The Groundswell Composting Process.

The purpose of this document is to summarise the composting process being used by four NSW councils to transform their residential food and garden waste into a high quality, high nutrient, and biologically active composted product as part of the Groundswell project. Groundswell is a three year project which is rebuilding the rural-urban relationship by returning organic material from urban communities to farmland. The project is funded by the NSW Environment Trust Urban Sustainability Program.

As part of the Groundswell project, Goulburn Mulwaree, Lachlan, Queanbeyan City and Palerang Councils are introducing a City to Soil food scrap and garden waste collection to householders already receiving a council waste service. City to Soil provides the opportunity for councils to divert 50% - 70% of kerbside residual waste from the waste stream and transform it into a premium compost product.

Composting facilities have been established in Goulburn Mulwaree Council and Lachlan Council, with the combined Palerang / Queanbeyan composting site to follow soon. The new City to Soil collections are underway in Goulburn, Marulan and Condobolin. Food scraps and garden waste collected through the City to Soil collections are being composted using the no-shred / Vital Resource Management (VRM) activated process outlined below.

The City to Soil composting process has been designed to meet the following criteria:

- Require minimal new machinery or infrastructure
- Able to use existing landfill or farm machinery (eg small tractor with blade or front end loader)
- Able to operate in exposed sites with no power and minimal water
- Minimal labour and machinery requirement
- Simple process that can be managed by existing waste management or farm labour without expert composting knowledge.
- Able to operate consistently with seasonally variable feed stocks.
- Able to effectively manage concerns about putrescibles including odour, vermin and ibis.
- Produce the highest quality biologically active compost possible with zero physical contamination that meets agricultural market requirements.

Summary of Composting Process

The City to Soil feedstock of combined kitchen and garden waste creates some special opportunities and risks for successful composting. The higher nutrient and moisture levels present in the food scraps, combined with potentially challenging ingredients such as meat scraps provides a perfect feedstock to produce a microbe rich, high nutrient product if properly treated. The specifics of the VRM activated composting process (technically more of a fermentative process) are outlined below. In essence, the composting process has been developed for simplicity, cost effectiveness and efficiency while ensuring a premium compost product.

The composting process is attracting quite a bit of interest due to its low labour, plant and water requirements. The feedstock is not shredded prior to processing. This removes the requirement for shredding equipment on site. Additionally, the fermentative process reduces the number of turns to just once during the 8-12 week composting process. This results in a cheaper, cleaner end product with less physical contamination.

The project is also challenging assumptions that the processing of food is synonymous with vermin and odour issues and needs to occur indoors or in vessel.

Feedstock

The City-to-Soil feedstock includes source separated household kitchen and garden waste. All food scraps including meat, bones and fat are included.

Householders in participating towns have received vented 6 litre MaxAir kitchen top food scrap bins and a year's supply of compostable biobags. The biobags and MaxAir bins minimise odours by allowing the contents to breathe. When the biobags are full, they are tied closed and placed in the City to Soil 240L wheelie bin along with any garden waste.

In Goulburn Mulwaree the 240 litre wheelie bins are collected monthly, In Condobolin, the collection is fortnightly.

Stage 1: Picking

The first task in the composting process is to pick through the feedstock by hand to remove any physical contamination. A nice feature of the biobags is that they ensure the food scraps arrive at the processing site neatly contained and in an aerobic state. Even with a monthly collection

the bags are robust enough to remain intact during the collection and compaction process.

Typical contamination removed at this stage includes the odd bottle, can or plastic bag. Initially we were opening the bags to check for contamination however we quickly found that householders were particularly good and keeping their food scraps free of contamination. The biobags of food scraps go into the composting process intact.

Stage 2: Inoculating

Once any physical contamination is removed, the feedstock is sprayed with the VRM composting solution produced by Vital Resource Management (VRM Bio-Logik) using Effective Micro-organisms (EM®) and an appropriate amount of non or de chlorinated water, piled into windrows and covered with polytarps weighed down with tyres.

The composting inoculant is a combination of *VRM Starter Culture*® and *VRM Microbial Seeding Agent*®. The VRM *Starter Culture* and VRM *Microbial Seeding Agent* has been specifically selected to meet the feedstock requirements of a combined food and garden waste collection.

Dilution rates are 1 litre of starter culture and 1 litre of seeding agent in 10 litres of water for every 10 cubic meters of green waste. Both products should be diluted in water at the above rates prior to application. Ideally the composting solution should be applied under pressure using a full cone spray or atomiser (e.g. a yellow pressure nozzle) as exposure of the solution to oxygen kick-starts the oxidisation process which kick-starts the biological activity and the fine droplet size maximises surface coverage.

Broadly speaking the inoculants contain combinations of aerobic and anaerobic bacteria, special fungi and yeasts. The composting process is more accurately described as a fermentative process. Specific microbes are included that actively breakdown fats, meats and other difficult products that might challenge a conventional aerobic composting process. Within certain limits, the specific balance of carbon to nitrogen in the feedstock is not vital to the composting process because the inoculants contain both carbon fixing and nitrogen fixing bacteria.

Odour produced by sulphur reducing bacterial which predominate in conventional anaerobic processes is addressed by the inclusion of *purple non sulphur bacteria* in the inoculant mix. These bacteria consume the *sulphur reducing bacteria* and also compete for their food source. The *purple non sulphur bacteria* require anaerobic conditions to flourish and

out compete the sulphur reducing bacteria. Unlike the sulphur reducing bacteria, the purple non sulphur bacteria are inhibited by sunlight. Covering the piles helps to create the conditions for the *purple non sulphur bacteria* to flourish.

Collectively these composting solutions provide a range of significant advantages.

- Firstly the requirement to turn piles is reduced as the microbial population does not require ventilation.
- Secondly, carbon retention is considerably higher than in regular composting.
- Thirdly, the manufacturer suggests odour is greatly reduced and in most instances eliminated all together. We have found that there is no issue with odour at any stage of the composting process.
- Fourthly, the requirement to cover piles with polytarps significantly increases the thermal and moisture efficiency of the piles, reducing both water requirements and runoff.

Additional information on VRM EM® can be found here:
http://www.vrm.com.au/

The covered piles are left for four to six weeks. During the first day or two the temperature climbs to around 65 - 70 degrees as a flush of aerobic activity take place. By the end of the first week the temperature stabilises at around 50 – 55 degrees. This early aerobic flush of activity provides the first of two opportunities for pasteurisation. According to the AS 4454 standards, compost must reach and hold a temperature of 55 degrees for three days to achieved pasteurisation requirements. If the expected temperatures are achieved throughout the pile, the City to Soil composting process exceeds the pasteurisation requirements outlined in the standard.

In association with the stabilisation of temperature around 55 degrees, the ph level drops to around 3.5 -4.5 as the fermentative bacteria colonise the piles. The piles should remain quite wet, and the colour quickly changes to a uniform black colour. Additionally, *ray* fungi and *actinomyces* quickly start to infiltrate the piles and can be observed as grey filaments or powdery flakes. If these grey powdery flakes and filaments are predominating, it can be an indication that the pile is too dry, so check moisture levels and apply de or non chlorinated water as required.

Evidence of secondary composting processes can usually be observed on the outer surface of the piles where there is more oxygen and the temperature is cooler through the presence of slaters, native cockroaches and other larger soil biology.

Moisture levels during the fermentation process should fall no lower than 30% with an optimum moisture level of 80% where adequate leachate controls are in place.

Stage 3: Turning and Respraying

After 4 – 6 weeks, the piles are uncovered, spread and re examined to remove any physical contamination that might have been missed at the beginning of the process. By this stage the piles have slumped by about a third and the biobags, food scraps and smaller items have disappeared. Smaller pieces of contamination, as well as those that may have been enclosed in the biobags become easier to see as the compost has taken on a uniform texture and dark colour.

The compost is then mixed, resprayed, re-piled, recovered and left for another 4 to 6 week period. A similar early spike in temperature (around 65 – 70 degrees) followed by a longer period at around 50- 55 degrees and an associated ph level of 3.5 – 4.5 can be expected during the second fermentation stage. This provides the second opportunity for pasteurisation and ensures material that was previously on the outside of the pile has been reincorporated and processed.

Stage 4: Curing

After 8 – 12 weeks, the compost is uncovered and exposed to sunlight. If the piles are very high, they can be spread out a little to facilitate the curing process. The compost is ready when the moisture level has dropped to 23%. At this stage, the ph has returned to neutral.

The end product is predominantly “chocolate brownie” in nature with some longer coarser but significantly softened particulate. It is usually too fine or soft to put through a shredder or grinder but is suitable for a screening (eg flip screen) process. Larger particles that are screened from the compost can either be reprocessed into the next compost batch or stockpiled until a shredder or grinder becomes available.

Any last remaining physical contaminants should be removed prior to screening or final processing.

Stage 5: Storage

Once the pile has reached a moisture level of 23%, it should be re-piled and covered with tarpaulins again until used. This will maintain the correct moisture level and prevent rain from leaching nutrients from the piles.

About the MaxAir II™ bins and Biobags™

The Groundswell project is utilising the MaxAir II system which combines a 6 litre vented plastic bucket and rolls of 10 litre compostable bags. The combined MaxAir bucket and bags are designed to prevent odours and putrification of food waste by retaining food scraps in an aerobic state. The breathability of the bags and bucket promotes ventilation and evaporation of moisture, resulting in a weight reduction of up to 25 % in five days. Initial trials, research and market testing indicate high levels of householder acceptance of the product. The MaxAir bins and BioBags are currently used in over 200 municipalities globally.

Trials undertaken by the Groundswell Project Team in early 2008 tested the performance of the MaxAir Bins and Biobags in a monthly collection scenario. In this trial, compostable bags were filled with a range of “high risk” food scraps including fish carcases, meat, left overs and rotten fruit and vegetables. Bags were then placed in a number of 240 liter MGBs with varying amounts of garden waste. Bins were monitored over a 4 week period. At no stage during the trial were offensive odours detected inside or emanating from the bins. The compostable bags appear to assist greatly in keeping food scraps aerobic. Odours were considerably less than might be expected from putrefying food waste enclosed in plastic bags in residual waste MGBs.

The BioBag has a very high penetration barrier against bacteria, viruses, spores and mould. BioBag also ensure safer and more hygienic conditions for waste collectors and composting facilities. BioBag is fully compostable and certified according to the European Standard EN13432 and the US standard ASTM D6400, which is compatible with the Australian Standard AS4454.