



SOLA FIDEI MANUFACTURING

Sasol Synfuels Sludge Composting

Commercial Proposal

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Project Number	Version	Date	Prepared by	Modification
2012	4	08/07/2012	P Swartz	Final

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1 SFM INTRODUCTION

1.1 Background and Introduction

The specific approach and information contained within this proposal is regarded sensitive and is not to be distributed. We trust that Sasol will treat the information as confidential.

With pressure building globally regarding environmental awareness and protection it has become a major focus and we need to evaluate and adapt strategies to remain competitive and viable on a continuous basis. The needs for an environmental friendly approach as well as, rejuvenation and protection of soil, water and other natural resources are only some of the challenges facing the industry. It was in this context that Sola Fidei Manufacturing introduced itself to the industry.

Sola Fidei Manufacturing approached ChemCity to explore an opportunity to manage a waste stream ("bio sludge") through compostation for Sasol Infrachem in Sasolburg and Sasol Synfuels and Sastech in Secunda, as an alternative to other technical solutions identified for this currently stockpiled and incinerated material. ChemCity-incubated SME Sola Fidei Manufacturing conducted a trial on a 33 ton sample of bio sludge to determine the quality of the resulting product. Based upon the results Sola Fidei manufacturing decided to generate a business case for the opportunity.

This document outlines the results of that trial, a business proposal for full-scale operations, and a recommendation for a 12-month larger-scale pilot to demonstrate sustainability of the business model.

1.2 Scope of this Document

A brief overview of the document is provided here to assist the reader to locate the information that she/he requires:

This proposal consists of 7 Chapters and an Appendix, including:

- Chapter 1 gives an introduction to the Sola Fidei Manufacturing proposal.
- The project team and their experience are described in chapter 2.
- Sasol ChemCity support and involvement is described in chapter 3.
- Chapter 4 gives an overview of the scope of work, challenges and findings of the initial study.
- The sludge composting proposal is discussed in chapter 5.
- The impact of the project on different areas are described in chapter 6. These areas include job creation, environmental, capex and final product applications.
- Chapter 7 gives a final statement and signature on the proposed tender
- Appendix A containing the interim proposal is attached in chapter 8

2 SFM PROJECT TEAM

2.1 Team Members

An experienced team with knowledge of the production and manufacturing of compost related products was selected for the purpose of this project. The following table illustrates the role/s and competencies of each:

TEAM MEMBER	COMPETENCIES AND RESPONSIBILITIES
Pieter Swartz	Client and Project Manager
MJ Els	Operational manager
Dr Linda Mayer	Microbiologist
Dr Arrie Janse van Vuuren	Soil Science Consultants
Prof Andries Claassens	Soil Science Consultants
Mills and Otten	Environmental Consultants

2.2 Experience and Capacity

2.2.1 Multi-Disciplinary Skills

The SFM team has the relevant experience, organisational skills and support infrastructure to execute a project of this nature successfully. Together the following multi-disciplinary skills are shared:

- Project management and co-ordination;
- Client relations
- Drafting of specifications;
- Administration and supervision;
- Process knowledge

2.2.2 Project Management Skills

Sola Fidei Manufacturing has been involved with the management and co-ordination of projects and programmes by means of our project management functions. The project management inter alia focuses on achievements of the overall project vision and objectives as prescribed by the client and contained in constitutional, legal and policy frameworks in terms of:

- Scope of work;
- Quality;
- Quantity;
- Risk Management;
- Financial Performance; and
- Contribution to Equity Performance.

Our experience in this field is depicted in the various successful appointments.

2.2.3 Capacity and Support Network

Currently Sola Fidei Manufacturing offices are in Sasolburg and will therefore be able to speedily and effectively communicate and deliver to the different Sasol divisions.

Should we be successful with the proposal we will establish a dedicated office in Secunda to ensure fast and efficient service delivery. This office will be equipped with necessary tools and capable staff for the execution of the project.

2.3 Consultants

2.3.1 Multi-Disciplinary Plant & Soil Consultants

(PhD (Soil Science). Pr.Sci.Nat. (Soil Science). SACNP Reg. No. 401598/83)

Dr Janse van Vuuren and Prof Andries Claassens are the directors of Multidisciplinary Plant and Soil Consultants Pty (Ltd), trading as “Greenhouse trial and Research Centre”,

Greenhouse trial and Research Centre specialize in pot-trials done under controlled climatic conditions to evaluate the efficacy of fertilizers, soil conditioners, plant growth enhancers, inoculants and stimulant products for use in Agriculture, Horticulture, Reclamation and Rehabilitation.

He was also a member of the non-affiliated working committee involved in standardization of soil analytical methods – produced “Handbook of standard soil testing methods for advisory purposes”.

2.3.2 Mills and Otten

Mills & Otten is a specialist, independent environmental consulting firm. It offers a full range of environmental services, including environmental impact assessments, waste management, pollution monitoring, environmental auditing and geotechnical investigations.

The firm was established in 1992 by engineering geologist, Charles Mills and Kirsten Otten an environmental scientist, who joined forces to create a company focused on helping clients with environmental challenges.

Both partners have substantial experience in environmental consulting, and work with an extensive network of legal, engineering, biological and geohydrological associates.

The firm has been involved in more than 1250 projects of varying scale and complexity throughout Southern Africa

3 SASOL CHEMCITY SUPPORT

Sola Fidei Manufacturing started its operations with the support and guidance from Sasol ChemCity. They have since formed an integral part of our decision making process and their value and experience is highly valued.

Sasol Business Ventures is Sasol's enterprise development vehicle, responsible for incubating small and medium enterprises (SME's) in the energy, chemical and related industries. With a myriad of focus areas and a wealth of knowledge, potential entrepreneurs are supported with their ideas from concept development to commercial phase. Sasol Business Ventures agricultural focus group supports innovative technology and niche markets in the agricultural industry, whilst simultaneously creating sustainable jobs.

Sasol Business Ventures Agriculture & Liquid Chemicals focus group helps local SMEs in the agriculture industry, focusing on crop and niche product-to-market development opportunities, with a strong drive towards local manufacture.

Through collaboration with Sasol Nitro, Sasol Business Ventures develops technologies for the agricultural industry. This creates sustainable jobs and strengthens local industry.

Some of the Agriculture & Liquid Chemicals focus group's latest projects include:

- green energy crop development
- food colourant extraction
- alternative casing soils
- Tree Lucerne
- carbon catalyst soil conditioners
- enriched organic and biologically enriched compost

4 SCOPE OF WORK: SLUDGE COMPOSTATION

The uniqueness of our microorganism rich compost is based upon the following principles:

Well-balanced compost delivers the right amount of nutrients for the plant and microorganisms. This ensures firstly the carbon activation of the soil through repopulation of the beneficial microorganisms. It also ensures the available nutrients are plant available, in the right form, for the plant to take up efficiently. All mineralized plant nutrients e.g. phosphorous, are made plant available through time by the microorganisms and therefore they contribute to the rejuvenation of the soil. To drive this process, the compost must also have enough accessible carbon to sustain the microorganisms. Anaerobic processes make plant accessible carbon. Therefore it is important to add material from an anaerobic source to ensure enough carbon for the process to initialize.

Microbial activity in the soil is what actually what feeds the plant or changes chemical elements in the soil to be bio-available. They also store elements into their cells and when they die off return these elements back in the soil. Basically the higher the level of micro-organism present in the soil, the healthier the soil is, resulting in higher plant yields and healthier plants. To put it simply, they bring elements to the plant in exchange for sugars/acids.

4.1 Secunda Bio Sludge Compostation: Feasibility Study

A Feasibility study was initiated to evaluate the viability of manufacturing organic compost from bio sludge in an effort to develop a solution which is economically viable and environmentally compliant.

4.1.1 Secunda Bio Sludge Trial

During February 2012 an initial 33 m³ of bio sludge was collected from the Sasol Synfuels bio works located in Secunda. The bio sludge was obtained post centrifugation and had a solids content of ca. 13%. The sludge was pumped into 1t iso-Containers and transported to the Sasolburg facility. The sludge was divided into 4 different windrows each with its own blending ratios described in Table 1. The bio sludge was absorbed onto a grass bed immediately upon discharge - within a plastic lined area. The sludge mixes were composted using additional virgin bio-matter as bulking agent to evaluate the effectiveness of a unique microbial strain contained within some of the bulking materials.

Information received from the project team stated that the Sasol Synfuels operations in Secunda produce ca. 19 440m³ of bio sludge per month (Bio sludge feed at 15% solids. This relates to a feed of 27 ton/hour (19 440 ton/month).

4.1.2 Composting Process

The Sasol Synfuels bio sludge was divided into 4 windrows each with its own bulking material mixing ratio thus providing a dilution effect to determine the optimal dilution ratio for legal compliance according to legislation. Bulking material consisted of a mixture of three (3) different sources of virgin bio-matter. (Grass, animal waste and our unique strain of microorganisms)

TABLE 1. The following table shows the different mixing ratios used on the different windrows.

Secunda Compostation Trial Run						
Wind Row	Compostation Ratio:	Sasol Secunda Sludge (T)	Bulking Material (T)			
			Total:	Type 1	Type 2	Type 3
Row 1	1 : 3	7.5	22.5	4.5	17.5	0.5
Row 2	1 : 2	7.5	15	2.5	12	0.5
Row 3	1 : 1	7.5	7.5	1	5.5	1
Row 4	1 : 0.5	7.5	3.75	0.75	2	1

Each windrow was composted for a period of 12 weeks while being monitored on a daily basis. Temperatures were monitored to determine row-turning intervals as well as the need for moisture and micro-organism additions. The process proved to be easily controlled as temperatures were obtained within the desired range and timeframes and composted with the same ease as traditional-type compost produced from plant derived materials only.

4.2 Challenges

4.2.1 Sludge Classification

THE GUIDELINES FOR THE UTILIZATION AND DISPOSAL OF WASTEWATER SLUDGE (VOL. 2 OF 5) was used for classification of the untreated sludge.

Three parameters had to be determined. The *faecal coliforms* were determined using the MPN method. The heavy metal content was determined by Aqua Regia extraction. The third parameter, stability, was determined by comparison to the nine stability options as outlined by the WRC (Guidelines for the Utilization and Disposal of Wastewater Sludge, Table 1, Volume 1 of 5, Pg. 24).

Using the above mentioned guidelines it was concluded that the untreated bio sludge from the Synfuels bio works was classified as a type **B2b**. The classification was acknowledged and agreed to by Sastech (Dr Karl Heinz Riedel) as well as independent Environmental Partners from Mills & Otten.

Microbiological quality, stability, but especially heavy metal concentrations contributed to the B2b classification. Lab results showed although some other heavy metals may be an issue it is primarily the Selenium concentration that is a matter of concern.

Table 2. The lab results done on the raw unprocessed sludge showed the following measurements issues on each of the parameters:

Parameter	Legislation		Raw Sludge	
	LCT0 mg/l	TCT0 mg/kg	LCT mg/l	TCT mg/kg
Faecal Coliforms:				
Faecal Coliform	N/A	10000	N/A	27500
Helminth Ova	N/A	1	N/A	>4
Heavy Metal Content:				
Se, Selenium	0.5	50	<0.024	394

4.2.2 Water Content and Odours

The bio sludge as received was extremely wet (solids content of 13.26%) and preparation was done to ensure that the material did not spill. To prevent contamination of the environment, the sludge was blended with grass on a plastic lining in the test area. No additional water was added during the start-up process as excessive moisture first needed to be absorbed and evaporated.

The bio sludge odour was above that of normal composting bio material such as grass and animal waste but started to subside to normal levels after 7 to 10 days. The final product odour was in line with normal commercial compost, representing an odour reminiscent to that of wet clay-soil.

4.2.3 Final Product Classification

THE GUIDELINES FOR THE UTILIZATION AND DISPOSAL OF WASTEWATER SLUDGE (VOL. 2 OF 5) was again used for classification of the end product (Agricultural Compost).

It is anticipated using Sasolburg compostation data as a basis that the composted final product will fall within the parameters for classification as a type **A1a** product that can be used on agricultural land without restrictions and with the minimum management practices. (Outstanding values: Faecal Coliform and Helminth Ova Expected date for results 20/07/2012) The classification was acknowledged by Multi-Disciplinary Plant & Soil Consultants, specifically Dr Arrie Janse van Vuuren, who also consults to the Registrar for registration of fertilizers, composts, soil and growth enhancers, under the auspices of ARTICLE 39.

4.3 Classification and Application

4.3.1 Environmental Regulations

The Sasol Synfuels activated sludge basins treat both domestic effluent and effluent from the Sasol plants (i.e. a chemical sewer) and the resultant sludge has been classified as B2b (according to the GUIDELINE FOR UTILISATION AND DISPOSAL OF WASTEWATER SLUDGE – WRC TT262/06). Once the sludge is composted it has been classified as A1a, suitable for agricultural use as a fertilizer at the maximum rate of 8 tons/Ha/annum.

Requirements for the Handling, Classification and Disposal of Hazardous Waste (2nd Edition, 1998; Department of water Affairs and Forestry) prior to the Regulations taking effect states that the concentration of Selenium must be below 50mg/kg, which has been achieved. However, should the fertilizer be sold for commercial use, the FERTILIZER ACT (NO. 36 OF 1947) has a more stringent requirement and the Selenium concentration may not exceed 15mg/kg.

The raw bio sludge has a selenium concentration varying between 180mg/kg and 400mg/kg. After composting the selenium concentration in the compost was below 50mg/kg (but not below 15mg/kg). This is primarily due to the dilution effect observed by the addition of the bulking materials.

From the guideline it can be determined that the application rate of the sludge and maximum parameter concentrations are the critical factors, i.e. a maximum concentration of 50mg/kg at an application rate of 8 tons/Ha/annum. Therefore should the concentration exceed the Fertilizer Act concentration of 15mg/kg, a lesser application rate would result in the same loading on the soil.

It is also recommended that the composting operation must be undertaken on a hard standing area so that no liquid (either contaminated rain water or leachate) can

percolate into the ground and cause contamination of the soil or groundwater. This hard standing area should be gently inclined to ensure all run-off is captured in a sump and the water either re-used in the process or discharged to sewer (depending on quality).

This requirement will ensure that the duty of care is being demonstrated by the operator.

For the full scale operation, a waste license will be required to be applied for and this will include a detailed scoping EIA process. This application would be handled by the National Department of Environment Affairs, the responsible authority for all hazardous waste applications.

4.3.2 Compost Regulations

The final compost analysis was sent to independent soil fertilizer consultants (Soil Science Consultants) for evaluation and classification under the different environmental and fertilizer regulations.

From the final analyses report only two elements were of concern, namely Selenium and Nitrate-Nitrogen:

- Selenium Leachable Concentration Threshold (actual) 0.034mg/l (LCT0 0.5 mg/l) and Total Concentration Threshold (actual) 34mg/kg (TCT0 mg/kg (N/A!)).
- Nitrate-N Leachable Concentration Threshold (actual) 1732mg/l (LCT0 300 mg/l) and Total Concentration Threshold (actual) 34640mg/kg (TCT0 mg/kg (N/A!)).

The results were analysed firstly according to the NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT OF 2008 (ACT NO. 59 OF 2008) and also the FERTILIZERS, FARM FEEDS, AGRICULTURAL REMEDIES AND STOCK REMEDIES ACT 36 OF 1947 AS AMENDED.

4.3.2.1 NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT, 2008 (ACT NO. 59 OF 2008)

The draft standard for assessment of waste for landfill disposal under section 7(1)(a) and 7(1)(c) was used (Composted sludge).

Table 3. The following LCT and TCT Threshold Values are proposed:

Metal Ion Contaminants	LCTi mg/l	TCTi mg/kg	LCT0 mg/l	TCT0 mg/kg	LCT1 mg/l	TCT1 mg/kg	LCT2 mg/l	TCT2 mg/kg
Se, Selenium	0.01	10	0.5	50	1	50	4	200
Secunda Sludge Actual			0.034	34				
Inorganic Anions								
NO3 as N, Nitrate-N	6	N/A	300	N/A	600	N/A	2400	N/A
Secunda Sludge Actual			1732	N/A			1732	

- $LC > LCT2$ or $TC > TCT2$ are Type 1: Very High Risk Wastes;
- $LCT1 < LC < LCT2$ or $TCT1 < TC < TCT2$ are Type 2: High Risk Wastes;
- $LC > LCTO < LCT1$ or $TC < TCT1$: Moderate Risk Wastes;
- $TC < 20x LCTO$ or $LC < LCTO$ and $TC < TCTO$ are Type 4: Low Risk Wastes

LCTi values for metal ions are the drinking water quality standard.

Findings on **Selenium** from Secunda composted sludge are as follows - Low Risk with proper control and on-going management to protect health and the environment. Soil analyses will be done on the receiving soil as to ensure no contamination.

4.3.2.2 **FERTILIZERS, FARM FEEDS, AGRICULTURAL REMEDIES AND STOCK REMEDIES ACT 36 OF 1947 AS AMENDED.**

The above mentioned Act was used for the classification of composted sewage sludge to be used or disposed of on land.

Fertilizer Act 36 of 1947 requires composted sludge to comply with the following quality requirements:

- Stabilised- should not cause odour nuisance of fly-breeding
- Contains no visible *Ascaris ova* per 10g dry sludge (compost)
- Maximum *Salmonella* organisms per 10g dry sludge
- Maximum 1000 *Faecal coliform* per 10g dry sludge immediately after treatment
- Maximum metal and inorganic content in mg/kg dry sludge

Table 4. The following table shows the Selenium volumes (mg/kg) allowed by the Fertilizer act:

Available	Availability (by TLCP method)	*1 Total
Selenium		15

The following actions need to be monitored and conveyed during the management process:

User must be informed about the moisture and NPK content

- User must be warned that not more than 8t/ha/Year (or 8kg/10sqm) (dry sludge) may be applied to soil and that the pH of the soil should preferably be higher than 6.5
- *1 TCLP Toxic Characteristic Leaching Procedure

4.3.2.3 **Application potential**

Based on the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act 36 of 1947 the following application ratio can be performed:

3ton/ha/year of the Synfuels sludge can be applied to agricultural land on a continued basis.

Applying **3 ton/ha/year** of the composted Sasol Synfuels bio sludge:

- This would be applying 102mg/kg Se/year compared to 120mg/kg from the 8ton/year which is allowed.
- The Nitrate Nitrogen translates to 103.92 kg/ha Nitrogen (34640mg/kg) which is the amount of Nitrogen normally applied annually to crops.

Both the Selenium and Nitrate Nitrogen concentrations found in the Secunda Sludge pose no threat to either crop or environment. The classification was acknowledged by Multi-Disciplinary Plant & Soil Consultants, independent soil science consultants.

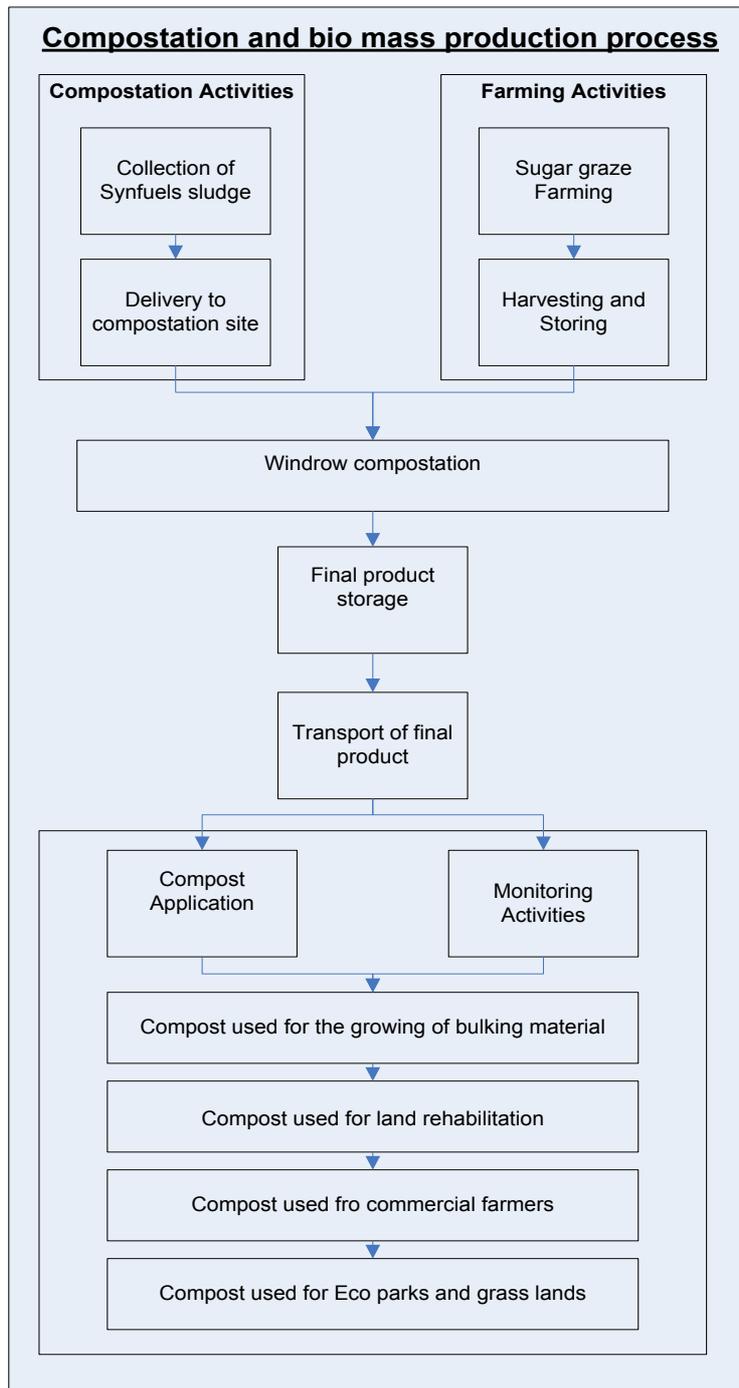
5 PROPOSALS

5.1 Compostation and bio mass production process

The proposal consists of various tasks and actions of which all is proposed to be performed by SFM and its partners.

The operational environment can be divided into three primary activities, namely the compostation activities, bulking material farming activities and then the compost application and monitoring activities. The following chapter will give a breakdown of each of the mentioned activities.

Diagram A:



5.1.1 Compostation Activities

5.1.1.1 Basic Compostation Equipment

SFM will provide all the equipment necessary to do compostation for Sasol Synfuels during the commercial phase and there is no need to budget for additional capex during this phase.

Table 5. The basic equipment provided by SFM needed to run the compostation facility will consist of the following:

SFM EQUIPMENT		
Item	# Units	Description
Compost Turner	3	Used to aerate and mix compost
Tractor	3	Power compost turner and wagons
Load Waggon	2	Used to transport bio matter and compost
Water Wagon	2	Used for transport and application of water
Front End Loader	3	Loading of bio matter and compost

5.1.1.2 Collection of Synfuels sludge

SFM will provide 1 dedicated truck to transport the bio sludge from the Synfuels site to the dedicated compostation site. Please note that SFM have planned for contingencies in the case of a breakdown. Based on the proposed 6500 tons of bio sludge to be composted the amount of trips will be:

- 189 trips per month.
- 7 trips per day
- Leaving 3.5 hours per trip if we can work on a 24 hour basis

Note: It is assumed that the allocated compostation site will be within 5 km from the collection point.

5.1.1.3 Delivery to compostation site

A sample of each batch (truckload) will be taken on arrival. This will then be used to compile a monthly composite sample to be sent to the lab for testing according to the testing schedule.

The sludge load will then be added to the bulking material in the pre composting area for absorption. **(1 hectare lined area)**

The absorption area will be lined with reinforced concrete with a 5 degree slope and a containment area. Sludge collected in this area will be pumped back onto the absorption material.

After two days the absorbed sludge will be added to the designated windrows where the compostation process can start. **(10 hectare area)** Current EIA information shows that this area does not require lining.

All capex needed for the site preparation and construction is included in the SFM proposal.

5.1.1.4 Windrow compostation

The Synfuels bio sludge is placed in a windrow and mixed with the bulking material provided by SFM. Bulking material will consist of the following:

- Sugar graze harvested for bulking material
- SFM might add different tested organic bulking material should it become available and prove to be effective.

The processed will be monitored on a daily basis. Based on these findings operational decisions will be made regarding turning frequency, water addition and the addition of additional microorganisms. This process will be well documented as to ensure that any variances in the final product can be traced.

5.1.1.5 Final product storage

Once the compost has met all the criteria set by SFM to ensure that the final product confirms to the set legislation samples will be taken from the final composted product and added to the monthly composite sample to be sent to the lab as per the testing schedule.

On conformation that the windrow complies the row will be transferred to the bulk storage area were the different approved composted windrows will be added to storage heaps. This will slow down the compostation process and allow for the final product to cure before application starts.

5.1.2 Farming Activities

5.1.2.1 Basic Farming Equipment

The following is a list containing some of the major equipment that will be used in the farming operations.

Biotech Farming will provide all equipment needed to do the farming activities for Sasol Synfuels during the commercial phase and there is no need to budget for additional capex during this phase.

Table 6. The basic equipment provided by SFM to perform all farming activities will consist of the following:

Farming Equipment		
Item	# Units	Description
Large Tractor	3	Used for large scale agri activities
Medium Tractors	6	Used for large scale agri activities
Medium to Small Tractors	4	Used for large scale agri activities
Self-Propelled Sprayer	2	Used to spray pesticides
Planters	6	Used for planting of crops
Primary Tillage	6	Needed for land preparation
Combines	2	Harvesting of crop
Tip Waggons	11	Transport of crop
Flatbed waggons	3	Transport of fertilizer etc.
Water waggons	3	Transportation of water to site
Truck with link	1	Transport of final product for distribution
Front end loader	2	loading of material
Compost Spreader	4	Spreading of compost onto soil

5.1.2.2 **Land allocation**

The farming activities will be done on the Sasol land available in the surrounding area. This farm land will consist of the following:

- Land already converted to agricultural land
- Land currently under rehabilitation
- And land forming a buffer zone around the different Sasol activities.

The discussions regarding available land were held between Sasol Mining (Mr Hennie Schoeman) and SFM and concluded that there is a minimum of 3000 hectares in the area available for the planting of bulking material.

Some of the land is currently leased to commercial farmers in the area and sufficient notice (**2 years**) will have to be given as to ensure that the good relationship between them and Sasol be maintained. SFM's strategy makes provision to ensure that no current jobs are put at risk and that there will be a healthy crop rotation strategy as per good farming practices.

Final clarification regarding the process to be followed can only be obtained once Sasol Synfuels has made a decision regarding the viability of the SFM proposal.

5.1.2.3 **Sugar graze Farming**

All the activities regarding the planting and harvesting of the Sugar graze needed as bulking material for the compostation process will be managed by Bio Tech Farming an affiliate of SFM. All equipment needed to perform these activities will also be provided by Biotech Farming.

The daily activities and operations will be based on the practices of good and sustainable farming.

5.1.2.4 **Harvesting and Storing**

Due to the restricted seasonal rainfall and harsh winter climate of the Secunda area, harvesting will be done during the months of January to March depending on the approach followed by Biotech Farming. This will result in the temporary storage of the bulking material to be distributed and used throughout the year.

The storage of the Sugar graze will be done in accordance with normal farming practices. SFM will prefer to allocate an area adjoining the compostation area as to eliminate unnecessary transportation of the bulking material.

Front end loaders will add the bulking material to the windrows.

5.1.3 **Compost Application and Monitoring Activities**

The final composted product will be distributed to the different areas as indicated below throughout the year:

- Fertilizer used for the growing of bulking material (SFM)
- Land Rehabilitation (Sasol Mining)
- Ash dump rehabilitation (Sasol Synfuels)
- Fertilizer for all grass land (Sasol Group)
- Fertilizer for eco parks (Sasol Group)
- Fertilizer for commercial farmers in Secunda area
- **Fertilizer for small farmers in and around Secunda area.**

Biotech Farming will provide all equipment needed to do the compost application and monitoring of soil conditions for Sasol Synfuels during the commercial phase and there is no need to budget for additional capex during this phase.

The total land needed to distribute fertilizer to on a yearly basis is 20 000 hectares. The compost will be transported to the assigned land and spread using a compost spreader to the indicated load level of 3 ton/ha/year.

The current land available to Sasol for the application of compost as fertilizer is 9 000 hectares. (To be confirmed) The additional compost will be distributed to commercial farmers and town parks. This process will be managed and controlled by Biotech Farming who has existing relationships with farmers in the area.

SFM will also manage and perform regular soil and plant tests to ensure that all the mentioned regulations are adhered to.

5.2 Commercial Phase

5.2.1 Sasol Synfuels Site – Commercial Phase

Compostation at the Sasol Synfuels site will only commence after the area has been lined and prepared according to the Waste act regulations and an EIA has been obtained.

Preparation requires clearing of the designated area, lining and fencing of the area as well as the provision of water and electricity to the compostation site.

The ideal size of land required would be in the region of 5 hectares.

SFM will provide all the equipment needed to run the direct composting operations on site as well as the farming operations needed to plant, grow and harvest the proposed bulking material.

5.2.2 Challenges

5.2.2.1 Sludge Volumes

Table 7. The following is actual volumes of sludge available for compostation:

Total Synfuels sludge volumes for compostation						
Sludge Volumes		Bulking Material Needed			Total T composted per year	Final Product T
Solids	T per month	Dilution Ratio	T per month	Ton per year		
15%	19440	1	19440	233280	466560	186624

We believe that only **32.15%** of the available volumes can be composted as to ensure that we can guarantee the provision of the necessary bulking material as well as distribute and apply the final product according to specification.

Based upon the information received regarding land availability for bulking material growth as well as the legal application ratio of the final product the following is proposed as a workable solution for compostation:

Table 8.

Proposed Synfuels sludge volumes to be composted (32.15%)						
Sludge Volumes		Bulking Material Needed			Total T composted per year	Final Product T
Solids	T per month	Dilution Ratio	T per month	T per year		
15%	6250	1	6250	75000	149999	60000

SFM bases its commercial proposal on the figures as mentioned in Table 8.

5.2.2.2 Land availability in Secunda

SFM together with Sasol ChemCity made contact with Sasol Mining regarding the use of Sasol owned land for the mentioned farming and compostation activities. The preliminary studies show that there are 3000 hectares of land available to perform these tasks on.

Some of the land is currently leased to commercial farmers in the area and sufficient notice (**2 years**) will have to be given to them as to ensure that the good relationship between them and Sasol be maintained.

Please note that this process will have to be finalized between Sasol Synfuels and Sasol Mining as soon as the direction of the project is clear.

5.2.2.3 Logistics – Road vs Conveyer

Although sufficient Sasol owned land is available within a 5 km radius from the Sasol waste water plant the amount of additional traffic in and out of the Secunda site will have to be taken into consideration and planned for.

The inbound and outbound movement will result in **189** trucks entering and exiting the Sasol site per month.

A conveyer belt option might prove to be cost efficient with the benefit of taking pressure off the operational environment as well as reduce gate traffic.

5.2.3 Benefits and Deliverables

5.2.3.1 Benefits of This Option

- Compostation is done on a Sasol site thereby eliminating unnecessary transport cost.

5.2.3.2 SFM Deliverables:

- Processing 6250 T per month of bio sludge material as received from the Sasol Synfuels bio works (post centrifugation @ ca. 15% solids).
- Samples to be taken of each raw bio sludge batch collected to prepare a monthly composite sample, for Laboratory Analyses.
- Samples to be taken of each composted batch to prepare a monthly composite sample, for Laboratory Analyses.
- Provision of bulking material for compostation of Sasol bio sludge as required with a maximum dilution ratio of 1 part bulking material to 1 part Sasol bio sludge.
- Composting of the bio sludge and bulking material to produce a fully compliant end product (A1a).
- Stock piling product for redistribution for internal soil rehabilitation and fertilizing.
- Identified additional potential outlets: Non Commercial – Agricultural and Soil rejuvenation.
- Management, monitoring and documentation of process and results

5.2.3.3 Sasol Synfuels Deliverables:

- Sasol Synfuels to extract the bio sludge with a solid content of between 10% and 15%.

5.2.4 Monitoring Program

Table 9. Lab tests will be done based on the following monitoring program:

Lab Analyses Schedule			
Month	Pre Compostation	Post Compostation	
	Heavy metal composite sample	Faecal coliforms composite sample	Heavy metal composite sample
1	Full	Yes	Full
2	Selenium	Yes	Selenium
3	Selenium	Yes	Selenium
4	Selenium	Yes	Selenium
5	Full	Yes	Full
6	Selenium	Yes	Selenium
7	Selenium	Yes	Selenium
9	Selenium	Yes	Selenium
10	Full	Yes	Full
11	Selenium	Yes	Selenium
12	Selenium	Yes	Selenium

5.2.5 Cost Breakdown

This pricing structure is based on a long term contract (minimum 5 years), between Sasol Synfuels and SFM for the compostation of Sasol bio waste.

5.2.5.1 Pricing Structure: Sasol Synfuels Bio Sludge Commercial Phase

Table 10.

6250		T per Month (15 % Solids)			
Description	#	Units	Cost	Total	Grand Total
Management and labour	1	1	R 414 000.00	R 414 000.00	R 414 000.00
Site Preparation	1	1	R 188 000.00	R 188 000.00	R 188 000.00
Analysis	1	2	R 25 000.00	R 50 000.00	R 50 000.00
Diesel	1	50000	R 13.00	R 650 000.00	R 650 000.00
Safety	1	60	R 400.00	R 24 000.00	R 24 000.00
Transport Cost	189	15	R 22.00	R 330.00	R 62 370.00
Planting Cost	1	6 250	R 270.00	R 1 687 500.00	R 1 687 500.00
Maintenance	1	3	R 10 000.00	R 30 000.00	R 30 000.00
Office Cost	1	4	R 3 000.00	R 12 000.00	R 12 000.00
Equipment Cost	1	1	R 780 000.00	R 780 000.00	R 780 000.00
Total:					R 3 897 870.00
Mark-up:				10%	R 389 787.00
Cost to Client					R 4 287 657.00
Cost per ton sludge reworked				6 250	R 686.03
% of original Sludge feed stream at 15% Solids				32.15%	

- Values are VAT exclusive.
- The costing provided includes **all** costs to provide the full solution as proposed.

5.2.6 Potential value add

5.2.6.1 Sasol Nitro liquid fertilizer

Sola Fidei Manufacturing believe that a waste stream of Sasol Nitro can be used to reduce the input cost of planting bulking material bringing the cost per sludge reworked down to **R600.00 per Ton**. This option is currently being investigated and results will be updated as they become available. Note: This product is currently being made available to farmers at no charge

5.2.6.2 Municipal Bulking Material

Any usable additional bio matter for example municipal garden waste (grass/branches and leaves) and agricultural grass bales could be added to the process for further dilution. This will reduce the amount of bulking material grown with a cost reduction impact. The impact can only be determined after 1 year to determine the true annual volumes available.

5.2.7 Pricing increases

Please note that the pricing structures provided in the attachments are fixed for a period of **12 months**.

Pricing will be reviewed on a yearly bases linked to inflation.

6 PROJECT IMPACT

6.1 Job Creation

The compostation project will have a significant impact on job creation in the Secunda area as this will be a new operation that will train and employ local people to perform the tasks at hand.

During the full commercial phase (15% solids) the following permanent jobs will be created performing the compostation activities as well as the bulking material production activities:

Position	Description	Quantity
General Manager	Manage operations and activities	2
Farming Manager	Oversee daily farming activities	3
Farming Forman	Manage daily farming activities	3
Senior Farmer	Responsible for equipment	8
Junior Farmer	Daily farming activities	16
Operational manager	Oversee daily operational activities	2
Driver / Process Controller	Drive Equipment	8
Process Controller	Perform daily compostation tasks	12
Total:		54

An additional **20 temporary** jobs will also be created on a seasonal basis.

6.2 Environmental impact

Well-balanced compost delivers the right amount of nutrients for the plant and microorganisms. This ensures that firstly the carbon activation of the soil through repopulation of the beneficial microorganisms. It also ensures the available nutrients are plant available, in the right form, for the plant to take up efficiently. All mineralized plant nutrients e.g. phosphorous, is made plant available through time by the microorganisms and therefore rejuvenates the soil.

Micro-organism life is actually what feeds the plant or change chemical elements into plant feed. They also store elements into their bodies and when they die off produce these elements back into the soil. Basically the higher amounts of micro-organism present the healthier your soil. In a simple way they bring elements to the plant in exchange for sugars/acids.

The compostation of waste material within the legal framework provided by government provides for a healthy alternative to other disposal options.

6.3 **Municipal garden waste**

Any usable additional bio matter for example municipal garden waste (grass, branches and leaves) and agricultural grass bales could be added to the process for further dilution and aeration.

6.4 **Capex**

The proposal is structured in such a way that no Capex will be needed from Sasol to implement the compostation commercial phase as well as the farming operations and compost distribution and application. All the capex needed will be planned for and provided by SFM.

6.5 **Final Product Application and Benefit**

The final composted product will be used for the following three application areas based upon an application ratio within the legal limits as described in the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act 36 of 1947.

1. SFM bulking material production

- Fertilizer used for the growing of bulking material (SFM)

2. Sasol Rehabilitation and conservation activities

- Land Rehabilitation (Sasol Mining)
- Ash dump rehabilitation (Sasol Synfuels)
- Fertilizer for all grass land (Sasol Group)
- Fertilizer for eco parks (Sasol Group)

3. Agricultural Fertilizer

- Fertilizer for commercial farmers in Secunda area
- Fertilizer for small farmers in and around Secunda area.

6.6 **Carbon Credits**

SFM is currently waiting for feedback from Promethium Carbon regarding the possibility to carbon credits. SFM decided to do this study as we believe that the proposal might have a significant Carbon credit value. This information can be made available during the final stages.

6.7 **Black Economic Empowerment**

Sola Fidei Manufacturing's approach to Black Economic Empowerment is that the cornerstone of successful BEE business practices is participation in the process by all personnel, financial viability of the business involved, transfer of skills, partnership between traditional and well established business, understanding and managing the realities of an emerging business, clear understanding and agreement of the empowerment partner's role in and contribution to the business and continuously finding ways of being more competitive.

SFM is in the process of structuring a BBBEE strategy with the assistance of Sasol ChemCity to incorporate all of Sola Fidei Manufacturing's personnel in the decision making processes as well as benefit from the profit made within the organisation. It is our dream to educate and improve our employees to reach new levels and build confidence in them to start their own businesses.

7 CONCLUSION

All the prices quoted in the attachment is valid for a period of 2 (two) months from date of quotation.

Sola Fidei Manufacturing would like to thank Sasol for the opportunity to submit this proposal for the above mentioned sludge composting solution. We can assure you of our continued commitment and support with quality products and service.

We hereby also confirm that Mr PM Swartz is authorised to sign the proposal on behalf of SFM.

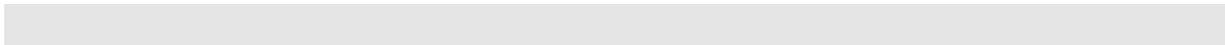
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MR PM Swartz

Date

For: Sola Fidei Manufacturing



8 Appendix A:

8.1 Intermediate Trial

The proposed phase will be done on a continues-batch process of 15 Tons per month of Secunda bio sludge. Ensuring that all the teething problems can be dealt with efficiently and that liaison with the relevant authorities can start (EIA), the process be documented and presented for final approval for commercialisation.

This trial allows for 15 Tons of sludge per month with a solid content of 15% or more to be moved to a new processing facility at the SFM site in Sasolburg. A dedicated area will be used for processing the Sasol sludge, as to enable close management and monitoring of the progress.

This will allow the process to continue under the EIA exemption of less than 15 T per month unprocessed hazardous material.

This phase will be run on a scaled down version of the expected full economic model. This will enable us to monitor the different conditions and variants throughout the bio sludge production cycle for a year as well as the variants in the different moisture ratios.

A fixed monthly monitoring program will be used to confirm the results received over this 1 year period with those from the trial run done during the feasibility study.

The process will be monitored and documented as to determine the viability and full economic impact required for the full commercial phase.

Please note: The process and costing model were designed according to the Secunda bio sludge compostation trials done by SFM and provision has been made for a variation of up to 10% for each metal ion, inorganic anion, organic and pesticide. Variations greater than the allowed 10% will require additional bio matter to ensure an appropriate compostation, hence a ratio step up.

Any additional bio material cost will be for the account of Sasol Synfuels. The monthly incoming sample analysis will indicate potential variations which will be communicated back to Sasol Synfuels for approval should the need be.

The Sasol Bio sludge compostation ratio will be based upon the following formula:

- 1 part Secunda bio sludge to 1 part bulking material

8.1.1 Environmental Regulations

In order to commence pilot scale trials of the composting, reference has been made to the WASTE ACT (NO. 59 OF 2008) for the listed activities that trigger the requirement of applying for a waste license. The assumption is made that the sludge is classified as hazardous waste.

It is understood that the pilot scale process would not involve the storage of any sludge.

The sludge would be transported in containers of 5000 litres and if temporary storage is required due to any form of delay or mechanical breakdown, the sludge will remain in the container for a short period of time. No further sludge would be collected and the volume of sludge to be stored could not exceed 20 000 litres (or

20m³). This would therefore not trigger the waste license requirements as the threshold is 35m³ for the storage of hazardous waste.

The composting of the sludge represents the treating of the waste as per activity Category B(4) : *“The biological, physical, or physico-chemical treatment of hazardous waste that has the capacity to receive in excess of 500kg of hazardous waste per day.”*

Therefore, should a pilot scale operation be proposed, the size of the facility must not exceed this threshold, i.e. not more than 500kg of waste per day should be accepted.

It is also recommended that the composting operation must be undertaken on a hard standing area so that no liquid (either contaminated rain water or leachate) can percolate into the ground and cause contamination of the soil or groundwater. This hard standing area should be gently inclined to ensure all run-off is captured in a sump and the water either re-used in the process or discharged to sewer (depending on quality).

This requirement will ensure that the duty of care is being demonstrated by the operator.

8.2 Value Add:

Drying of the bio sludge to a 40% solids state will also be done by SFM and different ratios tested to determine the correct dilution ratio as well as costing for a 40% solid solution.

8.2.1 SFM Site – Interim Trial

Compostation at the SFM site will only commence after the area has been lined and prepared according to the Waste act regulations.

Preparation requires clearing of the designated area as well as lining of the area to be exposed to the raw material.

The ideal size of land required is approximately 0.5 hectare.

SFM will provide the equipment needed to run the direct composting operations on site.

8.2.2 Benefits and Deliverables

8.2.2.1 Benefits of This Option

- Full analysis can be done on the samples taken every month for a year covering the full operational cycle.
- Sludge will be processed into 2 groups to determine feasibility and heavy metal build-up: 15% Solids and 40% Solids
- Drying of a portion of the bio sludge to a 40% solids state will be done by SFM.
- This phase will provide documentation and data for EIA application.
- Final costing can be done as to determine the viability of composting sludge with a solid content of 40%.

8.2.2.2 SFM Deliverables:

- Processing 15 ton/month of bio sludge from the Sasol Synfuels bio works.
- Samples to be taken of each raw bio sludge batch collected for Laboratory Analyses.
- Samples to be taken of each composted batch for Laboratory Analyses.
- Provision of planted organic bulking material for compostation of Sasol bio sludge as required with a maximum dilution ratio of 1 part bulking material to 1 part Sasol bio sludge.
- Composting of the bio sludge / bulking material to produce a fully compliant end product.
- Applying compost to land used for bulking material production trials to determine the precise need for additional fertilizer to ensure proper plant feeding.
- Management, monitoring and documentation of process and results

8.2.2.3 Sasol Synfuels Deliverables:

- Sasol Synfuels to extract the Secunda bio sludge with a solid content of between 10% to 15%.

8.2.3 Monitoring Program

The emphasis of this phase is to build a detailed report to assist in the application for an EIA and compost registration process for this reason we will do a full spectrum analysis on each batch received as to ensure that we have sufficient data should questions be asked.

Table 1. Lab tests will be done based on the following monitoring program:

Lab analyses schedule			
Batch	Pre compostation	Post compostation	
	Heavy metal	Faecal coliforms	Heavy metal
1	Full	Yes	Full
2	Full	Yes	Full
3	Full	Yes	Full
4	Full	Yes	Full
5	Full	Yes	Full
6	Full	Yes	Full
7	Full	Yes	Full
9	Full	Yes	Full
10	Full	Yes	Full
11	Full	Yes	Full
12	Full	Yes	Full

8.2.4 Cost Breakdown

This pricing structure is based on a short term contract (minimum 12 months), between Sasol Synfuels and Sola Fidei Manufacturing for the compostation of Sasol bio waste.

8.2.4.1 Pricing Structure: Sasol Secunda Synfuels Bio Sludge Pre Commercial Phase

Table 2.

Sasol Secunda Interim Proposal					
15	T per Month (15 % Solids)				
Description	#	Units	Cost	Total	Grand Total
Operational Cost	1	1	R 84 000.00	R 84 000.00	R 84 000.00
Analysis	1	2	R 25 000.00	R 50 000.00	R 50 000.00
Diesel:	1	1500	R 15.00	R 22 500.00	R 22 500.00
Safety	1	4	R 500.00	R 2 000.00	R 2 000.00
Transport Cost	1	400	R 22.00	R 8 800.00	R 8 800.00
Bio Mass	1	15	R 400.00	R 6 000.00	R 6 000.00
Office Cost	1	1	R 3 000.00	R 3 000.00	R 3 000.00
Equipment Rental	1	1	R 36 031.68	R 36 031.68	R 36 031.68
Total:					R 212 331.68
Mark-up:				12%	R 25 479.80
Cost to Client per month					R 237 811.48

- Values are VAT exclusive.

8.2.5 Equipment

SFM will provide all the equipment necessary to do compostation for Sasol Synfuels during intermediate trial run.

Table 3. The equipment will consist of the following:

SFM EQUIPMENT		
Item	# Units	Description
Compost Turner	1	Used to aerate and mix compost
Tractor	1	Power compost turner and wagons
Load Waggon	1	Used to transport bio matter and compost
Front End Loader	1	Loading of bio matter and compost