill by 2022.

These ambitious targets not only draw attention to government's commitment to integrated waste management, but also emphasize waste minimisation as an environmental policy priority.

a) Implementation process of the National Waste Management Strategy

The Waste Act provides a range of mandatory and discretionary regulatory instruments that can be used to achieve the objectives of the Waste Act. There is a suite of economic and fiscal measures that can play a complementary role to the regulatory instruments. Lastly there are the voluntary initiatives that can be taken by government and citizens, which constitute the mainstay of the strategy. Drawing on the above approach to implementing the waste hierarchy, the main instruments that will be used as elements of the overall strategy include:

- Norms and Standards;
- Categorisation and Classification;
- Waste Information System;
- Industry Waste Management Plans;
- Listing and Licensing of Waste Management Activities;
- Special Measures;
- Producer Responsibility;
- Consumer Protection;
- Economic Instruments; and
- Fiscal Mechanisms for Waste Management.

Included in the implementation process is provision for mechanisms to co-ordinate activities between different implementation agencies, to develop processes for the introduction of waste minimisation and reduction, to

record progress with the implementation through waste management information systems, and to establish appropriate funding mechanisms.

b) Role of Integrated Waste Management Planning (IWMP) in the development of the IDP

The IWMP should be seen as an integral part of the Integrated Development Plan (IDP) that needs to be developed by municipalities. The requirements with regard to integrated development planning, as stipulated in the Municipal Systems Act, and recently published regulations, must therefore be considered and complied with. Waste management input into the IDP is guided through the development of an Integrated Waste Management Plan (IWMP).

The primary objective of integrated waste management (IWM) planning is to integrate and optimise waste management, in order to maximise efficiency and minimise the associated environmental impacts and financial costs, and to improve the quality of life of all South Africans. The integration must be both horizontal and vertical within the government departments, as well as in other sectors and throughout the 'waste life-cycle'.

The integrated waste management planning process incorporates all the major stages of the environmental planning process, namely:

- Reviewing the existing baseline situation and legal environment;
- Making projections of future requirements;
- Setting objectives;
- Identifying system components;
- Identifying and evaluating alternative methods/approaches for meeting requirements;
- Developing and implementing an integrated waste management plan;
- Evaluating and reviewing the plan to ensure the respective objectives are being met.

3.2.3 Department of Water Affairs: Minimum Requirements

The National Environmental Management: Waste Act 59 of 2008 (NEMWA) makes provision for the licensing of waste disposal facilities through co-operative governance.

Currently there is an agreement in place between Department of Water and Sanitation and national and provincial departments of environment to include water protection conditions provided by the Department of Water and Sanitation in terms of the National Water Act in the waste management licenses. Part of the above-mentioned agreement was also to still use the DWAF minimum requirements guidelines.

The three documents produced by the DWAF in 1998 refer:

- Minimum Requirements for the Handling and disposal of Hazardous waste
- Minimum Requirement for Waste Disposal by Landfill
- Minimum Requirements for Monitoring at Waste Management Facilities.

The objectives of the Minimum Requirements for Waste Disposal include:

- Guidelines for Permitting, Design, Operation and Closure
- Classification of landfill, G – general and H – Hazardous
- Integrated Environmental Management approach
- Promoting waste minimisation through the emphasis of the waste management hierarchy.

3.2.4 SANS 10228

SANS 10228 is the code for identification and classification of dangerous goods and substances. This is a system for classifying hazardous substances for transport purposes. Until the new classification system is in place adherence to this standard has to be ensured.

In the Code, hazardous substances are given an identification number and divided into nine classes and various sub-divisions. These are listed in Table 1 below.

Waste must be tested against the nine classes mentioned above, to see into which class it falls. The Minimum Requirements for that class must then be complied with. If the minimum requirement show that the waste must be treated to reduce its hazardousness such treatment must be deployed. After treatment one would have to determine the toxicity of the waste or the residue remaining after in order to determine the Hazard Rating which in return will determine the method of final disposal.

SANS Code 10228 also provides a danger rating for transport. This rating is, however, only related to the risk the substance poses to man during transport. The Hazard Rating for disposal, on the other hand, also takes into account risk to the environment.

To determine the Hazard Rating, the Estimated Environmental Concentration (EEC) of the substance in the waste is calculated in grams disposed of per hectare per month multiplied by a factor of 0, 66. The EEC is compared to the Acceptable Risk Level and if the EEC is higher than the Acceptable Risk Level, then the waste remains in the originally classified Hazard Rating. If the EEC is lower than the Acceptable Risk Level, the waste may delist to a lower Hazard Rating for final disposal.

Table 1: SANS 10228

Class	Description
Class 1	**Explosives**
Class 2	**Flammable gases**
2.1	**Non-flammable gases**
2.2	**Poisonous gases**
2.3	**Explosives**
Class 3	**Flammable liquids**
3.1	**Low flashpoint group of liquids; flashpoint below – 18°C c.c*.**
3.2	**Intermediate flashpoint group of liquids; flashpoint of –18°C up to, but not including 23°C c.c.**
3.3	**High flashpoint group of liquids flashpoint of 23°C up to, and including, 61°C c.c**
Class 4	**Flammable solids or substances**
4.1	**Flammable solids**
4.2	**Flammable solids liable to spontaneous combustion**
4.3	**Flammable solids which emit flammable gases when in contact with water**
Class 5	**Oxidising Substances**
5.1	**Oxidising agents**
5.2	**Organic peroxides**
Class 6	**Poisonous (toxic) and infectious substances**
6.1	**Toxic substances**
6.2	**Infectious substances**
Class 7	**Radioactive substances**
Class 8	**Corrosive substances**
Class 9	**Other miscellaneous substances, that is any other substance which experience has shown, or may show, to be of such dangerous character that the provisions of this Section should apply to it**

The EEC is therefore used to determine the amount of a substance that can safely be disposed of per hectare per month at a landfill site. The EEC is also used to determine the total amount of a hazardous substance that may be accepted at a certain landfill site.

3.2.5 NEM:WA : Government Notice 636 Gazette No. 36784 of 2013

This Standard determines the requirements for the disposal of waste to landfill as contemplated in regulation 8{1){b) and 8(1)(c) of the Regulations. Chapter 2 focuses on the landfill design requirements, hazard requirements and permissible disposal at the landfill sites as per the latest classification standards, waste acceptance criteria for waste disposal to landfill and waste disposal restrictions.

3.2.6 NEM:WA : Government Notice 635 Gazette No. 36784 of 2013

Chapter 2 specifically deals with waste disposal risk rating of total concentrations and leachable concentrations associated with wastes. If the waste is classified according the DWAF Minimum Requirements, then the waste material will need to be re-classified. See below.

Table 2: Excerpt from Government Notice 635 Gazette No. 36784 of 2013

12.	**Implementation and Transitional Provisions**
(1)	**All wastes that were classified in terms of the Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste (2nd Edition, 1998; Department of Water Affairs and Forestry), or waste for which an alternative classification was approved by the Department of Water Affairs or Department of Environmental Affairs, prior to these Regulations taking effect, must be-**
	(a) Re-classified in terms of Regulation 4 (1); and
	(b) Assessed in terms of Regulations 8.1(1)(a) if the waste is to be disposed to landfill, within three (3) years from the commencement of this regulation

3.2.7 NEM: WA, 2008 (Act No. 59 of 2008) - National Norms and Standards for the Assessment of Waste for Land Disposal

Waste must be kept separate for the purposes of classification. A revised Waste Classification and Management System that will support South Africa's drive to ensuring the protection of the environment through application of the waste management hierarchy was gazetted and published on 23 August 2013. The waste management hierarchy requires firstly that the generation of waste is reduced, waste that cannot be reduce is reused or recycled, waste that cannot be reused or recycled should be treated or the energy should be recovered before landfilling. The landfill option is the least favoured option in this hierarchy.

Table 3: Excerpt from NEM: WA, 2008 (Act No. 59 of 2008)

Criteria	Waste Disposal Risk Rating	Description of Risk associated with Disposal to Landfill
LC > LCT2, or TC < TCT2	**Type 0: Very High Risk**	Considered very high risk waste with a very high potential for contaminant release. Requires very high level of control and ongoing management to protect health and the environment.
LCT1 < LCT2 ≤ LCT2, or TCT1 < TC ≤ TCT2	**Type 1: High Risk**	Considered high risk waste with high potential for contaminant release. Requires high level of control and ongoing management to protect health and the environment.
LCT0 < LC ≤ LCT1 and TC ≤ TCT1	**Type 2: Moderate Risk**	Considered moderate risk waste with some potential for contaminant release. Requires proper control and ongoing management to protect health and the environment.
LCT1 < LC < LCT0 and TC < TCT0	**Type 3: Low Risk**	Low risk waste with low potential for contaminant release. Requires some level of control and ongoing management to protect health and the environment.
TC < 20 x LCTi, or LC ≤ LCTi and TC ≤ TCTi	**Type 4: Inert Waste**	Very low risk waste that – (a) Does not undergo any significant physical, chemical or biological transformation (b) Does not burn, react physically or chemically or otherwise affect any other matter with which it may come into contact with, and (c) Does not impact negatively on the environment because the toxicity of its leachate is insignificant Only basic control and management required.

(d) Wastes with any element or chemical substance concentration above the LCT0 but below LCT1 values and all concentrations below the TCT1 values (LCT0 < LC ≤ LCT1 and TC ≤ TCT1) are Type 3 Wastes;

Refer to Gazette no 36784 notice no. 635, August 2013 - Norms and Standards for the Assessment of Waste for Landfill Disposal.

Refer to National Waste Information Regulations (Gazette number 36784 notice no. 634, August 2013) for detail on duties by “Waste generator” and the “Waste Manager”.

The solute seepage (organic and inorganic) does need to be calculated in accordance with prescribed Australian methods, as directed in the Regulations.

Although not a legal requirements as yet, it is prudent to classify waste-material in order to identify the necessary lining and capping system.

If the waste is not classified now, according to the regulations (634 of 2013), then it will possibly be a requirement to classify the waste within 180 days after the regulation has been gazetted. The waste material will then need to be re-classified every five years (See Part 6 of these Regulations).

Table 4: Excerpt from Regulation 634 of 2013, Section 10

10. Records of Waste Generation and Management
(1) Waste generators must keep accurate and up to date records of the management of the waste they generate, which records must reflect-
(a) the classification of the wastes;
(b) the quantity of each waste generated, expressed in tons per month;
(c) the quantities of each waste that has either been re-used, recycled, recovered, treated or disposed of; and
(d) by whom the waste was managed

3.2.8 National Norms and Standards for the Storage of Waste: Government Notice 926 Gazette No. 37088 of 2013

The NEMWA requires the establishment of the NWMS that obliges holders of waste to take practical measures to implement the waste hierarchy whilst protecting the environment and public health. The function of standards for the storage of waste is to ensure best practice and provide a consistent national approach relating to the management of waste storage facilities and to provide minimum standards for the design and operation of new and existing waste storage facilities. The development of these standards is the foundation of the regulatory system established in terms of Section 7(1) (c) of the NEMWA.

The location of waste storage facilities must take consideration of the public health and environmental protection. The following design requirements are applicable for waste storage facilities according to the National Norms and Standards for the Storage of Waste:

- Construction and development of the waste storage facilities must be carried out under the supervision of a registered professional engineer and according to the approved civil engineering designs. The plan must only be amended and approved by a registered professional engineer.
- The liquid waste storage area must have a firm, impermeable chemical resistant floors and a roof. Liquid waste containers that are not stored under a roofed area must be coated to prevent direct sunlight and rain water from getting in contact with the waste.
- The storage area for hazardous waste must have an impermeable, chemical resistant floor.
- The liquid waste storage facility must be surrounded by an interception trench with a sump for intercepting and recovering potential spills and must be lined in accordance with the requirements set out in paragraph (7) 2 of the National Standards for storage of waste.
- The storage facility must be constructed to maintain on a continuous basis a drainage and containment system capable of collecting and storing all runoff water arising from the storage facility in the event of a flood. The system must under the said rainfall event, maintain a freeboard of at least half a meter.
- The liquid waste storage area must have a secondary containment system (e.g. bund, drip tray) of sufficient capacity to contain at least 110% of the maximum contents of the storage facility. Where more than one container/tank is stored, the bund must be capable of storing at least 110% of the largest tank or 25% of the total storage capacity, whichever is greater (in the case of drums the tray/bund size must be at least 25% of total storage capacity).

4 ACTIVITY DESCRIPTION AND WASTE STREAM IDENTIFICATION

4.1 Construction related activity

A number of activities are expected to take place during the construction phase of the proposed CSP plant using parabolic trough technology. These activities include but are not limited to:

- Site establishment and construction of access roads and services;
- Site clearing activities and earthworks
    - Removal of vegetative cover
    - Grading
    - Excavation
    - Blasting
    - Drilling etc.
- Construction of buildings and other related infrastructure
- Installation and assembly of facilities.

At the peak of construction, it is anticipated that the labour force required for construction of the proposed plant is will be up to 2 000. About 67% of the labour workforce is expected to be sourced locally, the accommodation units to be planned would, consequently, cater for about 200 people (not the entire workforce). It is therefore anticipated that a temporary contractor's housing facility will be developed during the construction phase of the project. The use of potable water, ablution and sanitary facilities by the construction workers will thus impact waste generation during this period.

Thus waste generation during the construction phase of the project will comprise:

- General Site (construction) Waste i.e. Excavation and construction related material like bricks, timber, steel etc.
- Food waste;
- Sanitary waste (effluent and solids);
- Hazardous Site Waste (engine oils, lubricants, oily rags, spent solvents, etc.); and
- General/Domestic waste (packaging materials, paper etc.).

Due to the fact that construction related waste will include fuels, oils and other soluble, potentially hazardous substances (e.g. cement), which could pose a pollution risk to the soil and nearby water bodies, and in turn impact negatively on the water and sediment quality of these sensitive systems, it is therefore strongly proposed to have mitigation measures in place to prevent ground and surface water pollution during the construction phase of the CSP (parabolic trough) plant.

4.2 Operational Activity

The operational phase of the project entails the production of power through the conversion of solar energy to electricity. The main activities associated with the plant are thermal storage solar field, primary solar field, generation, transmission, heat transfer fluid recirculation, heat transfer fluid conditioning (Figure 3). The following sub-sections provide more information regarding the working principle of the CSP plant.

4.2.1 Parabolic Trough

Parabolic trough concentrated solar power (CSP) technology uses very precise parabolic shaped, sun-tracking mirrors to concentrate and collect sunlight on thermally efficient receiver tubes running through the optical focal line of the parabolic mirror troughs. The parabolic troughs, orientated along the north-south directional plane, are designed to track the sun along one axis as it moves from east to west. A heat transfer fluid (HTF), such as synthetic thermal oil, is heated to approximately 390°C by the focused sunlight as it circulates through the receivers and is then pumped through a series of heat exchangers where thermal energy is transferred to water.

This happens until the temperature of the water side of the system is heated sufficiently to generate high-pressure preheated, evaporated, and then superheated steam.

After passing through the heat exchangers and transferring the absorbed thermal heat, the cooled HTF is re-circulated through the solar field receivers to repeat the process. The heat transfer (exchange) system is a closed system resulting in the re-use of the HTF. Due to wear and tear, the HTF will require replacement and small volumes are continuously bled off with new fluid being introduced into the system.

The high-pressure steam is directed to a conventional Rankine-cycle steam turbine/generator set where the steam provides the energy to rotate the steam turbine and drive the generator producing electricity. The remaining steam is then transported to a condenser which cools the steam back to a liquid state. The low-pressure (spent) steam from the turbine is condensed by a cooling system as it flows through the cooling loop. After being cooled and condensed, the condensed water – or condensate - is returned to the HTF heat exchangers by feedwater pumps to again be turned into steam.

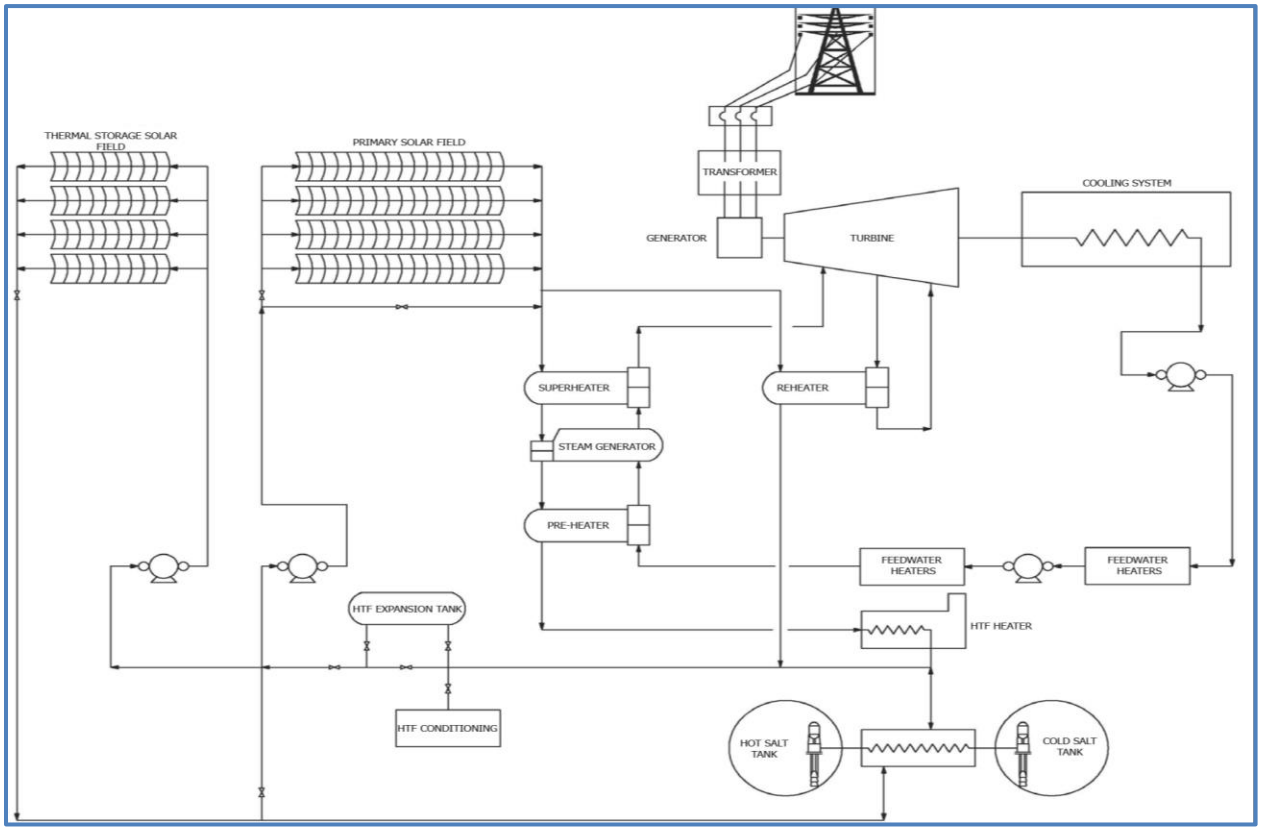

Figure 3: Process flow diagram for CSP (Parabolic trough) Plant

Some of the major advantages of the CSP – parabolic trough technology are presented below.

- Is the most proven CSP technology;
- Over 30+ years of operating experience;

- Energy storage is feasible and can be added. Therefore, the system could provide energy under cloudy conditions or at night; and
- The cost, performance and risk of parabolic trough technology are well established with existing parabolic trough plants around the world.

4.2.2 Ancillary Facilities

Ancillary facilities will be constructed to, amongst other things, support the water usage requirements of the CSP facility. A “dry cooling” system is proposed for the CSP plant. This system of cooling is a common, proven and effective cooling technique, as it uses considerably less volumes of water compared to other cooling systems such as wet and hybrid cooling systems. Using the dry cooling system, the facility’s annual water consumption is estimated at 350 000 m^3 (approximately 36% savings when compared to wet cooling systems). Most of the water that will be used by the solar power plant will be sourced from the Orange River, approximately 13 km from the plant site through an extraction point adjacent to the Sishen-Saldanha railway bridge (Refer to **Error! Reference source not found.**). The preliminary design of the abstraction system includes an open-water extraction unit, raw water settling tanks, and pipelines running along the Transnet servitude to two on-site storage tanks. Water will be pumped from the Orange River to the site and used for steam generation, cooling, washing of the plant mirrors and in the plant workers change rooms.

The project will require raw water and waste water storage ponds for the provision of service water as well as the separation and treatment of contaminated water. An on-site water treatment system will be used to provide the necessary quality of water for the various CSP requirements. Water uses at the facility can be divided into the following levels based on the quality required:

- Water for the cooling system;
- Service water for the plant, which includes all other miscellaneous uses;
- Demineralised water for make-up to the steam Rankine cycle and mirror washing; and
- Potable water. The potable system will supply water to sinks, toilets, showers, drinking fountains, and emergency eyewash/safety showers.

4.2.3 Waste Streams and Rejections

4.2.3.1 Solid and Non-Hazardous Waste

The CSP plant will produce maintenance and plant wastes typical of power generation operations. Generation plant wastes include: oily rags, broken and rusted metal and machine parts, defective or broken electrical materials, empty containers, and other miscellaneous solid wastes including the typical refuse generated by workers. All waste to be generated on site will be managed in accordance with the waste management hierarchy where disposal is regarded as the final option. Solid wastes will be temporarily stored on site and trucked offsite

for recycling or disposal at a licensed recycling facility or licensed landfill site in the vicinity. Waste collection and disposal will be in accordance with applicable regulatory requirements to minimise health and safety effects.

4.2.3.2 Hazardous Waste

A number of hazardous wastes may be generated during the operation of the facilities. These wastes include: spent HTF, mirror cleaning chemicals, used oil, spent oil filters, spent solvents, cleaning rags, old or out of date chemicals from the water treatment system, old paints etc.

The hazardous materials that may be used at the facility will be stored on-site in portable appropriately labelled tanks and inside containment structures to prevent exposure to the elements and reduce the potential for accidental releases. The quantities stored on-site will be evaluated to identify the required usage and maintain sufficient inventories to meet requirements without stockpiling excess volumes. These wastes will be thereafter be disposed of in permitted hazardous landfill sites. Sites under consideration are located in Johannesburg, Port Elizabeth, and Cape Town. The disposal of hazardous materials will be carried out by a chemical cleaning contractor in accordance with applicable regulatory requirements. Dangerous goods such as Diesel fuel and Liquid Petroleum gas will be required for the daily operation of the CSP plant and will be stored on-site in SANS compliant storage facilities. Workers will be trained to handle all hazardous wastes generated at the site.

4.2.3.3 Surface Water

The CSP facility will follow a zero liquid discharge approach, meaning that no liquid waste streams will be rejected into the environment. The following water related facilities are required:

- Raw water storage and treatment;
- Storm water detention basin;
- Firewater storage;
- Evaporation ponds (including liner and detections system);
- Septic Tank and sewage disposal facilities; and
- Water abstraction system.

Liquid wastes that will be produced by the CSP Plant must be collected within a separate network, with different streams according to the origin of the liquids that produced them.

With reference to the preceding sections, the blowdown for cooling tower will be the main effluent of the Plant under a Wet cooled condenser solution. In addition, other effluents will appear and can be classified within the following groups:

- Effluents of the process;
- Residual sanitary water;

- Effluents that may contain oily/greasy waste; and
- Reject from the wastewater treatment plant.

4.2.3.4 Wastewater and Evaporation Ponds

There are two separate wastewater collection systems. The first system will collect process effluents from all units of the plant, including the steam turbine electrical generator sets, cooling towers, and water treatment equipment. The effluents will be analysed and neutralised before being released into the two lined evaporation ponds. Non-contaminated process water will be discharged into two lined evaporation ponds.

Three evaporation ponds will be located nearby the solar field. The effluent will be piped or channelled to the evaporation ponds. The evaporation pond will consist of three (3) compartments that would enable maintenance on any one compartment without disrupting the normal operations of the CSP plant. The compartments will have a small emergency overflow to each of the other compartments. The flow to each of the compartments will be controlled via a splitter box at the top end of the evaporation ponds. A limited amount of silt is to be expected to enter the ponds as no surface water will enter the system. Oil will be separated out of the effluent stream before it reaches the evaporation ponds. The evaporation ponds will not be shared amongst the various plants.

It is estimated that the ponds will need to accommodate the disposal of 130 000 to 150 000 m^3/yr.

- Size of each evaporation pond = 150m x 175m x 6m = 157,500 m^3
- Number of Waste Ponds = 3
- Total area for the waste ponds = 8.5 hectares

Considering that the annual evaporation in the area is high at approximately 2 281 mm (EIA Scoping report), the total amount of water that will evaporate from the ponds is approximately 180 000 m^3/yr. As this amount is higher than the total discharge to the ponds (131 000 m^3/yr), the evaporation ponds is considered to have been designed with sufficient capacity to contain the total discharge.

The solid residuals will be collected and transported to a suitable off-site treatment plant for disposal by a licensed contractor.

4.2.3.5 Sewage

A gravity sewage system will be used for the CSP plant. The sanitary wastewater from sinks, toilets, showers, and other sanitary facilities will be collected by a sewerage network and treated in a biological treatment system comprising a compact oxidation plant (septic tank) and biological filter. Resulting sludge collected in the tank over time will periodically be removed by a third party service provider and accordingly disposed of at an appropriate landfill site.

With respect to the handling and treatment design and operations of the proposed effluent treatment plant the following philosophy will be put in place:

- A closed loop system will be introduced and implemented with regards to the handling, treatment and reuse of treated water. It is proposed that the sludge from the bio-filter treatment plant be removed from site and disposed of at an appropriate facility.
- Effluent treatment of sewage/sanitation water will be done in such a manner that the treated effluent will adhere to the general limit effluent standards.

4.2.3.6 Drainage Network System

The drainage network will be designed to allow the separation of the effluents with the aim of applying the most appropriate treatment to each one. The basic function of the drainage system is to collect all water streams that are produced during the operation of the Plant and to send them to the specific treatment processes before the neutralization and homogenization pond. The neutralized waste water will finally be discharged into the evaporation pond. The site will be serviced by a stormwater management system (available in separate specialist study) which aims to separate clean and dirty surface water.

An on-site stormwater conveyance system will control the 1:50 year storm event and protect structures from the 1:100-year storm event. On-site stormwater runoff will be collected by a surface drainage system consisting of terrace drains and swales to collect and direct runoff to a sedimentation/retention basin.

Stormwater that collects in the Power Block areas of the facility will be collected in a separate drainage system and routed through an oil/water separator before being conveyed to the main wastewater management system. Spills or any potential contaminated runoff within the power block area will be directed to a wastewater disposal system.

The Plant's drainage system is composed of:

- Collecting networks;
- Cooling Tank for potentially hot effluent;
- Stormwater basin;
- Retention basin;
- Separator of light hydrocarbons coming from the Power Island;
- Separator of hydrocarbons coming from the area of HTF and Salts;
- Neutralization and homogenization pond;
- Waste network and evaporation pond;
- Wells, manholes, drains and other typical components of a drainage network; and
- Evaporation pond.

The drainage collection network is made up of the following lines that collect reject waters according to their nature, as indicated below:

- Process blowdown (potentially hot):
    - Auxiliary boiler blowdown;
    - Deareator drainage;
    - Intermittent blowdown tank overflow;
    - Pressure safety valve (PSV) discharge and deareator overflow;
    - Drainage of atmospheric drainage tank from steam turbine (ST) and Balance of Plant (BoP); and
    - High and low pressure pre-heating drainage.
- Sanitary water network:
    - Generated within the administrative building, workshop and store room; and
    - Generated within the electrical building and control room.
- Oily water network 1: rainwater containing oil or hose water used for cleaning and washing:
    - Buildings containing turbines and drainage in the condenser area;
    - Compressed air unit slab;
    - Fire protection pump room;
    - Transformer area;
    - Drainage of pavement in supply water pump area;
    - Drainage of pavement in service water pump area;
    - Drainage of pavement in make-up pump
    - Drainage of pavement in demineralized water pump; and
    - Drainage of pavement in solar field pump.
- Oily water network 2: Rainwater carrying HTF or hose water for cleaning and washing in HTF area:
    - Filter area for thermal oil;
    - Boiler pumps area;
    - Steam generation area;
    - HTF heater area;
    - Main HTF pumps area;
    - Steam generation area;
    - Basin of expansion and overflow vessels; and
    - HTF-Salt exchanger area.
- Water network
    - Water flows from the oil-separating manhole in the Transformer area;
    - Water treatment area of the Plant;
    - Pre-water treatment area of the Plant;
    - Sampling area;
    - Compressed air area drainage;
    - Demineralised water tank drainage and overflow;

- Service water tank drainage and overflow;
- Eye-washing showers;
- Filter cleaning;
- Chemical dosification area drainage; and
- Cleaning water from chemical bunds (without chemical concentrates).

- Collecting concentrates
  - Reverse osmosis concentrate from the demineralization line; and
  - Blowdown of the cooling circuit.

4.2.3.7 Groundwater

Groundwater resources in the Siyanda District are scarce due to a very deep water table. The quality of water is normally brackish and the recharge rate for the water table can be high due to a lack of rainfall in the area. The CSP facility will therefore allow for the re-treatment of wastewater or process effluents. By adopting this approach, the facility will enhance the water usage efficiency of the plant and in so doing, minimise water wastage and eliminate groundwater recharge.

Figure 4 below presents the waste management process for the Sand Draai CSP – Parabolic Trough Plant.

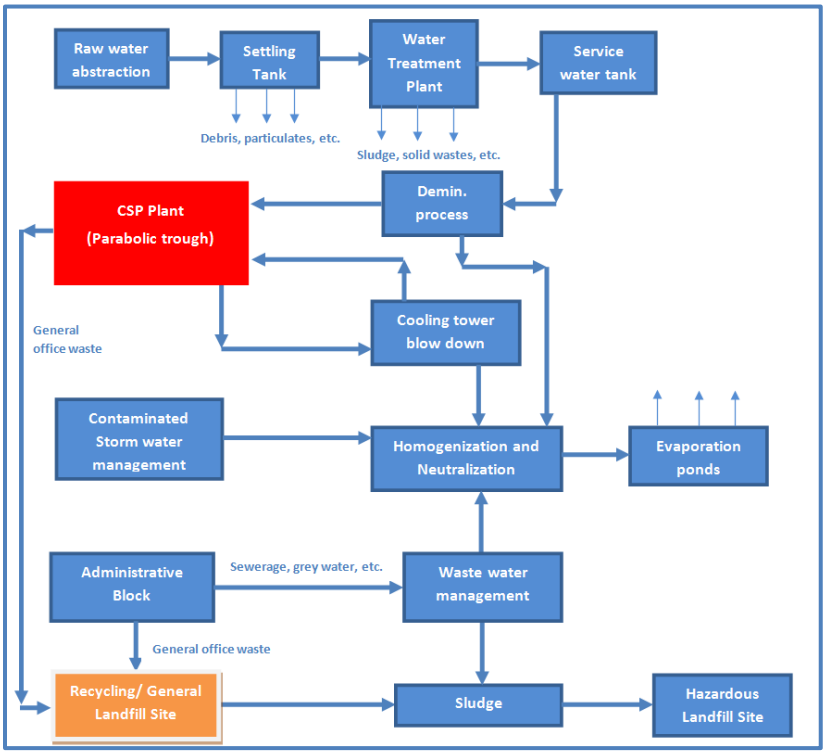

Figure 4: Waste management process for the CSP (Parabolic Trough) Plant

The specifications for the development of the CSP (Parabolic Trough) Plant are presented in Table 5.

Table 5: Plant Specifications

Solar Field
Trough Collectors
Parabolic trough solar collector with a total aperture of approx. 1 700 000 m^2
Heliostats between 12 – 15m high
Approximately 800ha overall plant footprint
Solar field will consist of 12 000 – 15 000 heliostats (dependent on the individual size)
Ancillary Facilities
Laydown area will be approximately 15ha
Assembly plant will be approximately 3 000m^2 (200m x 15m)
Two liquid gas/diesel auxiliary burners for start-up
Two-tank molten salt energy storage system (8 hours)
Two emergency diesel generators
Construction camp – accommodation and sanitation facilities for approximately 800 people. With respect to the construction of the plant it is estimated that up to 1 500 direct jobs will be created
Administrative and office buildings
Cooling System
Air cooled condenser
Molten Salt
Molten salt is 60% sodium nitrate and 40% potassium nitrate. Salt melts at 220 deg C and is kept liquid at 290 deg C in an insulated storage tank
Heat Transfer Fluid
HTF is a eutectic mixture of about 73.5% diphenyl oxide and 26.5% biphenyl, with a density of 694kg/m^3 at 400 deg C and a specific heat of 2.6kJ/kg K. It freezes at 12 deg C and is flammable and toxic so measures are required in the design and operation of the plant to mitigate freezing, fire and contamination risks. Over time HTF degrades into low and high boiling fractions, and these must be removed.
Water Usage
Approximately 750 000m^3 during the construction phase and 350 000m^3 of water per annum during the operations phase.
The water treatment process includes two multi-stage Reverse Osmosis units, and electro-deionization equipment. Pure demineralized water from the process is pumped into a separate demineralized water storage tank. Demineralized water is added to the de-aerator for steam plant makeup, for steam cycle blowdown quench water, and for heliostat washing. Waste water from water treatment system, including 1st pass RO reject and EDI, as well as a portion of the steam cycle blowdown are discharged to the evaporation ponds.

		The plant will have a raw water tank with an anticipated capacity of approximately 10 000 m^3. The major portion of the raw water is for plant use while a smaller portion of the raw water (2 500m^3) will be reserved for fire fighting water requirements		
	Waste			
		The CSP plant will generate several forms of liquid effluent as part of operations. The primary effluents sources generated include		
			Wastewater from the evaporation plant	
			Contaminated surface water, i.e. stormwater and rainwater	
			Sewage effluent	
			Brine blow down water	
		Total volume of discharge, inclusive of sewage water and evaporation system discharge is expected to be between 130 000 and 150 000 m^3 per annum		
		An evaporation pond consisting of three compartments with a combined area of approximately 8.5ha to completely contain all rejected water from the water treatment system and the steam cycle		
	Operations			
		The project will operate (generate electricity) for 12 - 18 hours per day, 7 days a week (with 8 hours of energy storage) throughout the year, with the exception of scheduled shutdowns for maintenance.		

5 WASTE ASSESSMENT

5.1 The CSP Waste Management Process/Principles

Waste management is the process whereby all wastes produced at the proposed plant are firstly minimised or reduced, properly collected, treated (if necessary), re-used and disposed of as a final resort. Wastes include process and sanitary wastewater, non-hazardous waste and hazardous waste, both liquid and solid.

The key process related emissions for the parabolic trough based system is shown in Figure 5.

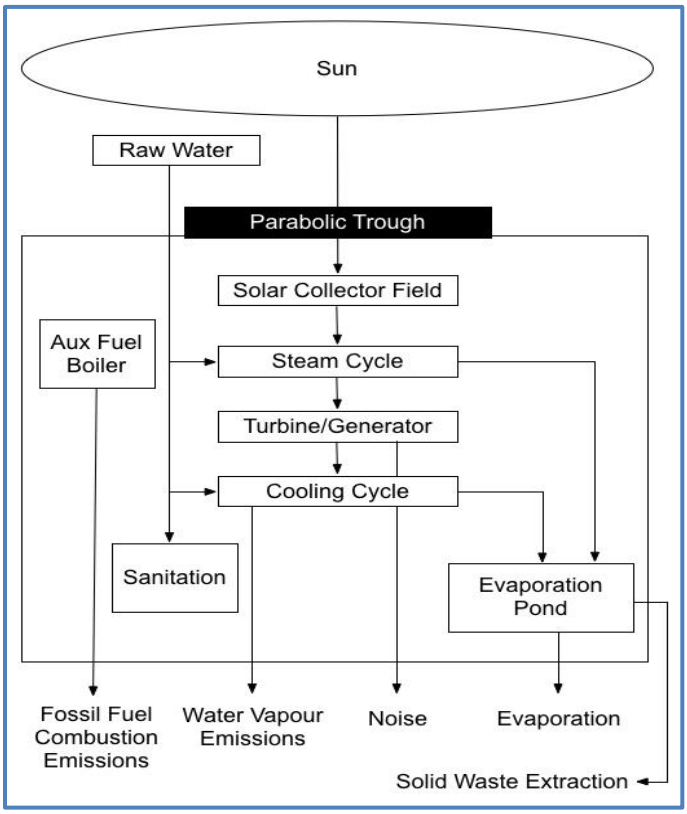

Figure 5: Key emissions from the CSP (Parabolic Trough) Plant

5.2 Waste Generation from the CSP Development

Waste has the likelihood of contaminating the surrounding environment especially water resource systems such as rivers, groundwater, wetland as well as soil. Solid and liquid wastes, if not properly managed, may impact negatively on the character of the locality, resulting in the generation of foul odours, pollution of water resource and ecological systems and may even pose a health hazard. Leachate resulting from water percolating though the solid waste is a major polluter. Waste generation will occur during the construction and operational phase of this project. These wastes are broadly categorized into solid and liquid waste. Solid wastes may include general

waste, waste material from construction activities, excavation materials, etc. while liquid wastes may include fuels, oils, process wastewater, sanitary waste, chemicals, etc.

Error! Not a valid bookmark self-reference. presents a summary of wastes streams that will be generated during CSP development, their sources and category and how they are proposed to be treated.

Table 6: Waste streams and by-products produced by the CSP system during construction and operations

Category	Waste Type	Source	Proposed Handling Strategies
Solid	• **General Waste** ○ Food waste ○ Packaging waste ○ Wastepaper ○ Sanitary waste ○ Solid sludge waste ○ Debris or oversized particulates removed from abstracted raw water	• Ablution facilities • Human activities during construction • Process wastewater • Potable water treatment plant	• Waste streams generated will be characterised and accurately quantified. • Volumes of construction related waste materials cleared from will be indicated on the operational plan which will then be integrated into the Environmental Management Programme. • Clearance area and volumes will be used to determine the extent and quantities of waste. A waste management plan will then be developed to ensure the waste management hierarchy is implemented. • The excavated material not intended for re-use will be stockpiled and disposed of in accordance with its classification. • Waste from construction and installation processes will be segregated and stored in different containers to encourage re-use and recycling. Disposal of residual
	• **Waste material from construction site** ○ Excavated soil ○ Garden refuse ○ Rubbles ○ Concrete	• **Construction activities** ○ Clearing ○ Grading ○ Excavation ○ Blasting ○ Drilling ○ Installation, etc.	
	• **Waste from assembly and installation of facilities/equipment** ○ Empty containers ○ Machine /metal /electrical parts or materials ○ Broken Glass	• CSP (Parabolic Trough) plant systems	

Category	Waste Type	Source	Proposed Handling Strategies
			wastes to take place at a licensed landfill site. • Solid sludge waste or particulates will be accordingly disposed of by a third party service provider to a registered disposal site.
Liquid	• **Process wastewater** ○ Boiler blow down stream ○ Floor, sump and piping drains ○ Demineralized water for used for cleaning purposes	• CSP plant systems ○ Boiler and steam systems drains ○ Cooling units ○ Mirrors ○ Water treatment process	• The WTP will be designed accordingly to permit for the re-treatment of waste water or process effluents produced by the plant operations, thus the plant will operate on the principal of “zero discharge”. • The discharge from the wastewater stream will be directed to an evaporation pond (with a liner detection system) where the water will be retained on site to evaporate, leaving solid waste constituents behind.
	• **Consumables** ○ Light fuel oil ○ Used engine oil ○ Lubricant ○ Cleaning /Drilling fluids ○ Thermal oil/water	• Generators • Boilers • Furnaces & Kilns • HTF • Construction activities	• All storage areas will be designed to make provision for a bund wall high enough to contain at least 110% of the waste from consumables and impermeable surfaces to prevent pollution. • Contaminated storm water (due to cleaning/washing) shall be directed to a homogenization and neutralization tank. • Wastewater from the cleaning of concrete trucks that could

Category	Waste Type	Source	Proposed Handling Strategies
			include cement and concrete waste shall be collected and allowed to settle, and water free of sediments may be used to irrigate the site area and access routes.

	• **Sanitary waste**	• Administrative and operations building
		  ○ Sewerage
		  ○ Grey water from kitchen, toilets and showers
			• A gravity sewerage system is to be installed for the CSP plant. Domestic wastewater (sewerage and grey water from kitchens, showers etc.) will be collected by a sewerage network, stored in a septic/conservancy tank and treated in a bio-filter plant. Resulting sludge collected in the tank over time will periodically be removed by a third party service provider and accordingly disposed of at an appropriate landfill site.

Hazardous Waste/Materials	○ LPG
	○ Diesel
	○ Turbine oil
	○ Nitrogen
	○ Mirror cleaning chemicals
	○ Used oil filters
	○ Oil rags
	○ Hazardous chemical substances and asphyxiants
	○ Water treatment chemicals
		• Possible spillage or leakage from:
		  ○ Vehicles
		  ○ Machines
		  ○ Generators
		  ○ Road tankers during construction
		  ○ Storage facilities
			• All storage areas will be designed such to make provision for a bund wall high enough to contain at least 110% and impermeable surfaces to prevent pollution.
			• The on-site storage facility shall comply with SANS 10131:2004 – “Aboveground storage tanks for petroleum products”.
			• Used oils may be recycled through a number of options

Category	Waste Type	Source	Proposed Handling Strategies
			such as direct burning in boilers, furnaces and kilns, simple or complex reprocessing into industrial fuels, processing into blasting explosives, re-refining into lubricating oils as well as processing into cement kiln and lime kiln fuel. • Construction of a site machinery maintenance area (lubrication, oil and filter changes, repair work, etc.). A waterproof concrete area or impermeable geotextile liner shall be provided with a tank or perimeter ditch to collect any liquid waste from this area.

According to Regulation 4(3) published in Government Gazette number 36784, the waste must be reclassified every 5 years, or within 30 days of modification to the process or activity that generates the waste. Generators of hazardous waste must ensure that a safety data sheet for the hazardous waste is prepared in according to SANS 10234.

6 WASTE IMPACT ASSESSMENT

The waste impact assessment for the construction and operational phase was conducted on the basis of following the key process flow streams in the parabolic trough based CSP in terms of liquid and solid waste through to treatment and disposal. The key waste streams considered were that of the solid waste streams (hazardous and general), onsite waste water treatment plant, process water and contaminated storm water streams. The assessment involved focusing on the key waste streams and considering the impact, mitigation and management measures. The assessment also focused on:

- Waste classification
- Waste characterisation
- Waste quantification
- Waste management plan
- Monitoring and measurement of data

In Table 7 below each impact was rated in terms of its spatial, temporal, severity and probability of occurrence. An impact significance rating was determined using criteria set out below Table 7. Mitigation, control and management measures were proposed for each impact. Thereafter the impact significance rating was calculated. Most of the residual levels have been reduced to low to medium impact.

The mitigation measures proposed constitute the core inputs into the Environmental Management Programme (EMPr). The proper implementation of the EMPr will ensure a low impact development.

Table 7: Impact Assessment

Phase	Potential Aspect and or Impact	Significance rating of impacts before mitigation	Mitigation	Significance rating of impacts after mitigation
Construction	Contamination of the surface and site with general and hazardous waste. General waste produced on site includes: • Office waste (e.g. food, waste, paper, plastic); • Operational waste (clean steel, wood, glass); and • General domestic waste (food, cardboards, paper, bottles, tins). Contamination or pollution of or effluent release into surface water, groundwater, rivers and other nearby hydrological or ecological systems with general and hazardous waste.	**Extent:** Local (-2) **Duration:** Medium-term (-3) **Frequency:** Frequent (-3) **Intensity:** Medium (-3) **Probability:** Very likely (-4) **Significance:** Medium (-6)	• An adequate number of general waste receptacles, including bins must be arranged around the site to collect all domestic refuse, and to minimise littering. • Bins should be clearly marked and lined for efficient control and safe disposal of waste. • Different waste bins, for different waste streams must be provided to ensure correct waste separation. • A fenced area must be allocated for waste sorting and disposal on the site. Solafrica must have a waste policy and waste management procedure and also engage a service provider who trains the operations staff on measures for implementing the plan as well as auditing. • General waste produced on site is to be collected in skips for disposal at the local municipal	**Extent:** Site (-1) **Duration:** Very Short-term (-1) **Frequency:** Very rare (-1) **Intensity:** Very Low (-1) **Probability:** Probable (-2) **Significance:** Low (-2)

Phase	Potential Aspect and or Impact	Significance rating of impacts before mitigation	Mitigation	Significance rating of impacts after mitigation
	Hazardous waste produced on site includes: • Waste sludge; • Spent activated carbon; • HTF, Oil and other lubricants, diesel, paints, solvent; • Containers that contained chemicals, oils or greases; and • Equipment, steel, other material (rags), soils, gravel and water contaminated by hazardous substances (oil, fuel, grease, chemicals or bitumen).		waste site. A waste disposal service provider must be appointed by Solafrica to carry out collection and disposal of waste as required. Hazardous waste is not to be mixed or combined with general waste earmarked for disposal at the closest permitted landfill site. • Under no circumstances is waste to be burnt or buried on site. • Waste bins should be cleaned out on a weekly basis by an appointed service provider to prevent any windblown waste and/or visual disturbance. • All general waste must be removed from the site at regular intervals and disposed of in suitable waste receptacle. • Hazardous waste is to be disposed at a Permitted Hazardous Waste Landfill Site. The Environmental Manager must have as part of his/her	

Phase	Potential Aspect and or Impact	Significance rating of impacts before mitigation	Mitigation	Significance rating of impacts after mitigation
			records the waste manifest for each batch based disposal. • Hazardous waste bins must be clearly marked, stored in a contained area (or have a drip tray) and covered (either stored under a roof or the top of the container must be covered with a lid). Labelling of hazardous substances must be done according to SANS 10233. • A hazardous waste disposal certificate must be obtained from the waste removal company as evidence of correct disposal. • In the case of a spill of hydrocarbons, chemicals or bituminous substance, the spill should be contained and cleaned up. The affected material together with any contaminated soil needs to be collected and disposed of. The bins and skips are to be emptied on a weekly basis. Reporting of spills and mitigation done must	

Phase	Potential Aspect and or Impact	Significance rating of impacts before mitigation	Mitigation	Significance rating of impacts after mitigation
			be done in accordance with section 10 of the minimum requirements for the handling, classification and disposal of hazardous waste (2nd edition, 1998). Internal and external auditing must be carried on an annual basis. • An Environmental Control Officer (ECO) for the duration of construction is to be appointed. • Neighbouring river and stream systems as well as their associated buffer areas are to be fenced off preferably with palisade fencing. This erection of the fencing should take place prior to any construction activities taking place on site. • Vehicles are to be checked for leakage of oils or potentially hazardous wet material before and after entering the construction area. • Areas where fuels are either kept or transferred are to be	

Phase	Potential Aspect and or Impact	Significance rating of impacts before mitigation	Mitigation	Significance rating of impacts after mitigation
			appropriately bunded so as to contain spillage. • Cement mixing areas are to be strategically designated and be at least 100m away from the water resource or ecological systems. • An inventory should be made of substances which will be used on site (both temporarily during construction and during operation) that are potentially harmful to surface water and other water related systems/bodies.	
Operational	Leakage of process wastewater, synthetic oils, lubricants, chemicals etc. onto land.	**Extent:** Local (-2) **Duration:** Long-term (-4) **Frequency:** Very Frequent (-4) **Intensity:** Medium (-3) **Probability:** Possible (-2) **Significance:** Medium (-10)	• Regular (annual) groundwater monitoring programme to be implemented. • Institute clean up protocol in accordance with section 10 of the minimum requirements for the handling, classification and disposal of hazardous waste (2nd edition, 1998) should there be a local leakage.	**Extent:** Local (-2) **Duration:** Long-term (-4) **Frequency:** Unusual (-2) **Intensity:** Low (-2) **Probability:** Probable (-2) **Significance:** Low (-3)

Phase	Potential Aspect and or Impact	Significance rating of impacts before mitigation	Mitigation	Significance rating of impacts after mitigation
	Untreated water discharge into environment	**Extent:** Local (-2) **Duration:** Long-term (-4) **Frequency:** Very Frequent (-4) **Intensity:** Medium (-3) **Probability:** Probable (-2) **Significance:** Medium (-10	• The bulk of the water would be treated in the evaporation pond which is used for storage purposes until the plant becomes operational. Evaporation pond represents a safety feature should there be a failure with the treatment plant. • The water treatment plant shall have a proactive service and maintenance plan in place to ensure high availability. • Contaminated wastewater including hydrocarbon contaminated water must not enter any watercourse and must be managed by the site manager to ensure that the existing water resources on and off site are not polluted by the development. • Institute clean up protocol should there be accidental release of untreated water.	**Extent:** Local (-2) **Duration:** Long-term (-4) **Frequency:** Unusual (-2) **Intensity:** Low (-2) **Probability:** Improbable (-2) **Significance:** Low (-2)
	Treatment and proposed handling of evaporation pond feed - the feed to	**Extent:** Regional (-3) **Duration:** Long-term (-4) **Frequency:** Very Frequent (-4)	• Contaminated wastewater including hydro-carbon	**Extent:** Local (-2) **Duration:** Long-term (-4) **Frequency:** Very Rare (-1)

Phase	Potential Aspect and or Impact	Significance rating of impacts before mitigation	Mitigation	Significance rating of impacts after mitigation
	the evaporation pond would have to be treated such that it can be considered for reuse or discharge into the environment, if not.	**Intensity:** Medium High (-4) **Probability:** Very likely (-4) **Significance:** Medium (-10)	contaminated water must not enter any watercourse and must be managed by the site manager to ensure that the existing water resources on and off site are not polluted by the development. • Sampling and analysis of evaporation pond feed and bulk water quality on a monthly basis under normal operating conditions. If alarming trends are noticed, then the frequency of sampling and analysis should be increased to establish the cause of the problem. Should something go wrong with the analysis, daily sampling must be called for; root cause analysis must be carried out; and also pollution incidences must be investigated. • Continue sampling and analysis of the treated stream for the target range of pollutants and water quality parameters. This must be done on a monthly	**Intensity:** Low (-1) **Probability:** Possible (-2) **Significance:** Low (-5

Phase	Potential Aspect and or Impact	Significance rating of impacts before mitigation	Mitigation	Significance rating of impacts after mitigation
			basis under normal operating conditions. But if alarming trends are noticed, then the frequency of sampling and analysis should be increased to establish the cause of the problem. Should something go wrong with the analysis, daily sampling must be called for; root cause analysis must be carried out; and also pollution incidences must be investigated. • Material Safety Data Sheets (MSDS) for the evaporation pond feed must be readily available. MSDS's should include information pertaining to environmental impacts and measures to minimise and mitigate against any potential environmental impacts which may result from a spill. • Ongoing monitoring of the inputs and outputs for the treatment plant; Monthly reports on removal efficiencies of the	

Phase	Potential Aspect and or Impact	Significance rating of impacts before mitigation	Mitigation	Significance rating of impacts after mitigation
			pollutants of concern.	
	Leakage of hydrocarbons in the CSP plant	**Extent:** Local (-2) **Duration:** Long-term (-4) **Frequency:** Frequent (-3) **Intensity:** Medium High (-4) **Probability:** Probable (-2) **Significance:** Medium (-6)	• Storm and process water should be separated by design and operating protocols. • Process water shall be directed to the water treatment plant. • All major incidents shall be reported and a root cause analysis undertaken. • Preventative measures shall be instituted to avoid potential hydrocarbon spillages.	**Extent:** Site (-1) **Duration:** Long-term (-4) **Frequency:** Very Rare (-1) **Intensity:** Very Low (-1) **Probability:** Probable (-2) **Significance:** Low (-2)
	Improper disposal of admin-based waste water, solid sludge and particulates.	**Extent:** Local (-2) **Duration:** Long-term (-4) **Frequency:** Unusual (-2) **Intensity:** Medium (-3) **Probability:** Probable (-2) **Significance:** Medium (-6)	• Contaminated wastewater including hydrocarbon contaminated water must not enter any watercourse and must be managed by the site manager to ensure that the existing water resources on and off site are not polluted by the development. • Measure volumes of sludge removed from site and maintain a waste manifest in terms of its ultimate disposal. The sludge shall be analysed monthly for	**Extent:** Site (-1) **Duration:** Short-term (-2) **Frequency:** Unusual (-2) **Intensity:** Very Low (-1) **Probability:** Probable (-2) **Significance:** Low (-2)

Phase	Potential Aspect and or Impact	Significance rating of impacts before mitigation	Mitigation	Significance rating of impacts after mitigation
			pH, total solids, organics, ammonia and ash content. • Maintain a log of solids removed. Regular monitoring of qualitative parameters in the solids. Waste manifest for solids to be documented. • Waste manifest for particulates to be documented.	
Operational	Leachate contamination to environment from evaporation ponds.	**Extent:** Regional (-3) **Duration:** Long-term (-4) **Frequency:** Frequent (-3) **Intensity:** Medium High (-3) **Probability:** Likely (-3) **Significance:** Medium (-6)	• Leakage detection system • Engineered liner design • Evaporation ponds must be adequately maintained and regularly monitored for possible leaks or damage to the structure of the ponds. • Measures accommodating overspill by the evaporation ponds must be incorporated into the design of the evaporation ponds.	**Extent:** Site (-1) **Duration:** Short-term (-1) **Frequency**: Very rare (-1) **Intensity:** Medium High (-3) **Probability:** Possible (-2) **Significance:** Low (-2)

CRITERIA		DESCRIPTION			
EXTENT	**International (5)** International scale	**National (4)** The whole of South Africa	**Regional (3)** Provincial and parts of neighbouring provinces	**Local (2)** Within a radius of 2 km of the construction site	**Site (1)** Within the construction site
DURATION	**Permanent (5)** Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient	**Long-term (4)** The impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter. The only class of impact which will be non-transitory	**Medium-term (3)** The impact will last for the period of the construction phase, where after it will be entirely negated	**Short-term (2)** The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (few months)	**Very Short-term (1)** The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (few days)
FREQUENCY	**Continuous (5)** Daily to a significant percentage every day	**Very Frequent (4)** Few times a week to daily	**Frequent (3)** Few times a month	**Unusual (2)** Once or twice every 5 years	**Very Rare (1)** Once or twice a decade
INTENSITY	**High (5)** Natural, cultural and social functions and processes are altered to extent that they permanently cease	**Medium High (4)** Natural, cultural and social functions and processes are altered to extent that they temporarily cease	**Medium (3)** Affected environment is altered, but natural, cultural and social functions and processes continue albeit in a modified way	**Low (2)** Impact affects the environment in such a way that natural, cultural and social functions and processes are not affected	**Very Low (1**) Impact does not affects the environment in such a way that natural, cultural and social functions and processes are not affected
PROBABILTY OF OCCURANCE	**Definite (5)** Impact will certainly occur	**Very Likely (4)** Most likely that the impact will occur	**Likely (3)** The impact may occur	**Probable (2)** Likelihood of the impact materialising is low	**Improbable (1)** Likelihood of the impact materialising is very low

Low impact **(0 -5 points)**	A low impact has no permanent impact of significance. Mitigation measures are feasible and are readily instituted as part of a standing design, construction or operating procedure.
Medium impact **(6 -10 points)**	Mitigation is possible with additional design and construction inputs.
Medium to High impact **(11 -15 points)**	The design of the site may be affected. Mitigation and possible remediation are needed during the construction and/or operational phases. The effects of the impact may affect the broader environment.
High impact **(16 - 20 points)**	High consequences and mitigation is essential.
Extremely High	Permanent and important impacts. The design of the site may be affected. Intensive remediation is needed during construction and/or operational phases. Any activity which results in a "very high impact" is likely to be a fatal flaw.
Status	Denotes the perceived effect of the impact on the affected area.
Positive (+)	Beneficial impact.
Negative (-)	Deleterious or adverse impact.
Neutral (/)	Impact is neither beneficial nor adverse.
It is important to note that the status of an impact is assigned based on the status quo – i.e. should the project not proceed. Therefore not all negative impacts are equally significant.	

7 ENVIRONMENTAL MANAGEMENT PROGRAMME

Findings and recommendations for construction as well as operational measures as outlined in Table 7 will be incorporated into the EMPr.

8 ASSUMPTIONS AND LIMITATIONS

The work undertaken for the waste impact assessment was based on information supplied by the client and information obtained from past experience as well as from legislation, guidelines etc. In some areas assumptions were used based on best available information. Noting that this assessment is an initial phase of the project, special attention was given to the provision of mitigation and EMPr measures, so as to protect the environment and conform to legislative and regulatory provisions.

9 CONCLUSION AND RECOMMENDATION

This Waste Impact Report aimed to identify and evaluate the potential impacts as a result of waste generation associated with all aspects of the proposed project. The legislative underpinnings and key management strategies relate to pollution prevention, waste minimisation, adoption of the precautionary principle, proper waste management, cradle to grave analysis and management and all measures that are protective of human health and the environment. This report comprises strategies and measures directed at the containment, re-use and safe disposal of CSP system waste streams.

The beneficial and adverse impacts were systematically evaluated, the requirements and benefits derivable from this project has been assessed as part of a larger process – the EIA.

Furthermore, to ensure that the required mitigation measures are implemented, it is recommended that an EMPr be compiled for the project, and attached to the final EIA Report, in order to transfer the findings of the environmental studies into practical measures. This EMPr should form part of the contract for the construction and operation of the proposed project. It is recommended that the monitoring, analysis and reporting for the various process and effluent streams continue so that there is an adequate database of objective information to fully comprehend the impact of the proposed development.