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A SUBMISSION TO THE PRODUCTIVITY COMMISSION REGARDING ITS DRAFT REPORT ON WASTE MANAGEMENT, DATED 23 MAY 2006

By Lawrence Huang, Managing Director, Wormtrade (a Division of LCH Nominees Pty Ltd ACN069833512)

6 July 2006

Mr Phillip Weickhardt
Presiding Commissioner
Inquiry into Waste Management and
Resource Efficiency
Productivity Commission
Locked Bag 2
Collins St East
MELBOURNE VIC 8003

Dear Mr Weickhardt:

1. I am involved as a business person in a newer and smaller overall scale field of commerce within waste management and agriculture known as vermiculture (a brief outline is at section 3, and a further overview of the commercial aspects thereof, is at section 4).

2. I have read the draft report on Waste Management by the Productivity Commission dated 23 May 2006. Thank you for the opportunity to comment (I registered as an interested party at the commencement of the inquiry, and haven't previously provided any comments). The contents are personal views.
I agree to allow this submission to be regarded as a publicly accessible document.
Because vermiculture was not mentioned anywhere in the draft report, and it isn't clear whether any parts of the field falls within the inquiry's scope, I have not made any specific comments about findings or recommendations, nor referred to the nature of my own vermiculture project (which is to do with a commercial worm farm in northern Victoria that is still being developed, and is to do with mainly agricultural wastes).
The approach is to just submit some general background information about the history of the field in Australia. Some other words are included to comment on different terminology in use, and coverage. Perhaps in writing the final report, a separate definition of "vermiculture" might be included within the glossary of terms, to distinguish clearly from "composting". I would expect that, over time, if and when there emerges relevant "public interest" reasons to suggest a suitable role for renewed public sector involvement in vermiculture (within either government, at local/state/Commonwealth level, or within parts of academia that are interested in research matters), those other parties would be well placed to make their own decisions.
I will not be able to attend a public hearing.
I can be contacted via the details listed at www.ausworm.com, if there is a need to clarify any point.

3.. <u>What is Vermiculture?</u>

"What is Vermiculture?" hasn't been discussed widely within the community, so there isn't yet universal agreement about a suitable definition.
The following description is worded generally, and is not meant to be definitive.

Diverse views are likely to exist – including about even a basic point such as what the field actually covers, regarding what is a fairly new and mostly unfamiliar field of commercial and intellectual endeavour in an Australian context.

As an aid to ongoing analysis, I have found the following description to be useful.

Vermiculture is to do with anything that involves the interaction of worm species with human beings.

There are several sub-aspects of the field. In Australia, all of the following points have had some importance in the past 15 or so years. Vermiculture is simultaneously:

- a field of rural-based commerce that is concurrently to do with both agriculture and waste management (section 4);
- a community service, involving mainly local governments but from time to time, also involving environmentally oriented not-for-profit bodies such as the AWGAVI, the Gould League and the Centre for Education and Research in Environmental Studies (CERES) in Victoria, and other organisations (this activity is to do with educating households to do worm farming in the garden to recycle food and garden wastes, or waste education within schools or community organisations, and supply of worm kits and worms for that purpose). Some state governments have prepared information brochures or funded waste education services to assist with this activity. Several local councils subsidise the sale of worm kits or worms, and have their own waste education programs that sometimes include worm farming;
- a type of commercial waste handling process (explained four paragraphs below);
- a potential area of scientific and intellectual investigation; and
- an area that could potentially require governmental involvement, either in terms of further policy development, or education and information dissemination or further grant funding, or involvement in doing some actual new research (depending on which person makes the observation, some aspects to do with vermiculture might appear to be conceptually similar to composting).

Some other uses of worms (such as the potential for using worms as animal feed, potential for using worm oil as a pharmaceutical) are also part of the field, but have nothing to do with waste management.

The application of vermiculture to the design of "green buildings", is one other application of worms for waste recycling purposes.

Of the above components, the first two dash points are the more important, because in principle there would be no need for, or no justification for additional public resources to be allocated to the last two mentioned (dash-pointed) aspects of vermiculture, if there aren't firstly ongoing activities within the two first-named spheres of vermiculture, that have sufficient size and scope within particular regions of Australia.

As a waste handling process, one definition which has been used for vermiculture is "a system of stabilising organic materials under controlled conditions by specific worm species and microorganisms under mesophilic temperatures".[1] In the absence of any

[1] . Source: Recycled Organics Unit NSW (2000), Processing of Commercial and Industrial Organics in Vermiculture Systems, p.49. Other publications of ROUNSW with an academic or policy focus developed mainly with reference to the New South Wales experience, are accessible at its website www.recycledorganics.com. *It is not possible to quote anything else from the ROINSW documents, other than the limited use that is allowed under copyright law.* Other than the definition of vermiculture to which this footnote refers, no other portion of this submission has made use of any other information within the ROUNSW publications.

contrary opinion, perhaps this definition might be followed for now, since some earlier intellectual effort had already been expended by someone, who had researched the general features of the topic, and that copyright effort had been paid for by public sector resources, into considering the relative merits of alternative English language words, to describe the concept. The term "mesophilic" refers to a certain temperature range, which is explained more precisely in AS4454, which is copyright to Standards Australia.[2]
Some other points on terminology are mentioned at section 7.
There are several hundred worm species found in nature. For vermiculture uses, typically in Australia, a combination of two or more of the four species known respectively by their Latin scientific names of Eisenia Andrei, Eisenia Fetida, Lumbricus Rubellus and Perionyx Excavatus are used, as those species have been found via experience and scientific research (the latter mainly in other countries) to be the most useful for breaking down waste materials. Those four worm species are sometimes referred to in a shorthand way, by using the term "live composting worms". A popular way of referring to the above are redworm, tiger worm, Indian blue. The above four worm species are different, from the species of earthworms found in most Australian gardens.
It is useful to note, that whether vermiculture ought to be regarded as a variant of "composting" depends in part, on how one defines the latter concept.
The afore-mentioned four species of worms have as their natural habitat, an environment of decaying waste materials. The worms feed upon, and digest most materials which were once living matter and which are capable of decaying (this would usually be covered by the terms "putrescible waste" or "organic waste"). Some types of "once living" material may require a somewhat longer period of time to be eaten by worms than other types (eg. meats and seafood, usually take longer to be digested), while others may be ignored (eg. citrus and onion) when other types of matter are also available in the worm bed. Some vermiculture firms are now developing ways of treating different types of wastes, to allow them to become more easily digestible by worms, and that is part of the ongoing process of technical innovation.
A worm is a hermaphrodite. That is, it has only one gender, and reproduces by splitting into two. Eggs (usually referred to as worm capsules) are laid, after hatching, worm capsules become baby worms.
After being subjected to worm digestion, the original waste material becomes worm excreta, for which the term vermicast is often used ("vermi" is a Latin prefix for anything to do with worms). Vermicast is a useful "soil conditioner". Vermicast is not usually referred to as a "fertiliser" in an Australian environment (depending on which

[2] Wordings were added to AS4454 to refer to solid vermicast. *That document is copyright to Standards Australia so cannot be quoted.* Those wordings represented the collective opinions of some persons who were engaged in the field during 1999-2002. The consultations during the said period, that resulted in those wordings, were led by the Australian Worm Growers Association Vermiculture Inc. Subsequently, some firms had left the field, other new producers have entered, and there has been no opportunity to revisit the topic. Most firms are currently focussed on other sub-topics. The understanding at the time the wordings which relate to solid vermicast had been included in the 2001 version of AS4454 was that it would be a voluntary benchmark. If over time, there is renewed interest in restarting discussions about standards, the institutional arrangement that allowed consultations to occur during that earlier period (ie. a technical sub-committee provided for, within the AWGAVI's Rules of Association) is still available to arrange consultations, if it is found to be agreeable to those persons who wish to restart consultations about product standards and additional resources can be found. Another kind of quality assurance (also voluntary) is available, which is to do with organic certification.

jurisdiction, there may be wordings within the fertiliser laws administered by state governments that relate to this). Microbes that were originally within a worm's gut become part of the vermicast that is added back to soils, from where waste matter originated, and the beneficial microbes are thought to be the most valuable part of the vermicast for agriculture. *Vermicast has very different technical (ie. agronomic) features and pricing structures from composts and other types of soil inputs manufactured from naturally occurring materials.*

There is now a fair amount of anecdotal information to suggest that the presence of the worm-sourced microbes, in liquid forms of vermicast when applied as a foliar spray, provide natural resistance to certain plant diseases without needing to resort to chemical pesticides and herbicides.[3] Relatively more observations of this point have been made in other countries, such as in the United States. If able to be confirmed eventually across a wider range of in-field situations within Australia, or by properly constituted and independently validated scientific research, this idea would constitute a major contribution to "sustainable farming" (including organically certified farming) since disease control without resort to chemicals, is one of the major challenges of that field. "Sustainable farming" (which might involve vermiculture as one of the possible options, for some farmers in certain cropping situations) is one of the ways that farmers are now hoping to reduce the so-called "negative externalities"(according to economic jargon) that are associated with traditional farming practices. The fact that there are now many farmers (eg. a grower of olives, cherries, apples, macadamias, avocadoes, wine grapes, walnuts, or chillis) who had previously resorted to use of man-made chemicals, and who now prefer to adopt vermiculture as their means of recycling on-farm wastes, and to produce vermicast for re-use on their own farm, is very strong anecdotal evidence that there are significant benefits in utilising worms for waste recycling purposes. A point worthwhile noting, is that *those farmers who are now using vermiculture regularly, in order to do farming "sustainably" had each reached an independent conclusion that worms applied to on-farm recycling of wastes provide wider benefits for improving soil health*.

Vermiculture is a multidisciplinary field of human endeavour. The field has both commercial applications and academically-oriented scientific research issues. In terms of the scientific issues, the intellectual fields which could be brought to bear in creating an improved scientifically based understanding of vermiculture include, for example, agricultural science, agronomy, soil science, microbiology, ecology, applied chemistry, bioengineering, environmental science, economics, and community-based education.

The "commerce" that is associated with vermiculture, involves harnessing the natural process of worm digestion to recycle putrescible/"organic" wastes, in order to secure a net profit or a net cost saving (another way of understanding it, is to regard the objective as being to seek ways to "commercialise" a biological process, that is already found in nature). The various types of revenue sources that are available to an owner of a vermiculture business, are outlined in section 4.

Historically, interest in vermiculture within Australia was begun by the CSIRO and some university academics in the late 1980s. Medium and larger scale agricultural and waste management applications of vermiculture in Australia mostly commenced only during the

[3] . For example, The Land, 25 October 2001, p. 52; presentation about "on-farm vermiculture" at a workshop during the Second National Organics Conference at University of Adelaide, October 2003.

mid-to-late 1990s. Presently, most Australians would only know about the aspect of worms that is just to do with encouraging households to set up small-size worm farms in their backyard.
Many local governments provide education to households to assist them to set up their own worm farms, and some councils subsidise sale of worm kits or worms for that purpose. Several state governments have prepared useful information leaflets about household worm farming. But in some cases, either because the persons who wrote the government leaflets hadn't kept up to date with industry-wide happenings or the AWGAVI, or the members therein had no spare resources to contact the relevant government department about it, some points that are obsolete information are still found in some government leaflets that are able to be accessed via the internet. Worm breeders, including those who had been members of the AWGAVI, have played a leading role in providing education to households to set up their own worm farms, and in selling worms and worm kits.
Many commercial vermiculture projects with either an agricultural or waste management focus are still at a trial stage. Information about what is happening within the private sector may be available, but quite often only for some aspects, and not all of the information might be reliable. Some private sector activities are associated with intellectual property with patent protection, or commercially sensitive matters, so there is nothing which is able to be reported, unless the proprietor themself wishes to discuss the topic.

4. Vermiculture as a Field of Commerce

The entire field of vermiculture within Australia has a relatively small number of firms doing business, the commercial applications have a relatively short history, and the field is smaller in scale compared with many others within the waste management or agricultural spheres. Many current projects are still in a trial or establishment phase.
Whenever much of what happens within a newer field in either the private sector, government, or the research community, is a "moving feast" and reliable information is either non-existent or difficult to obtain, attempting to provide a summary picture is difficult, and any effort to do so, should be regarded at best as "educated guesswork".
As a very broad generalisation … the medium-to-larger scale commerce that involves worms in Australia is almost entirely located in rural or regional parts of the country, and is typically along the following lines [not listed in order of importance]: (a) "on-farm vermiculture" (to do with sustainable horticulture, sustainable orchard production, sustainable viticulture – this activity [there are examples in Vic, Qld, SA, NSW] has created some farming jobs: examples were reported in Small Farms Sept 05, and Weekly Times 19/2/04, there was a presentation on this sub-topic at the Second National Organics Conference in Oct 03 at the University of Adelaide (arranged by the Organic Federation of Australia, with the assistance of two members of the AWGAVI). The crops to which "on farm vermiculture" has so far been applied successfully in Australia include: olives, avocadoes, macadamias, apples, cherries, winegrapes, chillis, and walnuts; (b) "gate fee" collection and large-scale waste processing (based on the available information, there is currently one vermiculture site that collects a gate fee in Victoria for food factory wastes, and vermiculture sites for green waste contracted by a

local government in respectively South Australia and New South Wales - other earlier experimental vermiculture projects in Queensland and NSW that were later suspended, had collected gate fees in respect of green waste, biosolids, food factory wastes, and government office wastes); (c) other onsite formats for waste disposal that utilise vermiculture, such as had been operated by some local governments, and some food factories or abattoirs or feedlots or sheep farmers or cattle farmers, either now or in the past; (d) offsite processing of animal and plant wastes; (e) vermicast and blended soil products with some vermicast included, are being sold to agriculture, sporting fields or gardening uses; (f) worms are being sold for bait or household use; (g) several different styles of patented in-vessel vermiculture equipment and entire systems with an engineered format are available, these can sometimes be applied to "gate fees" as well as other situations that do not involve a "gate fee", and can be adapted for different scales of processing. Development of those processes is at various phases; (h) exports (mainly of either worms or equipment, including to south-east Asia) (i) waste education (a AWGAVI member teaches household worm farming at TAFE); (j) producing worms as a protein-rich animal feed is commercially relevant in developing countries. A firm is reported to be conducting research, in the hope of developing a commercial application of this aspect within Australia; (k) some architectural firms and university departments associated with building and construction had hitherto shown interest in the potential for incorporating elements of vermiculture into so-called "green" building design.

The applications of "on farm vermiculture" or vermicast within Australian agriculture are still being developed. A much larger body of reliable anecdotal (ie. in-field) observations regarding agronomic features of vermicast, will be needed in order to be able to draw reliable conclusions, or to be the basis from which educational programs for end users, or additional independent scientific research activities, can be started. The nature of the activity (ie. developing a market for a newer soil input) is inherently longer term.

The four states where the larger scale vermiculture projects had been implemented or trialled since the mid-1990s (in no particular order) are Victoria, South Australia, Queensland, and New South Wales. There are smaller vermiculture sectors in each of Western Australia, Tasmania and the ACT.

At certain times in the past (eg. at Hobart City Council, and the ACT Government) a local government had operated a large worm farm to recycle green wastes. Some local governments have contracted a vermiculture firm to process green waste, as have food factories. Amongst the waste types excluded from the inquiry, at various times, piggeries and feedlots have also experimented with vermiculture.

The document known as AS4454 (copyright to Standards Australia) contains an appendix which explains the main elements of what is commonly thought to constitute "best practice" principles for operating a vermiculture system. That document would be a useful starting point to obtain a basic understanding of technical terms to do with vermiculture, and the meaning of terms like "mesophilic", "thermophilic", etc. The origin of the wordings that are now in AS4454 which refer to solid vermicast and vermiculture is explained at footnote 1 above.

In some other countries such as the United States, Canada, India and Cuba, vermiculture (as both a commercial activity and a field of scientific research) has been going on for much longer and so is wider in scope, and is more established, and bigger in aggregate scale (due to a much bigger population, and having been going on for a longer period).

As an indication of this, in the United States there is a greater number of long established vermiculture-based waste processing plants that have a larger processing capacity (eg. in California, Florida, Oregon), than those which now operate within Australia. In the US there are also several scientists in academia and elsewhere whose entire work effort is to do with vermiculture (eg. Dr Clive Edwards, Dr Scott Subler), and a major national conference just to do with various worm-related topics is held once every one or two years in Portland Oregon. In Australia, from time to time, there have been some academics, agricultural consultants and independent scientists who have added activities associated with vermiculture or vermicast, into a broader array of work activities they are mainly focused upon.

5. Possible relevance of vermiculture to the Commission's inquiry

Neither the field itself, nor the term "vermiculture", are mentioned in the draft report. There is not necessarily anything unusual about this situation – there was little by way of background in the earlier submissions about vermiculture. Vermiculture was mentioned briefly in a sentence in each of two submissions that I had an opportunity to read.
Whether any aspect of the field, falls within the inquiry's scope, and later on, whether the field is important at all within waste management, are both potential debating points.
Depending on one's viewpoint, certain aspects of vermiculture, as outlined above, might possibly fall within the areas deemed by the Commission to be of interest. Others (eg. applications that are to do with animal wastes, liquid wastes, biosolids – referred to as sewage sludge on p.5) have already been deemed to be outside the scope of the inquiry.
This point is part guesswork - the definition of "alternate waste technology" within the report (viz. "technologies that are applied to mixed wastes, other than traditional methods such as disposal to landfill", on page 77) might have potential to be interpreted to include the process of vermiculture.
Since the mid-1990s vermiculture has already created some full-time and part-time incomes, in predominately blue collar spheres, in rural and regional parts of Australia. Vermiculture also has the potential to save jobs, when found to be successful in reducing the costs of waste disposal for a waste generator, such as a food factory, feedlot, piggery, or a farm. That is, vermiculture is now making a contribution to "sustainability of consumption and production activities".
In the past, a composting firm had experimented with adding vermiculture to part of its operations.

6. Industry body.

An industry body hasn't interested every producer within the field, at every point during vermiculture's past history.
The Australian Worm Growers Association Vermiculture Inc (AWGAVI) was established in 1993 (before March 2000 the AWGAVI was known as the Australian Worm Growers Association Inc), and is a national focus organisation, that is registered as a not-for-profit incorporated association with Consumer Affairs Victoria. It is subject to the provisions of the Victorian Associations Incorporation Act 1981 as amended, and the

Rules of Association of the AWGAVI. A copy of the aims and purposes of the AWGAVI is enclosed.
Details of the current members is available at www.ausworm.com.
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Since being founded in 1993, the more important activities of the AWGAVI had included: successful cooperative research undertaken with the Commonwealth Scientific Industrial and Research Organisation (CSIRO) on the application of vermicast to two vineyards in South Australia during the period 1996-97 (discussed in the next paragraph - a copy of the write-up of the scientific results is enclosed); in 1997 a major workshop was held concurrently in four capital cities that had featured an international expert on vermiculture (Dr Clive Edwards)[4]; the AWGAVI had arranged and led industry-wide debates during 1999-2002 regarding a first-up attempt to create a product benchmark for solid vermicast (explained at footnote 1); from time to time, the AWGAVI was a conduit of information between the private sector and government personnel in mainly NSW and Victoria and sometimes in the Commonwealth or local governments to improve functioning of vermiculture; the AWGAVI had frequently provided answers to members of the public; school children and newcomers to the field, regarding the usefulness of worm species; two of the AWGAVI members had facilitated a major presentation held at the Second National Organic Conference at the University of Adelaide in October 2003 to explain the basic features of "on farm vermiculture" to organically certified farmers; and coordinating responses to requests from the media (The Land newspaper twice, Australian Farm Journal, Small Farms, South Korean TV, and one of the three times when vermiculture had been featured on ABC Landline) who had needed information to assist in reporting about vermiculture.
The collaborative R&D which had been undertaken jointly by the AWGAVI and CSIRO in 1996-97, is still widely quoted by many firms that still do business within the sector. It was written as a scientific paper by the two researchers then with CSIRO Land and Water who had conducted it, in the Australian Wine and Winegrape Journal of December 1998. That work was funded by the CSIRO and had additional voluntary inputs of time and materials from some former producer members of the AWGAVI, and continues to be quoted today, as the leading example of reliable publicly accessible scientific information that feeds beneficially into all future scientific discussions about that aspect of the field (ie. agricultural field trials for vermicast).
The AWGAVI was the main source that persons in the media or government or other industries, or school children, or members of the public, or newcomers, had referred back to, to obtain up-to-date information about what is happening at a broader level within the field.
Thus far, only volunteers had been available to do the type of work needed within the AWGAVI to facilitate the collection of information and ongoing monitoring, and intra-industry liaisons, that is a prerequisite for facilitating broader discussions.

7. Terminology

All of the following terms have at one time or other, been used to mean the process of waste conversion known as vermiculture -: vermiculture, vermicomposting,

[4] The papers which were presented to the 1997 conference are held by the AWGAVI.

vermiprocessing, worm processing, worm composting, composting with worms, digestion by worms.

All of the following have been used at one time or other to mean worm excreta - vermicast, worm casting, casting, vermicompost, worm poo, vermi-material, worm product ("vermicompost" is a commonly used term in countries other than Australia, to refer to worm excreta, and is typically also used by persons who had been trained in other countries or who had been influenced by the literature in other countries).

Whether vermicast is a type of "compost" (a point which tends to be suggested, if the term "vermicompost" is adopted as the way of referring to worm excreta) is a debatable issue. During the earlier community-wide discussions about AS4454 in the period 1999-2002, led by the then members of the AWGAVI, there was a consensus, the term "vermicast" would be a clearer way to refer to worm excreta.

All of the following have been used at one time or other to mean the liquid version of worm excreta: liquid castings, liquefied worm castings, acqueous worm extract, worm liquid, worm wee.

In the marketplace a distinction is made between a leachate, and something completely different which is a liquid extract that is produced from mature vermicast by a process such as brewing, sieving, or some other effective process for extracting beneficial microbes from solid vermicast and developing a liquid form of worm castings therefrom.

From time to time, some producers sell a soil product which has been partly digested by worms, in which case that soil input would contain some or all of the following: vermicast, original waste matter, live worms, worm capsules, and maybe even some parts which had become a compost due to decomposition without having been firstly digested by worms.

"Vermicompost" in some literature, can also have a slightly different meaning, to refer either to waste matter that has been partly digested by worms, or a soil product that is a mixture of mature vermicast and compost.

Within the context of the non-mandatory Australian Standard for Composts, Mulches and Potting Mixes (AS4454) the terms compost, composting, vermicast, and vermicompost have particular meanings, which may not be the same as the above, in each case. That standard is subject to copyright, owned by Standards Australia, so cannot be quoted except for situations allowed within copyright law. AS4454 only applies to solid forms of soil products. Vermicast is generally considered to be a soil conditioner. The origin of the wordings within AS4454 to do with solid vermicast or vermiculture, had been based at that time on the understanding that the benchmark would be a voluntary one (explained at footnote 1).

In the draft report, the Commission has adopted as a definition of "composting", "biological decomposition of solid organic materials by micro-organisms". Depending on the way one reads this definition, it might be interpreted to either include or not include vermiculture.

In Australia, there are various ways in which the term “organic” is used. “Organic” in the context of farming, typically is interpreted to mean “organically certified farming” (hence organic food, organic livestock etc); “organic” in the sphere of waste management typically refers to wastes which are putrescible (hence recycled organics, organic waste); “organic” in the context of chemistry as a science has yet another meaning (relating to carbon); “organic” within the term “organic matter” has a slightly different meaning again, and in business circles “organic” is sometimes used to mean “internal” (eg. organic growth). In the context of exports, something cannot legally be labelled as organic food or an organic input, unless it is approved as an organically certified product. Perhaps the Commission could consider whether there is a need to include a reference to the term “organic” within the definitions section of the report, to clarify which meaning of the term is being adopted.

Lawrence Huang
Wormtrade (6 July 2006)