ENVIRONMENTAL GUIDELINES

USE AND DISPOSAL OF BIOSOLIDS PRODUCTS

NSW EPA
NEW SOUTH WALES
ENVIRONMENT PROTECTION AUTHORITY

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Environmental Guidelines: Use and Disposal of Biosolids Products was prepared by Chye Ang, Environmental Policy, and John Sparkes, Operations Division, of the Environment Protection Authority (EPA), with the assistance of the Biosolids Subcommittee of the Hazardous Chemical Advisory Committee, which includes representatives from:

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Department of Health
NSW Agriculture
State Forests
Sydney Water Corporation
Hunter Water Corporation
Department of Public Works & Services
Department of Land and Water Conservation
Department of Urban Affairs and Planning
National Parks and Wildlife Service
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Preface

Over recent years the NSW Government has been re-evaluating how sewage should be treated and disposed of so that improvements to both environmental and public health can be assured. The overriding concern has been to try to move away from the traditional and unsustainable disposal of sewage to waterways, and to recognise that sewage contains a number of natural qualities which can, when managed judiciously, be utilised as a resource.

Not only does raw sewage include a plentiful supply of water, but the solids component is rich in essential nutrients such as nitrogen, phosphorus and organic matter; and these are in a form that is highly suitable for assimilation by plants. As a result, there has been an increased interest in finding ways to reuse both the water and solids components of sewage in a manner that is cost effective, environmentally sustainable and safe from a public health perspective.

The Environment Protection Authority of NSW has worked closely with other government bodies and with industry to identify how both solids, commonly known as biosolids, and effluent can best be reused in NSW. This has resulted in the development of a process by which biosolids can be classified for reuse purposes, and which also encourages and facilitates their application to land.

These guidelines, if followed by those industries that use biosolids, provide a means by which a sewage treatment plant can increase its ability to market the biosolids it produces, while ensuring that a high level of protection for both the environment and public health is maintained. The guidelines also provide an incentive for the operator to identify the sources of offensive chemicals that pollute the raw sewage, and to eliminate them from the system.

The guidelines focus on biosolids from human raw sewage, though the principles outlined could apply equally to animal wastes, if the material were to be properly characterised. The guidelines include an outline of the statutory requirements throughout NSW for reusing biosolids, and replace the following publications:

Guidelines for the Use of Sewage Sludge on Agricultural Land (NSW Agriculture 1991)

Draft Guidelines for the Treatment and Use of Sewage Sludge on Non-agricultural Land (NSW Health Department 1991).

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USE AND DISPOSAL OF BIOSOLIDS PRODUCTS

page 9 In **Table 3-1 Contaminant Acceptance Concentration Thresholds:**

- replace the Grade A contaminant threshold for PCBs of "0.3" with "ND[4]"
- under note 3. insert a new note that reads "*4. No detected PCBs at a limit of detection of 0.2mgPCB/kg biosolids*".

page 17 Under the heading ***3.6.3Reprocessing Facilities:***

- replace the second sentence of the second paragraph beginning "Alternatively, .." with "Biosolids that have not been mixed with additives may be blended to produce biosolids with a different classification. Biosolids are not to be reprocessed or mixed with additives if the resulting biosolids product has a lower contaminant or stabilisation grading or where the resultant product contains unacceptable levels of foreign non-biodegradable objects."

Page 23 Under the heading ***Determining Soil Contaminant Concentrations:***

- after the first paragraph insert "Relevant information should also be sought on whether persistent chemical residues (including PCBs, OC pesticides) have been previously identified on the land. For example this information could include the results of previous soil testing on the site, or information held by the local Rural Lands Protection Board such as cattle residue monitoring results or classification under the National Organochlorine Management Program."
- after the second paragraph insert "If soil testing carried out as part of the site assessment identifies existing contaminant concentrations for PCBs and OC pesticides exceeding the maximum allowable soil contaminant concentration, advice should be sought from the local Rural Lands Protection Board on suitable management practices to ensure agricultural produce is not contaminated."

page 25 In **Table 4-5 Maximum Allowable Soil Contaminant Concentrations for Agricultural Land Following Biosolids Application:**

- replace the Maximum Allowable Soil Contaminant Concentration for PCBs of "0.30" with "ND[2]"
- under note 1. insert a new note that reads *"2. No detected PCBs at a limit of detection of 0.1 mgPCB/kg soil. Biosolids products should not be applied to land where PCBs have been detected at a limit of detection of 0.1 mgPCB/kg or when the* ***calculated*** *level of PCBs* ***applied to the soil*** *will exceed 0.02 mgPCB/kg soil."*

page 26 In **Table 4-7 Management Practices for Restricted Use Biosolids Products in Agriculture:**

- at the end of Management Practice 1: Stockpiling on Application Sites, insert a new note that reads "d) Livestock should not have access to the stockpile area."
- after "2. Biosolids should be incorporated into the soil within 36 hours of spreading." insert "Animals should not be allowed to graze the land until the landholder is confident that the applied biosolids have been incorporated into the soil to the extent where they cannot be passively or preferentially ingested by grazing livestock."

page 44 Replace the third paragraph with "Foreign objects such as plastics, glass, blades and sharps may cause occupational hazards, damage or injury to livestock via ingestion and compromise the safety and credibility of reuse schemes. Biosolids products destined for reuse should meet the contaminant criteria for foreign objects specified in the Australian Standard *AS4454-1999: Composts, soil conditioners and mulches."*

CHANGES IN LEGISLATION

Since the release of these Guidelines in October 1997 there have been some changes to the overarching Legislation for environmental protection in NSW. The *Protection of the Environment Operations Act 1997* and associated regulations commenced on 1 July 1999, replacing a number of Acts and Regulations including the *Clean Waters Act 1970* and the *Pollution Control Act 1970.*

These legislative changes do not alter the EPA's general approach to regulating biosolids, but if you have any questions on this matter please call the EPA's Pollution Line on 131 555.

SECTION

1 Introduction

1.1 GUIDELINE OBJECTIVES

These guidelines will help planners, designers and operators of sewerage systems, and those involved with the processing and end-use of biosolids products, by establishing requirements for the beneficial use and disposal of biosolids products to land in NSW.

The specific objectives of the guidelines are to:

- encourage beneficial use of biosolids of acceptable quality, where safe and practicable, and to establish requirements for disposal
- ensure that the statutory requirements of regulatory authorities such as the NSW EPA, NSW Health Department, NSW Agriculture, State Forests, Department of Urban Affairs and Planning, Department of Public Works and Services, and Department of Land and Water Conservation are adequately specified
- develop a set of clear guidelines in one document which includes the requirements from state government agencies to assist regulators, producers and the biosolids industry to meet their statutory obligations
- encourage best management practices to ensure the development of sustainable and cost-effective biosolids management strategies by sewerage operators, re-processors, appliers and end-users
- set contaminant acceptance limits and stabilisation requirements which give adequate protection to the environment, human health and animal health, and agricultural products, whilst providing realistic and practical avenues for the utilisation or disposal of biosolids products
- ensure that monitoring, reporting and auditing systems are adequate in terns of acceptable risks

These objectives are discussed below.

1.1.1 Beneficial Use of Biosolids Products

The NSW Government's biosolids management policy is to encourage the beneficial use of biosolids where it is safe and practicable and where it provides the best environmental outcome. In cases where such beneficial use is not possible, the Government recommends the adoption of alternative methods for the placement of biosolids in the environment in an environmentally and socially responsible manner.

The EPA has established the following environmental performance objectives for the beneficial use of biosolids.

Resource Utilisation

The useful resources in biosolids, such as organic matter and nutrient content, should be identified and utilised to the maximum extent possible within the limitations of the guidelines.

Protection of Lands

A biosolids land application scheme should be ecologically sustainable. In particular, it should maintain the cropping capacity of the land, and should result in no deterioration of land quality through chemical contamination or soil structure degradation.

Protection of Groundwaters

Biosolids application and disposal areas should be located, designed and operated such that underground water resources do not become polluted by either the biosolids or run-off from the application site.

Protection of Surface Waters

Biosolids application and disposal areas should be located, designed and operated such that surface waters do not become contaminated by any flow emanating from the application site which may include first-flush rainfall run-off or contaminated sub-surface flow.

Community Amenity

Biosolids application and disposal schemes should be located, designed and operated so as not to cause unreasonable interference to neighbours. In this regard, special consideration should be given to odour, dust, health risks, transportation, location of storage sites, insects and noise above normal background levels.

The EPA's *Environmental Guidelines: Solid Waste Landfills* does not restrict the beneficial re-use of biosolids. However, when biosolids are to be disposed to landfill the requirements of the solid waste guidelines must be met. Section 5.2 deals with the disposal of biosolids to landfill.

1.1.2 Statutory Requirements

Any proposal to beneficially use or dispose of biosolids in NSW should take into consideration the requirements of the following legislation:

- *Clean Waters Act 1970*
- *Pollution Control Act 1970*
- *Environmental Offences and Penalties Act 1989*
- *Local Government Act 1993*
- *Environmental Planning and Assessment Act 1979*
- *Fertilisers Act 1985*
- *Sydney Water Corporation Special Areas Regulation 1989*
- *National Parks and Wildlife Act 1974*
- *Wilderness Act 1987.*

Should monitoring of any receiving site reveal a potential public health risk, the local Medical Officer of the Department of Health must be advised as soon as possible. Further details on statutory requirements for biosolids management are given in section 4.7.

It is intended that these guidelines will in no way compromise the safety of people who use biosolids. Requirements under the *Dangerous Goods Act 1975* and/or the *Occupational Health and Safety Act 1983* must be met, and if any conflicts are identified, they should be brought to the attention of the EPA. Biosolids producers and appliers should contact the NSW WorkCover Authority for information on occupational health and safety requirements for workers involved in the processing or use of biosolids.

1.1.3 Requirements of NSW Government Agencies

The guidelines set out, in the one document, the requirements of state government agencies that have an interest in the management of biosolids.

1.1.4 Best Management Practices

The concepts outlined in this document are intended to encourage the adoption of best management practices in the planning; design, and implementation of biosolids management strategies, in order to achieve a beneficial environmental outcome. Alternative approaches to those outlined in this document may be acceptable, providing the resulting strategy is ecologically sustainable and satisfies the requirements of the EPA and other statutory authorities.

This document provides guidelines only, and is not a design and operations manual. Technical and scientific problems associated with biosolids management can be complex and often require the integrated efforts of several disciplines in the natural and social sciences. Accordingly, producers, re-processors and end-users may need to seek advice from specialist consultants and from government authorities such as NSW Agriculture, NSW Health Department, State Forests, NSW Department of Urban Affairs and Planning, NSW Department of Public Works and Services and the NSW Department of Land and Water Conservation where appropriate. In particular, advice from NSW Agriculture may be required on appropriate agricultural application techniques and management practices for specific crops and soil types.

1.1.5 Contaminant Acceptance Limits & Stabilisation Requirements

The guidelines set out a number of classes of biosolids, based on the levels of metal and organic chemical contaminants and on the treatment processes that have been used to stabilise the biosolids to reduce pathogen levels, vector attractants and odour.

For each class outlined in the classification system, there is a range of beneficial use options that are applicable, except the lowest class which is only suitable for re-processing, appropriate surface application or landfill disposal (see Section 5).

1.1.6 Monitoring, Reporting & Auditing Systems

The guidelines set out sampling and testing requirements for classifying biosolids products and, where appropriate, requirements for monitoring the environment where the biosolids are placed to determine and verify its compliance with environmental criteria. The guidelines include pro formas for recording classification information, and the reporting of this information to interested parties and regulatory authorities.

1.2 SCOPE OF THE GUIDELINES

1.2.1 Framework & Applicability

The scope of these guidelines is limited to the land application and disposal of biosolids derived from sewage treatment plants. It establishes the obligations of the producers, re-processors, appliers and users of biosolids products. It also provides a framework for the classification of biosolids products, based on their quality, and sets requirements for application procedures for biosolids products of different qualities.

These guidelines apply only to the land route of biosolids use and/or disposal. Other routes of biosolids use and/or disposal—such as into water (ocean disposal), the air (incineration) or building products—are not considered (refer to section 1.2.2). The guidelines also identify sensitive areas where the application of biosolids products is not suitable.

These guidelines apply to the following organisational groups:

- producers—sewerage owners or operators, or their contractors, who operate sewage treatment plants and associated on-site and off-site biosolids storage facilities
- re-processors—sewerage owners or operators, or their contractors, or others who further process biosolids, for example, composters, pelletisers and chemical stabilisers
- appliers—sewerage owners or operators, or their contractors, or others who apply biosolids to land or to a landfill
- final users—farmers, mining companies, foresters and landscaping contractors who use biosolids products.

Subject to the exclusions listed in section 1.2.2, the guidelines apply to all biosolids and products derived from the further processing of biosolids. They apply, but are not limited, to the following products:

- liquid biosolids
- dewatered biosolids
- chemically stabilised biosolids
- dried biosolids (including sun-dried and pelletised)
- composted biosolids products
- products which contain any component of biosolids.

The guidelines also apply to all biosolids products imported to NSW.

1.2.2 Exclusions

The guidelines do not apply to the products listed below:

- biosolids products from sewage treatment plants with less than 500 equivalent person capacity **and** which treat purely domestic sewage.
- biosolids discharged to waters
- biosolids discharged to the air via incineration
- biosolids used in building products
- trade waste discharges
- septic tank sludge (septage) and night soil
- grease trap wastes
- screenings, grit and scum
- sewer silt and stormwater waste
- industrial waste
- drinking water treatment sludges.

The reader should contact the EPA for further advice regarding the products or methods excluded from the jurisdiction of the guidelines.

1.2.3 Implementation of Guideline Requirements

The requirements contained in the guidelines will be progressively introduced, where appropriate, in statutory mechanisms such as EPA Pollution Control Approvals and Licences. People and organisations whose activities could be affected by the guidelines are advised to commence the procedures outlined in the document as soon as practicable to facilitate compliance with statutory conditions when imposed.

The EPA has established a compliance audit program to assess enterprise compliance with environmental regulations and statutory instruments administered by the EPA. Under this program the EPA may audit any premises or activity covered by environmental regulations. For the control of biosolids, the EPA will generally target premises with an Approval or Licence under the Pollution Control Act or Certificate of Registration under the Waste Disposal Act.

The guidelines will be used by EPA auditors in assessing the environmental compliance of an enterprise processing, storing, handling, land applying or disposing of biosolids products.

1.3 REVIEW OF THE GUIDELINES

These guidelines are a step towards producing revised guidelines based on risk assessment. The review process includes:

- periodic revision of the guidelines in light of the review comments of the public, industry, and local and state government authorities
- risk assessment of contaminant acceptance concentrations via appropriate exposure pathways using methodology generally followed in establishing the US EPA 40-CFR 503 sludge regulations and the results of research presently being undertaken by NSW Agriculture, State Forests and CSIRO
- revision and publication of the guidelines for the use and disposal of biosolids products and accommodating input from the peer review and community consultation process.

These guidelines will be reviewed when research data and new technologies dictate that it is appropriate.

SECTION

2 Using The Guidelines

2.1 WHO SHOULD USE THE GUIDELINES

The guidelines are designed to be used by regulators, sewerage owner or operator personnel, re-processor personnel, appliers and others who merely want to know how to do their job correctly.

2.2 HOW TO USE THE GUIDELINES

The overall goal of the guidelines is to establish procedures for the safe and beneficial use or disposal of biosolids to land. By following the procedures set out in the guidelines this goal will be achieved.

There are two steps in using the guidelines:

Step 1: determine the classification of the biosolids product by establishing its Contaminant Grade and Stabilisation Grade. The classification is then used to determine the beneficial use and/or disposal options available to this product. Classification can be determined by reference to Section 3, Classification of Biosolids Products.

Step 2: determine where the beneficial application of biosolids products to land is permitted, and the maximum allowable biosolids products application rate, and to establish the relevant management practices for biosolids application. This can be accomplished by reference to Section 4, Beneficial Land Application of Biosolids Products.

In those instances where the biosolids cannot be used, Step 2 is to determine the relevant requirements and management practices associated with surface disposal or landfilling of biosolids products. This can be accomplished by reference to Section 5, Disposal of Biosolids Products. Certain specific tasks are required to be completed by users of the guidelines. Some of the more important tasks are listed in table 2-1, along with reference to the appropriate section of the guidelines.

TABLE 2-1

Tasks To Be Completed By Guideline Users

Task	Guideline Reference	User
General		
1. Consult with statutory agencies Determine their requirements	section 1.1.2 section 4.7	All users
Classification		
1. Determination of the contaminant grade and stabilisation grade	section 3.3 & 3.4 Schedule 2	Producer and/or re-processor
2. Determination of classification of biosolids	section 3.5	Producer and/or re-processor
3. Determination of the beneficial use and/or disposal options available	section 3.5 table 3-6	Producer and/or re-processor
4. Determination of when biosolids products may be released from facilities	section 3.6	Producer and/or re-processor
5. Record keeping and information transfer	section 4.6	Producer and/or re-processor
6. Complete Annual Report to the EPA	Schedule 5	Producer and/or re-processor
Land Application – Beneficial Use		
1. Determine location of sensitive areas and groundwater considerations	section 4.2 & 4.3	Applier
2. Obtain consent from owner	section 4	Applier
3. Site selection	section 4	Applier
4. Soil sampling	Schedule 3	Applier
5. Calculation of biosolids application rate	Schedule 4	Applier
6. Apply for EPA Approval & Licence (if needed)	section 4.7	Applier
7. Management practices and activity constraints	section 4	Applier
8. Record keeping and information transfer	section 4.6	Applier
Land Application – Surface Disposal		
1. Determine quality	section 5.1	Producer
2. Assess potential impact	section 5.1	Producer
3. Management practices & activity constraints	section 5.1	Producer
4. Record Keeping	section 5.1	Producer
5. EPA Approval & Licence (if needed)	section 5.1	Producer
Landfill Disposal		
1. Determination of biosolids product quality requirements	section 5.2 for landfills	Producer and/or re-processor

SECTION 3

Classification Of Biosolids Products

This section addresses the classification framework for biosolids products, their classification requirements, the sampling requirements for classification, how to classify biosolids, and the conditions under which biosolids products may be released from sewage treatment plants, and re-processing and storage facilities.

3.1 CLASSIFICATION FRAMEWORK

A system of classification has been developed to assist in identifying the suitability of biosolids products for land use or disposal. The system is based on a series of quality standards, including the concentration of contaminants in the product and its stabilisation characteristics.

The classification system comprises three classes, all of which relate to the manner in which biosolids products may be used:

- Unrestricted Use
- Restricted Use (3 sub-classes: Restricted Use 1, Restricted Use 2 and Restricted Use 3)
- Not Suitable For Use.

Details on the grading, classification and the uses of the three classes of products are set out in sections 3.2 and 3.3 below.

Classification is the first of the two essential steps in applying an adequate level of control to the use and disposal of biosolids products to the land. The second step is the implementation of a suite of use and disposal requirements and management practices and these are detailed in Section 4, Beneficial Land Application of Biosolids Products and Section 5, Disposal of Biosolids Products.

Some of the metal thresholds have been set based on extensive research carried out by NSW Agriculture.

3.2 GRADING FOR CLASSIFICATION

To classify a biosolids product as Unrestricted Use or Not Suitable for Use it is necessary to determine both its:

- contaminant grade—a category used to describe the quality of a biosolids product based on the concentration of its constituent contaminants.
- stabilisation grade—a category used to describe the quality of a biosolids product based on its level of pathogen reduction, vector attraction reduction and odour reduction.

Classification as Unrestricted Use or Restricted Use can only be performed if both of these grades are determined. **Classification as Not Suitable For Use will result if the above gradings are not undertaken or completed, or if the biosolids fail to achieve the higher grades.**

All sewage treatment plants (except those with less than 500 equivalent person (EP) capacity that treat purely domestic sewage), off-site storage facilities (when biosolids have not been previously graded) and biosolids re-processing facilities which deliver biosolids products into the environment

(that is, not to a storage facility or landfill) should undertake the sampling and analysis necessary for classifying biosolids products. Samples must be representative of the biosolids product that will be released from the facility.

Classification is generally carried out whenever compliance sampling occurs. The frequency of sampling for classification is addressed in sections 3.3 and 3.4.

3.3 CONTAMINANT GRADING

The first step in the classification process is to grade the biosolids product on the basis of the concentration of contaminants.

Contaminant grading of biosolids products is established by determining the contaminant concentrations in the product, and comparing these with the contaminant acceptance concentrations listed in table 3-1. It is important to note that the concentrations listed in table 3-1 are not mean concentration values. There are two sampling regimes which may be used to conduct the contaminant grading-batch sampling or continuous sampling. When batch sampling is used the contaminant concentration values (Q) are a function of the standard deviation (s) and batch mean (m). When continuous sampling is used the tabulated concentration values are used in the calculation of the target grade coefficient (C_t). Schedule 2 details the method for determining the contaminant concentrations and their respective gradings.

TABLE 3-1

Contaminant Acceptance Concentration Thresholds*

Contaminant	Grade A[1] (mg/kg)[3]	Grade B[2] (mg/kg)[3]	Grade C (mg/kg)[3]	Grade D (mg/kg)[3]
Arsenic	20	20	20	30
Cadmium	3	5	20	32
Chromium (total)	100	250	500	600
Copper	100	375	2,000	2,000
Lead	150	150	420	500
Mercury	1	4	15	19
Nickel	60	125	270	300
Selenium	5	8	50	90
Zinc	200	700	2,500	3,500
DDT/DDD/DDE	0.5	0.5	1.00	1.00
Aldrin	0.02	0.2	0.5	1.00
Dieldrin	0.02	0.2	0.5	I.00
Chlordane	0.02	0.2	0.5	1.00
Heptachlor	0.02	0.2	0.5	1.00
HCB	0.02	0.2	0.5	1.00
Lindane	0.02	0.2	0.5	1.00
BHC	0.02	0.2	0.5	1.00
PCBs	0.3	0.3	1.00	1.00

* Contaminant acceptance concentrations are not mean values. Refer to Schedule 2

Notes:

1. The Grade A threshold for cadmium is under review and will be revised in 2 years. Subject to the outcome of this review, the standard for cadmium would be revised and then may become the same as the maximum allowable soil concentration for agricultural land, namely 1 mg/kg.

2. The Grade B threshold levels are under review and will be revised in 2 years.

3. Values are expressed on dry weight basis.

3.3.1 Contaminant Acceptance Thresholds

Each contaminant is to be graded A, B, C, D or E (Grade E being the lowest grade). The lowest grade for any one contaminant is the grading category for the biosolids product. For example, if all of the metals (excluding zinc and copper) and organochlorines in a biosolids product are Grade A, but the zinc concentration is Grade B and the copper concentration is Grade C, then the entire product would be classified as a Contaminant Grade C.

Contaminant concentrations which exceed contaminant acceptance concentration for Grade D shall be graded contaminant Grade E. Prior to contaminant grading, all biosolids products shall be considered contaminant Grade E until proven otherwise. Biosolids are to be graded before their transfer from a sewage treatment plant, off-site storage facility or re-processing site (see also section 3.6).

A grade with low contaminant concentrations may be achieved by blending (diluting) with other acceptable materials or biosolids products. To establish that a grade with lower contaminant concentrations has been achieved the biosolids should be re-sampled, analysed and regraded after blending.

Acceptance concentrations were considered for polychlorinated dibenzo dioxins and polychlorinated dibenzo furans; however, they have been omitted from the guidelines at this stage, subject to the review of studies undertaken in the US.

3.3.2 Sampling Requirements for Contaminant Grading

The minimum number of samples which need to be taken to determine the contaminant grading depends on whether batch or continuous sampling is carried out. Table 3-2 sets out the sampling requirements. The sewage treatment plant or re-processing facility operator has the option of adopting either the batch or continuous sampling.

Facilities using batch sampling are required to grade every batch. Batch size may be selected by the operator. The batch samples shall be used to calculate the batch mean (m). Relevant historical data may be used to calculate the standard deviation (s) (refer to Schedule 2).

Facilities using continuous sampling are required to take at least 17 samples to provide sufficient information regarding quality variability to enable the continuous sampling to proceed. Historical data may be used. As biosolids quality deteriorates or becomes variable, sampling frequency moves to high frequency. If further deterioration occurs or variability increases then failure to comply with the threshold may occur (refer to Schedule 2).

Producers or re-processors may propose an alternative sampling scheme for continuous sampling provided that the proposed scheme is demonstrated to not allow more than 10% of biosolids product to be passed that should not be passed for a designated grade.

The requirements for the testing of organic compounds in processed products such as compost may be reduced on the basis of historical data presented to the EPA.

3.3.3 Sampling Requirements for Nutrient Content

Biosolids products classified as Restricted Use 1, 2 or 3, and which are to be beneficially used in agriculture, land rehabilitation or forestry, require sampling and analysis for nitrogen (total Kjeldahl, ammonium and nitrate/nitrite) and total phosphorus in order to determine nutrient loading rates. The nitrogen results are used to calculate the nitrogen limited biosolids application rate (NLBAR) as shown in Schedule 4.

TABLE 3-2

Minimum Sampling Frequency Requirements For Contaminant Grading

Sampling Regime	Number of Samples Per Batch or Sample Event	Comment
Batch Sampling		
Each Batch	1 sample per 100 dry solid tonnes (dst) with a minimum of 3 samples per batch, i.e.3 samples[1] per 300 dst batch, 5 samples per 500 dst batch	Must use data from all samples collected from batch to calculate batch mean (m).All data including relevant historic data to be used to calculate the standard deviation (s). Refer to Schedule 1 for sampling methods
Continuous Sampling		
Sampling to establish monitoring program	17 samples[2] (minimum)	May use historical data[3]
Subsequent sampling[4,5]	1 sample per event[6]	Frequency of sample event is related to daily biosolids production rate and proximity of contaminant concentrations to threshold.

Notes:
1. To reduce the risk of mistakenly rejecting a batch of biosolids when it should be accepted, or of mistakenly accepting a batch of biosolids that should be rejected, samples in addition to the numbers specified above may be taken. The former risk is greater than the latter risk.
2. The initial 17 samples may be taken at the high frequency as set out in table S2-5. Existing data may be used if available.
3. Sewage treatment plants which desire to sample under continuous mode may commence monitoring on batch basis and revert to continuous when I 7 samples are available.
4. Selection of low frequency or high frequency is based on current biosolids quality based on the method outlined in Schedule 2.
5. Low frequency is the common frequency and is indicated by requirements when biosolids contaminant concentrations are low and stable. High frequency is usually indicated when contaminant concentrations are increasing or variable.
6. Sample event refers to the sampling undertaken at the sampling frequency selected.

Sampling for nitrogen analysis should be conducted as close to the biosolids application period as possible due to the changes which occur in biosolids nitrogen content with extended storage.

Sampling should be conducted at the same frequency as contaminant grading, and **mean** nitrogen and phosphorus results should be used to establish nutrient content.

3.3.4 Sampling & Analysis Procedures

The recommended procedures for collecting and analysing biosolids samples are detailed in Schedule 1.

3.4 STABILISATION GRADING

The grading of the stabilisation status of a biosolids product is the second essential step in the classification process.

The pathogen reduction and vector attraction reduction criteria used for stabilisation grading have been derived from the US EPA requirements contained in the Code of Federal Regulations Part 503 (1993) for the land application of sewage sludge.

Three stabilisation grades have been established: A, B and C. Stabilisation grading is established in two ways: firstly by process, and secondly (in the case of stabilisation Grade A) by microbiological verification that the process is performing effectively. The requirements for each grade are described in table 3-3. For each stabilisation grade the biosolids product must satisfy one of the pathogen reduction process requirements **and** one of the vector attraction reduction requirements for that grade.

Prior to grading for stabilisation, all biosolids products shall be considered stabilisation Grade C until proven otherwise.

A superior stabilisation grade may be achieved by further treatment and/or re-processing. To establish that a superior stabilisation grade has been achieved the biosolids product must be regraded following further processing and must meet the stabilisation requirements.

Care should be taken to ensure that biosolids products which are being stored at a storage facility, re-processing facility, land application site or being land applied do not result in complaints due to the generation of offensive odours (refer to section 4.9).

3.4.1 Stabilisation Grade A Product

Products which meet the pathogen reduction and vector attraction reduction requirements listed in table 3-3 and the microbiological standards in tables 3-4 and 3-5 are classified as stabilisation Grade A.

Application for the status of stabilisation Grade A for a process (or equivalent stabilisation Grade A for a combination of processes) may be made to the EPA for those processes not covered in table 3-3. Approval will be granted subject to agreed testing, and test results meeting the stabilisation Grade A requirements.

Stabilisation Grade A pathogen reduction must be accomplished before or at the same time as one of the vector attraction reduction requirements. This requirement is necessary because bacterial regrowth is possible unless a deterrent remains in the biosolids product after the pathogen reduction process. Drying or alkali addition provide such a deterrent. When the pathogen reduction process occurs at the same time, or before, the vector attraction reduction the non pathogenic bacterial populations in the biosolids provide a deterrent to bacterial regrowth.

Stabilisation Grade A biosolids products should not exhibit offensive odours.

Sampling Requirements for Stabilisation Grade A

i) Initial Process Verification

Biosolids products derived from the processes listed in table 3-3 or any other approved Stabilisation Grade A processes, shall initially be subjected to a program of process verification to ensure the process conditions are met. The initial process verification standards are contained in table 3-4. The biosolids must also be tested for compliance with the microbiological standards in table 3-5.

All process conditions, together with process design diagrams and calculations, supported by validated tracer experiments must be submitted to the EPA for approval. Any changes to the process conditions are to be resubmitted and revalidated by the EPA. Routine calibration of control equipment, e.g. temperature probes, is required to approved specifications. Records are to be maintained for all process conditions such as time-temperature data and pH.

For stabilisation Grade A processes in use at the time of release of the guidelines, the process verification shall be carried out within three months of publication of the guidelines.

TABLE 3-3

Biosolids Stabilisation Requirements

*A biosolids product must meet at least one **pathogen reduction** requirement and at least one **vector attraction reduction** requirement.*

Pathogen Reduction Process	Vector Attraction Reduction Requirements
Stabilisation Grade A 1. Thermally treated biosolids a) Biosolids > 7% solids with temperature at least 50° C. The equation (1) for the time -temperature requirement is: $D = \frac{(131{,}700{,}000)}{(10^{0.1400t})}$ where D = time required in days, t = temperature in degrees Celsius This option includes pasteurisation at 70°C for 30 mins; b) Biosolids > 7% solids. This option includes composting at 55°C for 3 consecutive days. c) Biosolids > 7% solids that are small particles heated by contact with either warmed gases or an immiscible liquid. The temperature should be at least 50°C for at least 15 seconds using the equation above. This option includes biosolids in contact with a hot gas stream in a rotary drier or biosolids dried in a multiple-effect evaporator system. d) Biosolids < 7% solids and less than 30 minutes contact time. Use equation 1 for contact times > 15 seconds and < 30 minutes. e) Biosolids < 7% solids and > 30 minutes contact time at 50° C or higher use equation (2) below: $D = \frac{(50{,}070\,000)}{(10^{0.1400t})}$ This option includes thermophilic aerobic digestion. 2. High pH—high temperature process The pH of the biosolids product is to be raised to greater than or equal to pH 12 and remain above pH 12 for 72 hours. During at least 12 hours of the 72-hour period, temperature of the biosolids product has to be greater than 52°C. After 72 hours biosolids product must be air dried to a solids content of more than 50%. 3. Biosolids from unknown processes For biosolids where the history of processing is not known, the product will be subject to a program of testing for the parameters contained in tables 3-4 and 3-5.The testing regime must be accepted by the EPA. This option includes stockpiles of "dewatered" or dried biosolids which have been stored for a minimum of three years.	1. Mass of volatile solids in the biosolids shall be reduced by a minimum of 38%. 2. Anaerobically digested biosolids which do not meet requirement 1. above must have no more than 17% further volatile solids reduction when incubated under anaerobic conditions in a bench scale reactor for an additional 40 days at 30-37° C. 3. Aerobically digested biosolids which do not meet requirement 1. above must have no more than 15% further volatile solids reduction when incubated under aerobic conditions in a bench scale reactor for an additional 30 days at 20°C (typically used for extended aeration processes). 4. Specific oxygen uptake rate for biosolids treated by an aerobic process shall be less than 1.5 mg 0_2/hour/g total solids at 20°C. 5. The pH value of the biosolids shall be raised to 12 and without the addition of further alkali shall remain at 12 or higher for two hours and then at 11.5 or higher for an additional 22 hours. 6. For biosolids which contain stabilised solids only, the proportion of dry solids shall be at least 75%. 7. For biosolids which contain unstabilised solids generated in a primary wastewater treatment process the proportion of dry solids shall be at least 90%. 8. Biosolids shall be treated in an aerobic process for at least 14 days. During that time, the temperature of the biosolids shall be >40°C and the average temperature >45° C. This option relates primarily to composted biosolids.
Stabilisation Grade B 1. Anaerobic digestion 2. Aerobic digestion 3. Air drying 4. Composting 5. Lime stabilisation 6. Extended aeration 7. Other processes accepted by the EPA	One of the vector attraction reduction requirements from Stabilisation A above or one of the following requirements: Process Option (for Stabilisation B only) 1. At least 20 days continuous or intermittent extended aeration including aerobic digestion time followed by six (6) months storage of biosolids in a lagoon or equivalent process. Barrier Options (for Stabilisation B only) 2. Biosolids shall be injected below the surface of the land. 3. Biosolids applied to the land surface must be incorporated within six hours of application on the land.
Stabilisation Grade C Not meeting any of the above requirements	Not meeting any of the above requirements

ii) Routine Monitoring

The microbiological standards which stabilisation Grade A biosolids products must achieve are set out in table 3-5. Testing for these microbiological standards shall be conducted by obtaining one composite sample consisting of five individual grab samples per 300 dst batch. Alternative pathogen sampling regimes may be approved by the EPA based upon the provision of product variability data.

iii) Regrowth Potential and the Timing of Stabilisation Grade A Sampling

The potential for regrowth of pathogenic bacteria in stabilisation Grade A biosolids products makes it important to ensure that substantial regrowth has not occurred. The requirements in table 3-5 should be met when the biosolids product is used, disposed of, sold or given away. Sufficient time must be allowed to obtain the results before the biosolids are used or disposed.

In some instances periodic sampling of stabilisation Grade A biosolids products may be required at the site of land application to ensure regrowth has not occurred.

However for composted biosolids products the microbiological testing should be conducted before mixing the composted biosolids with any other products in the formulation of soil mixes.
The recommended procedures for sampling and analysis are contained in Schedule 1.

3.4.2 Stabilisation Grade B Product

Biosolids products meeting any one of the requirements for pathogen reduction and the vector attraction requirements in table 3-3 are deemed to have met stabilisation Grade B.

To meet stabilisation Grade B a method of pathogen reduction is required as part of the sewage treatment process, in either the liquid or solid stream. These pathogen reduction methods contained in table 3-3 must be conducted to a level acceptable to the EPA.

Stabilisation Grade B biosolids should not exhibit offensive odours. Odour reduction may be achieved by the injection or immediate incorporation into the soil of the receiving land, required by the barrier options for vector attraction reduction (table 3-3).

The volatile solids reduction requirements contained in table 3-3 relate to the percentage of volatile solids reduction from the raw sludge to the biosolids that are used or disposed of. This includes any volatile solids reduction which may occur on drying beds or in lagoons.

Sampling Requirements for Stabilisation Grade B

Biosolids products from processes requiring stabilisation Grade B shall initially be subjected to a program of testing (volatile solids reduction tests, specific oxygen uptake rate (SOUR) tests) to verify compliance in accordance with the requirements of table 3-3. Thereafter, testing for compliance with the requirements of table 3-3 shall be repeated:

- on an annual basis during peak seasonal production of biosolids products
- when there is a marked increase in production
- when there is significant variation to the process
- as directed by the EPA.

3.4.3 Stabilisation Grade C

Biosolids products not meeting any of the requirements set out in table 3-3 have not been sufficiently stabilised and are graded stabilisation Grade C.

TABLE 3-4

Initial Process Verification Standards

Parameter	Standard
Enteric viruses	< 1 PFU per 4 grams total dry solids
Helminth ova *(Ascaris* sp. and *Taenia* sp.)	< 1 per 4 grams total dry solids

PFU = plaque-forming unit

TABLE 3-5

Stabilisation Grade A Microbiological Standards

Parameter	Standard
E. coli	<100 MPN per gram (dry weight)
Faecal coliforms	<1,000 MPN per gram (dry weight)
Salmonella sp.	Not Detected / 50 grams of final product (dry weight)

MPN = most probable number.

3.5 CLASSIFICATION

Once the contaminant and stabilisation grades have been determined, the biosolids product is to be classified as either Unrestricted Use, Restricted Use or Not Suitable for Use on the basis of the assigned grades. The minimum quality grades corresponding to each product classification and allowable applications (uses) and disposal methods of classified biosolids are described in table 3-6.

3.5.1 How to Classify Biosolids Products

The steps involved in the classification process are summarised in table 3-7.

3.5.2 Reclassification of Biosolids

To re-classify a biosolids product, the contaminant and/or stabilisation grade must be re-evaluated in accordance with sections 3.3 and 3.4. Biosolids must be reclassified:

- after dilution with other material including other biosolids products
- after further treatment which alters the classification.

3.6 RELEASING BIOSOLIDS PRODUCTS FROM FACILITIES

3.6.1 Sewage Treatment Plants

Releasing biosolids from a sewage treatment plant before the completion of grading for classification is permitted only if one of the following conditions is satisfied:

1. Biosolids are released to an EPA approved off-site storage facility and retained there until grading for classification is complete.
2. Biosolids are released to an EPA approved re-processing facility and the re-processed biosolids products are classified according to the guidelines.

TABLE 3-6

Classification of Biosolids Products

Biosolids Classification	Allowable Land Application Use	Minimum Quality Grades	
		Contaminant Grade	Stabilisation Grade
Unrestricted Use	i) Home lawns and gardens. ii) Public contact sites. iii) Urban landscaping. iv) Agriculture. v) Forestry. vi) Soil and site rehabilitation. vii) Landfill disposal. viii) Surface land disposal[2].	A	A
Restricted Use 1	i) Public contact sites. ii) Urban landscaping. iii) Agriculture. iv) Forestry. v) Soil and site rehabilitation. vi) Landfill disposal. vii) Surface land disposal[2].	B	A
Restricted Use 2	i) Agriculture. ii) Forestry. iii) Soil and site rehabilitation. iv) Landfill disposal. v) Surface land disposal[2].	C	B
Restricted Use 3	i) Forestry. ii) Soil and site rehabilitation. iv) Landfill disposal. iv) Surface land disposal[2]	D	B
Not Suitable For Use	i) Landfill disposal. ii) Surface land disposal[2].	E[1]	C[1]

Notes:
1. Biosolids products which are not contaminant or stabilisation graded are automatically classified Not Suitable For Use.
2. To be applied within the boundaries of sewage treatment plant site.

3. Biosolids are classified as Not Suitable for Use and released in accordance with that classification.
4. Approval for release is secured from the EPA.

Apart from the four exceptions listed above, releasing biosolids from a sewage treatment plant or EPA approved off-site storage facility (see below) is only permitted at the completion of the classification process and in accordance with the biosolids classification achieved (section 3.5).

Under no circumstance shall beneficial land application, distribution, or sale of biosolids products be permitted until classification is complete.

3.6.2 Off-site Storage Facilities

Off-site storage facilities approved under Section 17K of the Pollution Control Act may receive classified or unclassified biosolids products from sewage treatment plants or re-processing facilities.

Releasing biosolids from an off-site storage facility is permitted provided that classification of the biosolids product is complete (noting that ungraded biosolids will be classified as Not Suitable For Use) or the biosolids are released to a re-processing facility. In addition, the release must be in accordance with the classification achieved (section 3.5).

Under no circumstances shall beneficial land application, distribution, or sale of biosolids be permitted until classification is complete.

3.6.3 Reprocessing Facilities

EPA approved re-processing facilities may receive biosolids from sewage treatment plants or off-site storage facilities before classification is complete or if classified Contaminant Grade E or Stabilisation Grade C.

Reprocessing facilities may release biosolids products in accordance with the classification of the biosolids in the product if it can be demonstrated to the EPA that the biosolids additives contain concentrations of contaminants less than the acceptance limit for the desired contaminant grade. Alternatively, the re-processing facility may reclassify the biosolids product (section 3.5.2).

TABLE 3-7

How To Classify Biosolids Products

Step	Item Description
	Contaminant Grade:
1.	Take biosolids product samples as required by table 3-2.
2.	Analyse samples for regulated contaminants in table 3-1.
3.	From results of analyses calculate the contaminant grade for each contaminant in accordance with the procedures in Schedule 2.
4.	Compare the calculated contaminant grades with threshold concentrations in table 3- 1
5.	Assign contaminant Grade A, B, C, D or E to each contaminant. Assign to Grade E if not sampled or if an inadequate number of samples have been taken.
6.	Identify the lowest contaminant grade for all the tested contaminants (assuming A is high and E is low).
7.	Assign contaminant Grade A, B, C, D or E to the biosolids product according to the lowest grade identified in Step no.6.
	Stabilisation Grade:
1.	For stabilisation Grade A, take and analyse the samples for the parameters listed in table 3-4 and table 3-5.
2.	For stabilisation Grade B, take sample and carry out the analyses for one of the parameters listed in table 3-3, where applicable.
3.	Compare results of the analyses with the requirements of table 3-3, table 3-4 and table 3-5 (stabilisation Grade A), and table 3-3 (stabilisation Grade B)
4.	Assign stabilisation Grade A, B or C to the biosolids product.
	Biosolids Classification:
1.	When contaminant and stabilisation grades have been assigned, compare the grades with table 3-6 and establish biosolids classification.
2.	Retain the contaminant and stabilisation grading records.
3.	Distribute a copy of the contaminant and stabilisation grading information to the receiver of the biosolids product (that is the re-processor, applier or landfill operator) and retain information for 25 years.

Table 3-8

Biosolids Products Summary of Application Requirements

Biosolids Application Site	Biosolids Product Classification	Ability to Bag for Sale	EPA Site Approval	Individual Site Assessment	Consent from Owner/Controlling Authority	Site Post Application Monitoring	Access Constraints	Record Keeping	Site Location Reporting in EPA Annual Report
All lands including home lawns	Unrestricted	yes; label as biosolids source.	no	no	yes	no	no	no	no
Public contact sites & urban landscaping	Restricted Use 1	no	no	no	yes	no	no	no	no
Agriculture	Restricted Use 1 & 2	no	yes	yes	yes	application- & site-dependent	yes	yes	yes
Land rehabilitation	Restricted Use 1 & 2	no	yes	yes	yes	application- & site-dependent	yes	yes	yes
Forestry	Restricted Use 1 , 2 & 3	no	yes	yes	yes	application- & site-dependent	yes	yes	yes
Industrial & urban rehabilitation	Restricted Use 2 & 3	no	may be required; site-dependent	yes	yes	application- & site-dependent	yes	yes	yes
Landfill	All classifications	no	yes	yes	yes	yes	yes	yes	yes
Surface disposal	All classifications	no	yes	yes	yes	application- & site-dependent	yes	yes	yes

SECTION 4

Beneficial Land Application of Biosolids Products

This section covers land application of biosolids products for beneficial use. It addresses the application rates for beneficial uses, the suitability of sites for biosolids land application, management practices, site requirements, administrative requirements and statutory requirements.

The application of biosolids is defined as beneficial use when the application rate is such that:

- the utilisation of nutrients in the biosolids is at a rate which does not exceed the nutrient requirements of the vegetation, crops or pasture growing on the land
- the beneficial characteristics of the organic matter are used for soil conditioning purposes.

Whenever biosolids products application rates exceed the nutrient requirement or the requirement for organic matter, the application of the biosolids products is not considered beneficial use and has become land disposal (refer to Section 5).

4.1 APPLICATION OF CLASSIFIED BIOSOLIDS PRODUCTS

Biosolids products shall be classified according to the procedure outlined in Section 3. To be eligible for beneficial land application, biosolids must be classified as either: Unrestricted Use, or Restricted Use 1,2 or 3.

Biosolids products which are classified Not Suitable For Use may not be applied to land outside the boundaries of the sewage treatment plant site unless it has been identified for surface land disposal (see Section 5). If grading for classification remains incomplete, the biosolids products are classified Not Suitable For Use.

The suitability of land for the application of biosolids products is determined by two parameters:

- biosolids products classification (Section 3)
- site characteristics, in particular, the site land use (i.e. agricultural land or non-agricultural land).

Allowable applications of classified biosolids to land are listed in table 4-1, along with references to those sections of the guidelines which set out the associated requirements.

4.2 SENSITIVE AREAS

Sensitive areas are land areas which have ecological, natural, cultural or heritage values worthy of preservation. Table 4-2 lists the types of sensitive areas where the application of biosolids products is not suitable. Biosolids products of all classifications shall not be applied to the areas listed in table 4-2 or the buffer zones around such areas (table 4-3) without the approval of the relevant controlling authority and the owner or occupier of the sensitive area, and the EPA.

The list of sensitive areas in table 4-2 does not include environmental protection zones which may be identified in local and regional planning instruments. Appliers and users are advised to consult with local councils regarding these areas.

TABLE 4-1

Allowable Application of Classified Biosolids

Biosolids Classification	Allowable Land Application	Guideline Reference to Requirements
Unrestricted Use	i) Home lawns and gardens	table 3-8
	ii) Public contact sites	
	iii) Urban landscaping	
	iv) Agriculture	
	v) Land rehabilitation	
	vi) Forestry	
	vii) Landfill disposal	section 5.2
	viii)Surface land disposal	section 5.1
	Non-agricultural Land:	
Restricted Use 1 (Urban)	i) Public contact sites	table 3-8
	ii) Urban landscaping	
	iii) Forestry	section 4.5
	iv) Landfill disposal	section 5.2
	v) Surface land disposal	section 5.1
	Agricultural Land:	
	i) Agriculture	table 3-8
	ii) Land rehabilitation	section 4.4
Restricted Use 2 (Agricultural Land)	i) Agriculture	table 3-8, section 4.4
	ii) Land rehabilitation	section 4.4
	iii) Forestry	section 4.5
	iv) Landfill disposal	section 5.2
	v) Surface land disposal	section 5.1
Restricted Use 3 (Non-agricultural Land)	i) Forestry	table 3-8, section 4.5
	ii) Land rehabilitation	section 4.5
	iv) Landfill disposal	section 5.2
	iv) Surface land disposal	section 5.1
Not Suitable For Use	i) Surface land disposal (site dependent)	table 3-8, section 5.1
	ii) Landfill disposal	section 5.2

4.3 GROUNDWATER CONSIDERATIONS

Groundwater is recharged by infiltration of water from the land surface, and while some areas can be delineated where there may be a concentration of recharge, the process is generally a diffuse one. There are very few areas where it can be stated that recharge will not occur.

The vulnerability of an aquifer system to pollution as well as the current and future uses of the system need to be determined in order to assess potential risk of biosolids application. Key factors to be considered are the level of pathogen reduction and nutrient content of the biosolids product, the proposed biosolids loading rate and the potential cumulative effects of other land practices within the aquifer recharge area.

The types of geologic formations which are most vulnerable to pollution risk are coastal dune sands, alluvial deposits and basalt formations. The coastal sand dunes which have a very high infiltration rate are most vulnerable to pollution. Alluvial deposits, which contain sand and gravel layers together with silt and clay deposits in the main river valleys, are also relatively vulnerable. The degree of vulnerability is quite variable and depends on the distribution of low permeability clay layers within the deposits. Where clay layers occur at or near the surface, the likelihood of pollution is diminished. Basalt in itself is often quite impermeable, but basaltic formations are often subject to

TABLE 4-2

Sensitive Areas Where the Application of All Biosolids Products of Any Classification is Not Suitable

Environmentally Sensitive Areas	Legislation/Regulation	Source of Information
1. Drinking water supply restricted catchment areas.[1,2,3]	*Sydney Water Corporation Act 1987* & other acts (e.g. The Hunter Water Corporation Act)	Sydney Water Corporation, Hunter Water Corporation, local councils or Dept of Land and Water Conservation (Division of Water Resources)
2. Aquifer recharge area currently in use for drinking water supply.[1]		As above
3. Water treatment plants and uncovered drinking water transfer infrastructure such as canals & reservoirs.		As above
4. National Parks (S.33), Historic Sites (S.33), State Recreation Areas (S.47B), Nature Reserves (S.49) State Game Reserves (S.58A), Karst Conservation Areas (S.58K), Wilderness Areas (S.59),Wild and Scenic Rivers (5.61), Aboriginal Areas (5.62), Archaeological Areas (S.65),Wildlife Refuges (S.68), Wildlife Management Areas (5.69), Areas Subject to Conservation Agreement (S.69B), Lands Submerged by Water (S.80),Aboriginal Places (S.84).	*National Parks and Wildlife Act 1974,* No.80 *National Parks and Wildlife (Karst Areas) Amendment* Act 1990 National Parks and Wildlife (Land Management) Regulations 1995	Local district office of NSW National Parks and Wildlife Service
5. Wilderness Areas (identified or declared in the Wilderness Act).	*Wilderness Act 1987* No. I 96	Local district office of NSW National Parks and Wildlife Service
6. Aquatic Reserves, Inter-tidal Protected Areas, mangrove and seagrass habitats, and areas inhabited by endangered or threatened species of fish	*Fisheries Management Act 1994*	NSW Fisheries
7. Marine National Parks, Marine Nature Reserves in either estuarine or marine water, under either Federal or NSW legislation and Marine and Estuarine Protected Areas (MEPA).	*National* Parks *and Wildlife Conservation Act 1975* (Federal); legislation to be enacted by NSW Parliament	NSW Fisheries and Dept of Environment Sport & Territories
8. Wetlands, especially under SEPP 14 or Littoral Rainforests (SEPP 26)	*Environmental Planning and* Assessment Act 1979, No.203	Department of Urban Affairs & Planning
9. Karst areas.		National Parks and Wildlife Service
10. Karst Conservation Areas.	Reserved under the National Parks and Wildlife Act	National Parks and Wildlife Service
11. Native Forests, Flora Reserves and Forest Preserves.	*Forestry Act 1916*	State Forests
12. Native Forests and identified significant vegetation types (Crown and private but excluding native and exotic plantations).The native forest provision will be revised following completion of the Comprehensive Regional Assessment of Forests.		National Herbarium, Royal Botanic Gardens and National Parks and Wildlife Service
13. World Heritage Areas and areas listed in international migratory bird agreements.	International Convention	Department of Environment Sport & Territories
14. National Estate listed Areas (federal).	*Australian Heritage Commission Act 1975* (Federal)	
15. Aquaculture industries (including oyster or mussel farms and fish hatcheries) and commercial and recreational fishing grounds.	*Fisheries Management Act 1994*	NSW Fisheries
16. Crown Reserves for the preservation of flora and fauna.	*Crown Lands* Act 1989	Department of Land and Water Conservation

Notes:

1. Catchment area boundary to be defined by the water supply authority and Department of Land and Water Conservation in groundwater drinking catchments.

2. Buffer zones beyond the catchment area boundary are not applicable.

3. Within the water supply catchment areas for Sydney Water; no biosolids shall be applied to lands within the Schedule I or Schedule 2 special areas. These special areas are defined by Sydney Water Corporation (Special Areas) Regulation 1989.

4. A plantation is defined as an intensively managed stand of trees of either native or exotic species created by the regular placement of seeds or seedlings. For operational purposes, plantations may include undisturbed vegetation within its bounds retained exclusively for maintenance of water quality or small areas otherwise left unpainted. A natural regrowth native forest is not classed as a plantation and is considered to be a native forest.

5. For buffer zones for native forests and significant native vegetation types see tables 4-4, 4-9 and 4-12.

TABLE 4-3

Buffer Zones to Sensitive Areas Listed in Table 4-2

Protected Area	Minimum Width of Buffer Zones (m)		
	Flat (<3% or <2°)	**Downslope (>3% or > 2°)[1]**	**Upslope[1]**
Sensitive Area (table 4-2 excluding item 11 native forests & significant native vegetation types)	500	500	250

Note:
1. Downslope refers to the situation where the sensitive area is downs/ape/downstream of the biosolids application area. Upslope refers to the situation where the sensitive area is upslope/upstream of the biosolids application area.

widespread fracturing and may have permeable zones between successive flow layers. In these circumstances, water can move very rapidly through basalt and such areas need special attention for pollution control (DWR 1987).

Biosolids products such as alkaline stabilised products which are typically applied for soil pH adjustment and therefore at nutrient application rates well below crop requirements are considered to have a low potential for risk of polluting aquifers. In cases where the application of biosolids products such as dewatered cake and liquid biosolids is conducted at rates in excess of annual crop requirements, for example land rehabilitation, careful consideration of groundwater with respect to potential vulnerability and the beneficial use of the aquifer should be undertaken.

Consideration should be given to the total assimilative capacity, at sub-catchment scale, of the groundwater system to accept nutrients derived from biosolids. As a general principle if groundwaters in a sub-catchment are already under stress from nutrient loadings, then there should be a limit to the amount of the catchment that can be used for biosolids land application. In such situations, advice should be sought from the regional office of the Department of Land and Water Conservation.

4.4 APPLICATION ON AGRICULTURAL LAND

The requirements set out in this section apply specifically to the application of biosolids products to land used for agriculture. Where the proposed application of biosolids products is on non-agricultural land the requirements set out in section 4.5 apply.

Application of classified biosolids products to land used for agriculture must comply with the requirements contained in this section.

4.4.1 Definition of Agricultural Land

Land used for agriculture is defined as land which is now or could be in the future used for agricultural purposes. The definition of agricultural land is contained in the glossary.

Such land would also include land which is now vacant or used for other purposes, but may in the future be used for agriculture. It includes home vegetable gardens and home gardens. **Mine sites or degraded lands whose rehabilitation plan indicates grazing or other agricultural uses are included here (see 4.4.8)**. These requirements apply even if the land is not immediately returned to grazing.

4.4.2 Biosolids Products for Use on Agricultural Land

The following biosolids products may be used on land used for food production:

i) _Unrestricted Use Products - applied in accordance with the requirements of table 3-8. Management of stockpiles of large quantities of Unrestricted Use products on agricultural land should carefully consider stormwater run-off to avoid pollution of the environment.

ii) _Restricted Use 1 and Restricted Use 2 Products - applied in accordance with section 4.4.

4.4.3 Areas To Be Avoided When Using Restricted Use Products In Agriculture

On agricultural land, Restricted Use 1 and 2 biosolids products should not be applied to the areas with the site characteristics listed in table 4-4.

4.4.4 Determining Soil Contaminant Concentrations

The quality of the soil must be assessed before biosolids application. The range of contaminants which need to be considered in such an assessment are listed in table 4-5. The soil contaminant concentrations must be determined from the analysis of soils at the proposed application site which have been sampled in accordance with Schedule 3. The results of the soil analysis are then used in the calculation of contaminant limited biosolids application rate (CLBAR) as described in section 4.4.5.

Biosolids products should not be applied to sites where the existing contaminant concentrations are in excess of the maximum allowable soil contaminant concentration contained in table 4-5, unless approved by the EPA.

4.4.5 Maximum Allowable Biosolids Application Rate

The maximum allowable biosolids application rate, as detailed in this section, does not apply to Unrestricted Use biosolids products unless specifically required by the owner or controlling authority of the land.

Restricted Use 1 and 2 biosolids products may be applied to agricultural land with certain restrictions on the application rate. The application of biosolids products should ensure that the maximum allowable soil contaminant concentrations (MASCC) listed in table 4-5 are not exceeded and nitrogen from bio-solids are utilised and their release to the groundwater or surface waters are prevented or minimised.

The maximum allowable biosolids application rate can be established by determining the CLBAR and the nitrogen limited biosolids application rate (NLBAR). The maximum allowable application rate is the lower rate of the CLBAR and NLBAR.

The CLBAR is the rate at which biosolids can be applied without exceeding the maximum allowable concentration of contaminants in the soil. To calculate the CLBAR, knowledge of the existing soil contaminant concentrations (section 4.4.4) and biosolids contaminant application concentration (BCAC) is required for each contaminant in the biosolids to be applied. BCAC is defined as (m+s) for batch and (X_t+s) for continuous sampling (see Schedule 2). The calculation of CLBAR is demonstrated in Schedule 4.

The NLBAR is the rate at which biosolids can be applied without exceeding the annual nitrogen requirements of the crop or vegetation grown on the land (see Schedule 4). Advice should be sought from NSW Agriculture or a professional agronomist regarding appropriate crop nutrient requirements and timing of application.

TABLE 4-4

Site Characteristics of Agricultural Land where Restricted Use 1 & 2 Biosolids Application Should be Avoided

Site Characteristics	Restriction			
	Biosolids should not be applied to:			
Maximum Slope	- land with slope in excess of 10% (6°)			
Areas of Undesirable Drainage Characteristics	- waterlogged soil - slowly permeable soils (refer to Schedule 3)			
	- highly permeable soils (refer to Schedule 3)			
Depth of Bedrock	- land where depth to bedrock is less then 60cm			
Surface Rock Outcrop	- land with >10% surface rock outcrop			
Vegetation	- native forests and significant native vegetation			
Buffer Zones[1]	- land within the following buffer zones:			
	Protected Areas	**Minimum Width of Buffer Zones (m)**		
		Flat (<3% or <2^0)	**Downslope[2] (>3% or >2^0)**	**Upslope[2]**
	Surface Waters	50	100	5
	Farm Dams	20	30	5
	Drinking Water Bores	250	250	250
	Other Bores	50	50	50
	Farm Driveways & Fence Lines	5	5	5
	Native Forests and other Significant Vegetation Types	10	10	5
	Animal Enclosures	25	50	25
	Occupied Dwelling	50	100	50
	Residential Zone	250	500	250

Careful consideration should be given to biosolids to be applied to areas within the 1 in 100 year floodline unless approved by the EPA. Biosolids should not be applied as a general rule to land where the depth to watertable is considered to be less than three metres. Exceptions will be permitted where technical advice from recognised consultants or the Department of Land and Water Conservation states that the environmental impact is acceptable, based on the principles set out in the *Draft Guidelines* for *Groundwater Protection* in the National Water Quality Management Strategy (AWRC 1992)[3].

Notes:

1. All buffer zones must be stable and covered with suitable vegetation to limit the transfer of biosolids from the application area to neighbouring protected areas.

2. Downslope refers to the situation where the Protected Area is below the biosolids application area. Upslope refers to the situation where the Protected Area is above the biosolids application area.

3.The depth to watertable can either be assessed by a suitably qualified professional using standard hydrogeological techniques (soils, geology, topography, local information and the States Groundwater Database) or, if insufficient information exists, a shallow drill hole will be required.

In addition, phosphorus loading rates should also be estimated on sites which receive yearly (or more frequent) biosolids applications. In these instances, crop phosphorus requirements can be exceeded. The total phosphorus and the phosphorus adsorption capacity of the site should be determined at five yearly intervals to ensure that the soil does not become overloaded.

The maximum allowable biosolids application rate should be determined by following the steps in table 4-6 below. Schedule 4 provides an example of the determination of the rate.

TABLE 4-5

Maximum Allowable Soil Contamination Concentrations for Agricultural Land Following Biosolids Application

Contaminant	Maximum Allowable Soil Contaminant Concentration[1] (mg/kg dry weight of soil)
Arsenic (As)	20
Cadmium (Cd)	1
Chromium (Cr, total)	100
Copper (Cu)	100
Lead (Pb)	150
Mercury (Hg)	1
Nickel (Ni)	60
Selenium (Se)	5
Zinc (Zn)	200
DDT/DDD/DDE	0.50
Aldrin	0.02
Dieldrin	0.02
Chlordane	0.02
Heptachlor and heptachlor epoxide	0.02
Hexachlorobenzene	0.02
Lindane	0.02
Benzene hexachloride	0.02
PCBs	0.30

Note:

1. Maximum Allowable Soil Contaminant Concentrations are mean (m) concentration values.

TABLE 4-6

Calculation of Maximum Allowable Biosolids Application Rate for Agricultural Land

Step	Activity
1.	Determine the soil contaminant concentrations to be used in the calculation from composite soil samples as detailed in Schedule 3.
2.	Determine, for each contaminant, the BCAC to be used in the calculation. Use (m+s) for batch sampling or (X_t+s) for continuous sampling regimes.
3.	Calculate the CLBAR via the tabulated method given in Schedule 4.
4.	Determine the NLBAR. Method in Schedule 4.
5.	Determine the maximum allowable biosolids application rate by comparing the CLBAR and NLBAR. Select the lower of the two

4.4.6 Management Practices For Restricted Use Products In Agriculture

This section addresses the management practices required for the application of biosolids products in agriculture. These practices do not apply to Unrestricted Use biosolids products unless specifically required by the owner or controlling authority of the land.

The management practices applying to the use of Restricted Use 1 and 2 biosolids products on agricultural land are set out in table 4-7.

4.4.7 Activity Constraints for Restricted Use Products in Agriculture

This section details the constraints on activities where biosolids are applied to agricultural land. The constraints are imposed to minimise the risk of exposure to pathogens in the biosolids. The constraints do not apply to Unrestricted Use or Restricted Use 1 biosolids products.

TABLE 4-7

Management Practices for Restricted Use Biosolids Products in Agriculture

Item	Management Practice
Stockpiling on Application Sites	1. Where biosolids are stockpiled on application sites the following performance objectives should be met a) All biosolids to be retained within the storage area. b) Drainage from the stockpile area should be reused on the biosolids application area. c) Minimized odour impacting on neighbours. The following area recommended methods to achieve these objectives: i) Storage period of biosolids shall be restricted to 30 days. At the end of this period application should commence and all stored biosolids product should be applied. ii) The stockpile bund walls should be constructed of compacted earth and maintained to contain the first hour of a I in 20 year rainfall event. iii) Surface water diversion is required at the entrance to the bunded area which allows truck access. iv) A drainage collection point should be located within the stockpile area which is separate from the stored biosolids. Drainage from the stockpile area should not be released to surface waters. Collected drainage may be applied to the application site. v) The stockpile area should be located within the biosolids application area and conform to the buffer zone restrictions in table 4-4. vi) Stockpile areas should be located on a maximum slope of 4% (2.3°).Alternative methods of achieving these performance objectives must be approved by the EPA. For biosolids being applied using a barrier vector attraction reduction option (table 3-3) stockpiling is limited to the day of application due to the possible attraction of vectors.
Incorporation of Biosolids	2. Biosolids should be incorporated into the soil within 36 hours of spreading.
Frequency of Application	3.[1] Once applied to a portion of land, biosolids should not be reapplied to that portion of land until at least five years has elapsed or pH requirements detailed below are met.
Soil pH Adjustment	4.[1] For an application frequency of greater than one in five years, the applier should apply a liming agent to the soil o achieve a minimum soil pH $5.5_{(CaCl2)}$ and maintain at that pH for at least two years following biosolids application.
Water Sampling	5. Where application rates of biosolids exceed 1,200 kg total N/ha, a water sampling program is to be developed for groundwater and adjacent surface waters where deemed appropriate by the EPA

Note:
1. These management practices do not apply to contaminant Grade A biosolids products.

When Restricted Use 2—stabilisation Grade B biosolids products are applied to land used for food production, the land user shall meet the constraints set out in table 4-8 to minimise the risk of exposure to pathogens.

4.4.8 Areas To Be Avoided When Using Restricted Use Products in Land Rehabilitation

The requirements in sections 4.4.8 to 4.4.12 have been developed for the application of biosolids to spoil materials from open-cut coal mine operations. However these requirements may also be used for the application of biosolids on washery reject materials, tailing dams or spoil materials from metalliferous mines or other land rehabilitation projects where sites have been disturbed or degraded.

Where rehabilitated land may be used for future agricultural purposes, Restricted Use 1 and 2 biosolids products should not be applied to the areas with the site characteristics listed in table 4-9.

4.4.9 Determining Soil Contaminant Concentrations

The quality of the replacement topsoil and overburden must be known before biosolids application. The soil contaminant concentrations must be determined from the analysis of overburden and/or soils at the proposed application site which have been sampled and analysed in accordance with Schedule 3. Overburden samples will not require analysis of organic compounds. Overburden areas

TABLE 4-8

Activity Constraints Specifically For Restricted Use 2— Stabilisation Grade B Biosolids Products on Agricultural Land[1]

Item	Activity Constraints
Human Food Crops	1. Where harvested parts touch the biosolids/soil mixture but are above the land surface, e.g. lettuce, the crop should not be grown for I8 months after biosolids application.
	2. Where harvested parts are below the surface of the land, e.g. carrots, the crops should not be grown for five years after biosolids application.
	3. Where harvested parts do not touch the biosolids/soil mixture, the parts shall not be harvested for 30 days after biosolids application
Animal Feed & Fibre Crops	4. Should not be harvested for 30 days after biosolids application
Animal Withholding	5. Animals should not be allowed to graze the land for 30 days after biosolids application
	6. Lactating (including mail for human consumption) and new-born animals should not be allowed to graze the land for 90 days after biosolids application.
	7. Poultry and pigs should not be grazed on biosolids application areas.[2]
Turf	8. Turf grown on land to which biosolids have been applied should not be harvested for one year after biosolids application.
Public Access[3]	9. Where there is a high potential for public exposure, access should be restricted by fencing and signing for one year after biosolids application
	10. Where there is a low potential for public exposure access should be restricted for 30 days after biosolids application.

Notes:

1. *These site constraints do not apply to any Stabilisation Grade A biosolids products.*
2. *This constraint is due to feeding habits of these animals resulting in high levels of ingested soil material.*
3. *Potential for public exposure will be determined by the EPA.*

TABLE 4-9

Site Characteristics of Land Used for Rehabilitation Where Restricted Uses 1&2 Biosolids Application Should be Avoided

Site Characteristics	Restriction:			
Maximum Slope	- land with a slope in excess of 18% (10°)			
Areas of Undesirable Drainage Characteristics	- waterlogged soils			
	- very slowly permeable soils (refer to Schedule 3)			
	- highly permeable soils (refer to Schedule 3)			
Vegetation	- native forests and significant native vegetation types			
Buffer Zones[1]	- land within the following buffer zones:			
	Protected areas	**Minimum width of buffer zones (m)**		
		Flat (<3% or <2⁰)	**Downslope[2] (>3% or >2⁰)**	**Upslope[2]**
	Surface Waters	50	100	5
	Sedimentation Basins	10	10	5
	Drinking Water Bores	250	250	250
	Other Bores	50	50	50
	Access Roads & Fence Lines	5	5	5
	Native Forests[3]	50	100	5
	Animal Enclosures	25	50	25
	Occupied Dwelling	50	100	50
	Residential Zone	250	500	250

Careful consideration should be given to applying biosolids to areas within the 1 in 100 year floodline unless approved by the EPA. Biosolids should not be applied as a general rule to land where the depth to the watertable is considered to be less than three metres. Exceptions will be permitted where technical advice from recognised consultants or the Department of Land and Water Conservation states that the environmental impact is acceptable, based on the principles set out in the *Draft Guidelines for Groundwater Protection* in the National Water Quality Management Strategy (AWRC 1992).[4]

Notes:

1. All buffer zones must be stable and covered with suitable vegetation to limit the transfer of biosolids from the application area to neighbouring protected areas.
2. Downslope refers to the situation where the protected area is below the biosolids application area. Upslope refers to the situation where the protected area is above the biosolids application area.
3. In considering licence applications for applying biosolids to land adjoining any sensitive area (see table 4-2), the EPA must examine possible impacts assessed in the Review of Environmental Factors (REF) and consult with relevant government authorities. The licence may then require increased buffer zones to protect the sensitive area.
4. The depth to the watertable can either be assessed by a suitably qualified professional using standard hydrogeological techniques (soils, geology, topography, local information and the States Groundwater Database), or if insufficient information exists, then a shallow drill hole will be required.

should be sampled before topsoil spreading. The results of the soil and/or overburden analysis is then used in the calculation of CLBAR as described in section 4.4.5.

Biosolids products should not be applied to sites where the existing contaminant concentrations are in excess of the maximum allowable soil contaminant concentration contained in table 4-5, unless approved by the EPA.

4.4.10 Maximum Allowable Biosolids Application Rate for Rehabilitated Land

The maximum allowable biosolids application rate, as detailed in this section, does not apply to Unrestricted Use biosolids products unless specifically required by the owner or controlling

authority of the land. Restricted Use 1 and 2 biosolids products may be applied to rehabilitated land to be used for agriculture with certain restrictions on application rate. The application of biosolids products should ensure that the MASCCs listed in table 4-5 are not exceeded and nitrogen from biosolids are utilised and its release to the groundwater or surface waters is prevented or minimised.

The maximum allowable biosolids application rate can be established by determining the CLBAR and the NLBAR. The maximum allowable biosolids application rate is the lower rate of the CLBAR and NLBAR application rates.

The CLBAR is the rate at which biosolids can be applied without exceeding the maximum allowable concentration of contaminants in the soil. To calculate the CLBAR, knowledge of the existing soil contaminant concentrations (section 4.4.9) and the BCAC is required for each contaminant in the biosolids to be applied. BCAC is defined as (m+s) for batch and (X_t+s) for continuous sampling (see Schedule 2). The calculation of the CLBAR is demonstrated in Schedule 4.

The NLBAR is the rate at which biosolids can be applied without exceeding the nitrogen requirements of the crop or vegetation grown on the land (see Schedule 4).

In addition, phosphorus loading rates should also be estimated on sites which receive yearly (or more frequent) biosolids applications. In these instances crop phosphorus requirements can be exceeded. The total phosphorus and phosphorus adsorption capacity of these sites should be determined at five-yearly intervals to ensure that the soil does not become overloaded.

The maximum allowable biosolids application rate should be determined by following the steps in table 4-10 below. Schedule 4 provides an example of the determination of the rate.

4.4.11 Management Practices for Restricted Use Products in Land Rehabilitation

This section addresses the management practices required for the application of biosolids products to rehabilitated land used for agriculture. These practices do not apply to Unrestricted Use biosolids products unless specifically required by the owner or controlling authority of the land. The management practices applying to the use of Restricted Use 1 and 2 biosolids products on rehabilitated land used for food production are set out in table 4-11.

TABLE 4-10

Calculation of Maximum Allowable Biosolids Application Rate for Rehabilitated Land

Step	Activity
1	Determine the soil contaminant concentrations to be used in the calculation from composite soil samples, as detailed in Schedule 3.
2	Determine, for each contaminant, the BCAC to be used in the calculation. Use (m+s) for batch sampling or (X_t+s) for continuous sampling regimes.
3	Calculate the CLBAR via the tabulated method given in Schedule 4.
4	Determine the NLBAR. Method contained in Schedule 4.
5	Determine the maximum allowable biosolids application rate by comparing the CLBAR and NLBAR. Select the lower of the two.

TABLE 4-11

Management Practices for Restricted Use Biosolids Products in Land Rehabilitation

Item	Management Practice
Stockpiling on Application Sites	1. Where biosolids are stockpiled on application sites the following performance objectives should be met: a) All biosolids to be retained within the storage area. b) Drainage from the stockpile area should be reused on the application area. c) Minimise odour impacting on neighbours. The following is a recommended method of achieving these objectives: i) Storage period of biosolids should be restricted to 30 days. At the end of this period application should commence and all stored biosolids product should be applied. ii) The stockpile bund walls should be constructed of compacted earth and maintained to contain the first hour of a 1 in 20 year rainfall event. iii) Surface water diversion is required at the entrance to the bunded area which allows truck access. iv) A drainage collection point should be located within the stockpile area which is separate from the stored biosolids. Drainage from the stockpile area should not be released to surface waters. Collected drainage may be applied to the application site. v) The stockpile area should be located within the controlled drainage area of the sediment control basin. vi) Stockpile areas should be located on a maximum slope of 4% (2.3^0).Alternative methods of achieving these performance objectives must be approved by the EPA. For biosolids being applied using a barrier vector attraction reduction option, (table 3-3) stockpiling is limited to the day of application due to the possible attraction of vectors.
Incorporation of Biosolids	2. Biosolids should be incorporated into the soil within 36 hours of application by deep ripping, chisel plough or other method approved by DLWC (Soil Conservation). 3. DLWC (Soil Conservation) should be consulted regarding application and incorporation methods
Run-off	4. Stormwater run-off from biosolids application sites should be directed to the sediment control basins on the mine site to prevent run-off of biosolids to surface waters.
Frequency of Application	5.[1] Once applied to a portion of land, biosolids should not be reapplied to that portion of land until at least five years has elapsed or pH requirements detailed below are met
Soil pH Adjustment	6.[1] For an application frequency of greater than one in five years, the applier should lime the soil to achieve a minimum soil pH 5.5($_{CaCl2}$) and maintain at that pH for at least two years following biosolids application.
Water Sampling	7. Where deemed appropriate by the EPA, sites which apply more than 1,200 kg total N/ha may require a water sampling program to be developed for groundwater and adjacent surface waters.

Note:
1. These management practices do not apply to contaminant Grade A biosolids products.

Application of biosolids on mine sites will typically be conducted by the application of dewatered or dried biosolids using biosolids spreading equipment. Alternative means of application such as hydro-mulching will be considered by the EPA on a case by case basis.

4.4.12 Activity Constraints for Restricted Use Products in Land Rehabilitation

This section details the constraints on activities where biosolids are used in land rehabilitation. The constraints are imposed to minimise the risk of exposure to pathogens in the biosolids. The constraints do not apply to Unrestricted Use, Restricted Use 1, or Restricted Use 2—stabilisation Grade A biosolids products.

When Restricted Use 2—stabilisation Grade B biosolids products are applied to land used for food production, the land user shall meet the constraints set out in table 4-8 to minimise the risk of exposure to pathogens.

In general, rehabilitation areas on open-cut mines are considered to have a low potential for public exposure access.

4.5 APPLICATION ON NON-AGRICULTURAL LAND

The requirements set out in this section apply specifically to the application of biosolids to non--agricultural land. Where the proposed application of biosolids is applied to land used for agriculture, the requirements set out in section 4.4 apply.

4.5.1 Definition of Non-agricultural Land

i) Non-agricultural land is land which will not be used for agricultural purposes within the foreseeable future (refer to the definition of agricultural land in the Glossary).

ii) It may not be clear whether some land constitutes agricultural land or not. In such cases, the final decision is to be made by NSW Agriculture.

iii) Land where biosolids have been applied in accordance with non-agricultural land requirements may, in the future, be used for agriculture provided the site is assessed, the soil contaminant concentrations listed in table 4-5 are not exceeded, and approval is granted by the EPA and NSW Agriculture.

4.5.2 Biosolids Products for Use on Non-agricultural Land

The following biosolids products may be used on non-agricultural land:

- Unrestricted Use products—applied in accordance with table 3-8. Management of stockpiles of large quantities of Unrestricted Use products on non-agricultural land should carefully consider stormwater run-off to avoid pollution to the environment.
- Restricted Use 1, 2 and 3 products—for use on forestry sites and land rehabilitation, applied in accordance with sections 4.5.3 to 4.5.7.
- Restricted Use 2 and 3 products—for use on industrial and urban site rehabilitation, applied in accordance with section 4.5.8.

4.5.3 Areas to be Avoided

These requirements have been developed for the application of biosolids to forestry operations. However these requirements may also be used for the application of biosolids on other non-agricultural lands.

On non-agricultural lands Restricted Use biosolids products should not be applied to the areas with the site characteristics listed in table 4-12. These practices do not apply to Unrestricted Use biosolids products unless specifically required by the owner or controlling authority.

TABLE 4-12

Site Characteristics of Non-agricultural Land Where Restricted Use 1, 2 & 3 Biosolids Application Should be Avoided

Site Characteristics	Restriction			
	Biosolids should not be applied to:			
Maximum Slope	- land with a slope in excess of 18% (10°)			
Areas of Undesirable Drainage Characteristics	- waterlogged soils			
	- very slowly permeable soils (refer to Schedule 3)			
	- highly permeable soils (refer to Schedule 3)			
Vegetation	- native forests and significant native vegetation types			
Buffer Zones	- land within the following buffer zones:			
	Protected Areas	**Minimum width of buffer zones (m)**		
		Flat (<3% or <2⁰)	**Downslope[2] (>3% or >2⁰)**	**Upslope[2]**
	Surface Waters	50	100	5
	Drinking Water Bores	250	250	250
	Other Bores	50	50	50
	Forest Roads & Fence Lines	5	5	5
	Native Vegetation	50	100	5
	Property Boundaries or Land Used for Food Production	25	50	25
	Residential Zone	250	500	250
	Occupied Dwelling	50	100	50

Careful consideration should be given to biosolids applied to areas within the 1 in 100 year floodline unless approved by the EPA. Biosolids should not be applied as a general rule to land where the depth to watertable is considered to be less than three metres. Exceptions will be permitted where technical advice from recognised consultants or the Department of Land and Water Conservation states that the environmental impact is acceptable, based on the principles set out in the *Draft Guidelines* for *Groundwater* Protection in the National Water Quality Management Strategy (AWRC 1992).[4]

Notes:
1. All buffer zones must be stable and covered with suitable vegetation to limit the transfer of biosolids from the application area to neighbouring protected areas.
2. In considering an application for a licence for application of biosolids on land adjoining any sensitive area (see table 4-2), the EPA must examine possible impacts on the sensitive area assessed in the Review of Environmental Factors (REF) and consult with relevant government authorities. Following this assessment the licence may require increased buffer zones to protect the sensitive area.
3. Downslope refers to the situation where the Protected Area is below the biosolids application area. Upslope refers to the situation where the Protected Area is above the biosolids application area.
4. The depth to watertable can either be assessed by a suitably qualified professional using standard hydrogeological techniques (soils, geology, topography, local information and the States Groundwater Database) or, if insufficient information exists, then a shallow drill hole will be required.

4.5.4 Determining Soil Contaminant Concentrations

The quality of the soil must be known before biosolids application. The soil contaminant concentrations must be determined from the analysis of soils at the proposed application site which have been sampled in accordance with Schedule 3. The results of the soil analysis are then used in the calculation of the CLBAR as described in Schedule 4.

Biosolids products shall not be applied to sites with contaminant concentrations in excess of the maximum allowable soil contaminant concentration contained in table 4-13 unless approved by the EPA, for example the restoration of industrial land. Under these circumstances an application may be made to the EPA for special consideration (see section 4.5.8).

4.5.5 Maximum Allowable Biosolids Application Rate

The maximum allowable biosolids application rate as detailed in this section does not apply to Unrestricted Use biosolids products unless specifically required by the owner or controlling authority of the land.

Restricted Use 1, 2 and 3 biosolids products may be applied to land not used for food production with certain restrictions on the application rate. For State Forests the application rate of biosolids is restricted to prevent the maximum allowable soil contaminant concentrations listed in table 4-13 and the forestry NLBAR from being exceeded. For other forestry applications, such as private forests and agro-forestry the maximum allowable soil contaminant concentrations are those contained in table 4-5.

The maximum allowable biosolids application rate should be determined by following the steps in table 4-14.

In areas of concern, the EPA may request an assessment of groundwater vulnerability. Advice should be sought from the controlling authority regarding application rates and timing of application.

4.5.6 Management Practices

This section addresses the management practices required for the application of biosolids products to non-agricultural land. These practices do not apply to Unrestricted Use biosolids products unless specifically required by the owner or controlling authority. The management practices applying to all land application sites which receive "Restricted Use" biosolids products are set out in table 4-15.

The application of biosolids of all classifications to State Forests should have written approval from State Forests and must comply with any requirements deemed necessary by State Forests.

TABLE 4-12
Maximum Allowable Soil Contaminant Concentrations for Non-agricultural Land

Contaminant	Maximum Allowable Soil Contaminant Concentration[1] (mg/kg dry weight of soil)
Arsenic (As)	20
Cadmium (Cd)	5
Chromium (Cr, total)	250
Copper (Cu)	375
Lead (Pb)	150
Mercury (Hg)	4
Nickel (Ni)	125
Selenium (Se)	8
Zinc (Zn)	700
DDT/DDD/DDE	0.5
Aldrin	0.2
Dieldrin	0.2
Chlordane	0.2
Heptachlor and heptachlor epoxide	0.2
Hexachlorobenzene	0.2
Lindane	0.2
BHC	0.2
PCBs	0.3

Note:
1. Maximum Allowable Soil Contaminant Concentrations are mean (m) concentration values.

TABLE 4-14

Calculation of Maximum Allowable Biosolids Application Rate for Non-agricultural Land

Step	Activity
1.	Determine the soil contaminant concentrations to be used in the calculation from composite soil samples, as detailed in Schedule 3.
2.	Determine, for each contaminant, the BCAC to be used in the calculation. Use (m+s) for batch sampling or (X_t+s) for continuous sampling regimes.
3.	Calculate the CLBAR via the tabulated method in Schedule 4.
4.	Determine the NLBAR. Method contained in Schedule 4.
5.	Determine the maximum allowable biosolids application rate by comparing the CLBAR and the NLBAR. Select the lower of the two.

Application of Restricted Use products to state forests should comply with the State Forests Biosolids Application Plan. The form for this plan is available from the Research Division of State Forests.

4.5.7 Activity Constraints

This section details the constraints on activities where biosolids are applied to land not used for food production. The constraints are imposed to minimise the risk of exposure to pathogens in the biosolids. The constraints do not apply to Unrestricted Use, Restricted Use 1 and Restricted Use 2— stabilisation Grade A biosolids products.

When Restricted Use 2 and 3 biosolids products are applied to land, the land user should meet the constraints set out in table 4-16.

4.5.8 Biosolids Products for Use on Industrial & Urban Site Rehabilitation

Restricted Use 2 and 3 biosolids products may be used for one-off rehabilitation of industrial and urban sites. Such land may include: urban land not used for growing food crops or grazing food animals; public ovals, playing fields, bowling greens, racetracks, council parks and gardens; military establishments; aerodromes; nature strips; median strips; completed rubbish dumps; and other land zoned by councils to prevent use for agricultural purposes.

The method of application will be assessed on a case by case basis. For such applications, the biosolids loading should be limited by the NLBAR as described in Schedule 4 (ii) and CLBAR as described in Sections 4.5.4 to 4.5.5 and table S4-6. Activity constraints are the same as those outlined in table 4-16. Discussion with the EPA shall be required at the planning stage to determine whether such an application is acceptable.

4.6 RECORD KEEPING & INFORMATION TRANSFER

4.6.1 Record Keeping

This section sets out the types of records to be kept by producers, re-processors, appliers and final receivers/users. The records are to be kept for 25 years and are subject to audit by the EPA. All records are to be forwarded to the EPA on request.

TABLE 4-15

Management Practices for Restricted Use Biosolids Products for Non-agricultural Land

Item	Management Practice
Stockpiling on Application Sites	1. Where biosolids are stockpiled on an application site the following performance objectives should be met: a) All biosolids to be retained within the storage area. b) Drainage from the stockpile areas should be reused on the biosolids application area. c) Minimise odour impacting on neighbours. The following is a recommended method of achieving these objectives: i) Storage period for a batch should be restricted to 30 days. At the end of this period, application operations should commence and all biosolids products should be applied. ii) The stockpile bund walls should be constructed of compacted earth and maintained to contain the first hour of a 1 in 20 year rainfall event. iii) Surface water diversion is required at the entrance to the bunded area which allows truck access. iv) A drainage collection point should be located within the stockpile area which is separate from the stored biosolids. Drainage from the stockpile area should not be released to surface waters. Collected drainage may be applied to the application site. v) The stockpile area should be located within the biosolids application area and conform to the buffer zone restrictions in table 4-12. vi) Stockpile areas should be located on a maximum slope of 4% (2.3°). Alternative methods of achieving these performance objectives must be approved by the EPA. For biosolids being applied under item 7, table 3-3 stockpiling is limited to the day of application due to the possible attraction of vectors
Incorporation of Biosolids	2. Biosolids should be incorporated into the soil within 36 hours of spreading. Incorporation is not required for biosolids applied to areas of forests used for timber production or private pine plantations; or where the forest is not used for grazing.
Run-off	3. Stormwater run-off from biosolids application sites should be controlled where appropriate to prevent contamination of surface waters with biosolids by either run-off diversion or run-off collection
Water Sampling	4. Where application rates of biosolids exceed an available nitrogen load of 350 kg N/ha in the first year, a water sampling program is to be developed for adjacent surface waters and groundwater where deemed appropriate by the EPA (see Schedule 4.1.3).

TABLE 4-16

Activity Constraints Specifically for Restricted Use 2 & 3 Biosolids Products on Non-agricultural Land

Item	Activity Constraints[1,2,3]
Public Access[1,2,3]	1. Where there is a high potential for public exposure access should be restricted by fencing and signing for one year after biosolids application. 2. Where there is a low potential for public exposure access should be restricted for 30 days after biosolids application.

Note:
1. Fencing is not required for biosolids applied to state forests.
2. These activity constraints do not apply to stabilisation Grade A biosolids products.
3. Potential for public exposure will be determined by the EPA.

Record keeping is not required for Unrestricted Use products and Restricted Use 1 products, used on non-agricultural land in the urban environment. The producer and re-processor records are, however, required to be maintained to demonstrate compliance with the classification.

Record keeping procedures required in the guidelines must be in place within 6 months of the guidelines being issued, or immediately when a licence to apply biosolids products to the land is applied for.

Producers

Records to be maintained by the producer of biosolids are listed in table 4-17. Records shall be maintained and transferred in: Form 1—Annual Biosolids Producer Report (Schedule 5).

Re-processors

Records to be maintained by re-processors of biosolids are listed in table 4-18 for biosolids products for each re-processing facility. Records shall be maintained and transferred in: Form 2 Annual Biosolids Re-processor Report (Schedule 5).

TABLE 4-17

Records to be Maintained by Producers

Biosolids Classification	Record Keeping Requirements
Unrestricted Use	Biosolids classification information including: 1. Batch number[1]. 2. Production period. 3. Contaminant grade and contaminant concentrations (Q) for batch sampling and the value (C_t) for continuous sampling (see Schedule 2). 4. Stabilisation grade, method of achieving stabilisation grade and microbiological testing results. 5. Non-compliance with the target classification[2]. 6. Quantity (in dry tonnes) of this class of biosolids. 7. Type of product produced.
Restricted Use	Biosolids classification information including: 1. Batch number[1]. 2. Production period. 3. Contaminant grade and contaminant concentrations (Q) for batch sampling and the value (C_t) for continuous sampling (see Schedule 2). 4. Stabilisation grade, method of achieving stabilisation grade. 5. Non-compliance with the target classification2. 6. Concentration of nitrogen and total phosphorus. 7. Quantity (in dry tonnes) of this class of biosolids. 8. Address of destination of biosolids.
Not Suitable for Use and Biosolids Transferred to a Re-processor	Biosolids classification information including. 1. Batch number'. 2. Production period. 3. Contaminant grade and contaminant concentrations (Q) for batch sampling and the value (Cr) for continuous sampling, if tested (see Schedule 2) and leachate analysis, if required. 4. Stabilisation grade, method of achieving stabilisation grade. 5. Quantity (in dry tonnes) of this class of biosolids. 6. Biosolids classification testing completed (Yes/No). 7. Address of destination of biosolids.

Note:
1. *For continuous operation, Batch refers to the quantity of biosolids produced between the previous and the current sampling.*
2. *When monitoring shows that a classification change has occurred, all the requirements relating to the new classification shall be observed immediately.*

TABLE 4-18
Records to be Maintained by Re-processors

Biosolids Classification	Record Keeping Requirements
Unrestricted Use	1. Biosolids classification information prepared by the producer. 2. Contaminant concentrations (m+as) for batch and the value (X_t) for continuous sampling, in re-processed biosolids (see Schedule 2). 3. Stabilisation grade, method of achieving stabilisation grade and faecal coliform density in re-processed biosolids. Results of microbiological testing for pathogens. 4. Non-compliance with the target classification.' 5. Quantity (in dry tonnes) of this class of biosolids produced, by type. 6. Type of biosolids product produced and batch number.
Restricted Use	1. Biosolids classification information prepared by the producer. 2. Contaminant grade and contaminant grading concentrations (m+as) for batch and the value (X_t) for continuous, in re-processed biosolids (see Schedule 2). 3. Stabilisation grade, method of achieving stabilisation grade and faecal coliform density in re-processed biosolids, if tested. 4. Non-compliance with the target classification[1]. 5. Concentration of nitrogen and total phosphorus. 6. Quantity (in dry tonnes) of this class of biosolids produced, by type. 7. Address of destination of biosolids and batch number
Not Suitable for Use	1. Biosolids classification information prepared by the Producer 2. Concentration of nitrogen and total phosphorus, if tested. 3. Quantity (in dry tonnes) of this class of biosolids. 4. Address of destination of biosolids and batch number.

Note:
1 .When monitoring shows that a classification change has occurred, all the requirements relating to the new classification shall be observed immediately.

Appliers

Records to be maintained by appliers of biosolids are listed in table 4-19 for each application site. Records shall be maintained and transferred in: Form 3—Biosolids Application Report (Schedule 5).

4.6.2 Information Transfer

Certain information must transfer from one party to another party in order to facilitate compliance with the guidelines. Information must transfer from the producer to re-processor, from the producer or re-processor to the applier, and from the applier to the final receiver/user of the material and relevant authorities. The information must be held for a period of 25 years and be available for inspection by the EPA on request.

Producer to Provide Information to Re-processor

When an operator of a sewage treatment plant provides biosolids for further processing to a re-processor (e.g. for chemical stabilisation, composting, artificial soil production, incorporation into fertiliser pellets) the information listed in table 4-20 should also be provided, if available.

Producer or Re-processor to Provide Information to Applier

If a biosolids product is classified as Unrestricted Use then no information is required to be passed on to the applier. The local office of the NSW health department should be informed of the production by producers or re-processors of Unrestricted Use products.

TABLE 4-19

Records to be Maintained by Appliers for Each Application Site

Biosolids Classification	Record Keeping Requirements
Unrestricted Use	No records required.
Restricted Use	1. Location of the application site. 2. Name of occupier or owner of site. 3. Area of the application site. 4. Date of application. 5. Concentrations of contaminants in soil and soil $pH_{(CaCl2)}$ before biosolids application. 6. Nitrogen limiting biosolids application rate. 7. Contaminant limited biosolids application rate and the limiting contaminant. Copy of the calculation table in Schedule 4. 8. Actual application rate of biosolids. 9. Method of application of biosolids. 10. Source of biosolids received and batch number. 11. Contaminant grade and contaminant application concentrations (m+s) of contaminants in biosolids applied (refer Schedule 4). 12. Stabilisation grade and method of achieving stabilisation grade and microbiological testing results of biosolids applied. 13. Concentration of nitrogen and total phosphorus. 14. Copy of EPA licence or equivalent

When a producer or re-processor provides Restricted Use 1, 2 or 3 biosolids to an applier, the information listed in table 4-21 should be provided. However when a producer or re-processor provides Restricted Use 1 biosolids products to an applier for use in urban landscaping or public contact sites there is no requirement for information to transfer to the applier.

Applier to Provide Information to Final Receiver/User

Appliers of biosolids should obtain the information from producers and re-processors necessary to comply with the guidelines. Appliers of biosolids to the land should provide the final receiver/user (owner, farmer, mining company, etc) with the information listed in table 4-22. Information should be transferred in the form of Form 3—Biosolids Application Report (Schedule 5).

Applier to Provide Information to Relevant Authorities

Appliers of biosolids should provide all relevant authorities listed in Table 4-23 with a copy of the EPA Approval/Licence and Form 3—Biosolids Application Report (Schedule 5) for their records and information. The application of biosolids products to mine sites must be reported on an annual basis to the Department of Mineral Resources via the Annual Environmental Management Plan Report (AEMPR) of the lessee of the mine area.

4.7 STATUTORY REQUIREMENTS

4.7.1 Relevant Legislation

There are statutory requirements relevant to the use and disposal of biosolids products, these are:

i) Environment Protection Legislation

The EPA has statutory responsibility to regulate the land application of biosolids products on the basis that such activities have the potential to pollute waters. This statutory responsibility is

TABLE 4-20

Information Transfer- Producer to Re-processor

1. Source of the biosolids and batch number.
2. Mass of product (in dry tonnes).
3. [1] Contaminant Grade (A, B, C, D or E) of biosolids and the concentration of contaminants.
4. [1] Stabilisation Grade (A, B or C) of biosolids and the method of achieving the stabilisation grade.
5. [1] Concentration of nitrogen and total phosphorus.

Note:
1. The information thus indicated may be given to the *re-processor after the biosolids transfer, or not at all if the re-processor classifies the biosolids.*

TABLE 4-21

Information Transfer- Producer or Re-processor to Applier

1. Source of the biosolids products, batch number and date of dispatch.
2. Mass of product (in dry tonnes).
3. Volume of biosolids products (cubic metres, kilolitres or tonnes "as is").
4. Contaminant Grade (A, B, C, D or E) of biosolids products and the concentration of contaminants.
5. Stabilisation Grade (A, B or C) of biosolids products and method of achieving the stabilisation grade.
6. Concentration of nitrogen and total phosphorus.

TABLE 4-22

Information Transfer- Applier to Final Receiver or User

1. Source of the biosolids, batch number and date of dispatch.
2. Concentration of nitrogen and total phosphorus in the applied biosolids.
3. Copy of EPA Licence or approval, if it exists.

TABLE 4-23

Recipients of Information from the Applier

1. Local Council
2. Organic Waste Recycling Unit, NSW Agriculture, if on agricultural land
3. Local office of the Department of Health
4. Research Division, State Forests, if on forested land
5. Regional offices of the Department of Land and Water Conservation
6. Department of Mineral Resources, if on mine sites
7. Producer or re-processor of the biosolids

conferred primarily through the application of the *Clean Waters Act 1970* and the *Pollution Control Act 1970.* The EPA will take into account the requirements of the guidelines when granting approval, or licence, for the land application of biosolids products.

ii) Local Government Act

Local councils that operate sewerage schemes must, in accordance with section 60 of the *Local Government Act 1993*, obtain the approval of the Minister for Land and Water Conservation to provide for sewage from their areas to be discharged, treated or supplied to any person.

iii) Environmental Planning and Assessment Act

Proponents should be aware of requirements for development consent and environmental impact assessment under the provisions of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Depending on the proponent and the nature of the biosolids scheme, a number of situations arise:

a) If the proponent is a private organisation, Sydney Water or Hunter Water, the storage, disposal or use of biosolids at an STP would normally require consent under the provisions of the local environmental plan (LEP). However if the proponent is a municipal council, the storage, disposal or use of biosolids at a municipal STP does not require development consent under the provisions of SEPP 4—Development without consent. The potential environmental impacts must be assessed under the provisions of Part 5 of the EP&A Act.
A REF would need to be prepared to assess the likely significance of the use of the biosolids. An environmental impact statement (EIS) must be prepared for schemes which have the potential to significantly affect the environment.

b) If the biosolids are used, stored or disposed of on a site not directly associated with the STP, then SEPP 4 may not apply. In this case, the proposal needs to be characterised to determine if it is permissible and whether development consent is required under the LEP. When characterising a proposal, the scale and nature of the proposal needs to be considered. For instance, if biosolids are applied to agricultural, forestry or rehabilitated land at the rate recommended in the guidelines for the purpose of soil enrichment, then the application of biosolids to the land could be considered to be ancillary to and subsumed by the purposes of agriculture, forestry or land rehabilitation. As these purposes do not usually require consent, the application of the biosolids would also not require consent. As consent is not required, schedule 3 of the EP&A Regulation 1994 would not apply. If an EPA licence is required, the provisions of part 5 of the EP&A Act would apply and a review of environmental factors (REF) would need to be prepared to assess the likely significance of the use of the biosolids. The REF should be submitted to the EPA so they can determine if an EIS is required.

c) If the biosolids were applied to land at a rate beyond the recommendations in the guidelines, then taking into consideration fact and degree, the proposal may be characterised as having two purposes: agriculture as the dominant purpose, and biosolids disposal as the ancillary but independent purpose. The LEP needs to be consulted to determine if biosolids disposal is permissible and whether development consent is required. If development consent is required, then Schedule 3 would need to be consulted to determine if the proposal is designated. If a development is designated, then an environmental impact statement (EIS) must be lodged with a development application.

d) For biosolids use or disposal schemes which do not require development consent, a government authority before approving an application or granting funds to undertake a scheme, must first consider whether the activity has the potential to cause significant environmental impacts. If significant impacts are likely to result, under the provisions of part 5 of the EP&A Act, an EIS must be considered before any approval being granted. Determining authorities should refer to the guideline *Is an EIS required?* (Department of Urban Affairs and Planning) in deciding if the impacts are likely to be significant.

iv) Fertilisers Act

In 1992 an amendment was made to the *Fertilisers Act 1985* to include products derived from sewage sludge. This amendment will not be proclaimed until the regulation which NSW Agriculture

is formulating is finalised. The prescribed composition standards contained within the new regulation for fertilisers are expected to reflect the requirements of the guidelines

v) Sydney Water Special Areas Regulation

The Sydney Water's Special Areas Regulation 1989 prohibits the bringing in or application of pollutants within a Special Area.

vi) National Parks and Wildlife Act and the Threatened Species Conservation Act

Proponents need to be aware of requirements under the *National Parks and Wildlife Act 1974* (NP&W Act). The National Parks and Wildlife Service (NPWS) is responsible for the care, control and management of all areas reserved or dedicated under the NP&W Act, as well as the protection and care of fauna, the protection of native plants and the protection and care of Aboriginal sites and places throughout NSW. Areas gazetted or reserved under the NP&W Act are excluded from biosolids disposal because of their special significance. Proponents would need to consider the impact of their proposal on the environment including native plants and animals and Aboriginal sites in their REF (see above). Should any Aboriginal sites be damaged or destroyed, then a Consent to Destroy needs to be obtained from the Director-General of the NPWS.

In 1995, the *Threatened Species Conservation Act* became law to require that the assessment and management of threatened species be taken into account when land is developed.

Under the Act, if the National Parks and Wildlife Service determines that the proposed development is likely to significantly affect threatened species, populations or ecological communities, or their habitats, a species impact statement must be prepared.

The National Parks and Wildlife Service may also grant a licence authorising a person to take action that is likely to result in one or more of the following:

(a) harm to a threatened species, population or ecological community (so far as animals are concerned),
(b) picking of a threatened species, population or ecological community (so far as plants are concerned),
(c) damage to a critical habitat,
(d) damage to a habitat of a threatened species, population or ecological community.

A general licence under section 120 of the *National Parks and Wildlife Act 1974* may only be issued:

(a) for scientific purposes, or
(b) for the welfare of an animal, or
(c) if there is a threat to life or property.

Some exemptions do exist under the Act for certain activities.

Information on the *National Parks and Wildlife Act, Threatened Species Conservation Act,* threatened species and archaeological sites is available from the local office of the NPWS.

4.7.2 Steps For Approval

The following is a suggested checklist of procedures to be followed by any person(s) when setting up a scheme to apply biosolids products to a site for the first time and for subsequent applications.

i) Discuss Proposal with the EPA and Other Appropriate Authorities

Discussion with the EPA should commence at an early stage to ensure that all relevant issues are addressed before the design and approval phases are commenced. Discussion may need to be conducted simultaneously with other authorities, such as NSW Agriculture, if biosolids products are to be used for agricultural purposes, or State Forests, if biosolids products are to be used for forestry purposes. Where appropriate, proponents should also discuss groundwater protection requirements with the Department of Land and Water Conservation.

ii) Determine the Need to Apply for a Pollution Control Approval

Biosolids appliers are advised to hold discussions with the EPA before they embark on any activities involving the use of biosolids products. This will assist them in determining whether a pollution control approval is required for their proposed activities.

Generally, if the proposed development or work is covered by the provisions of Section 16 of the Clean Air Act, section 27 of the Noise Control Act, or section 19 of the Clean Waters Act, then a pollution control approval under the Pollution Control Act must be obtained in writing from the EPA.

Sections 19 (1) and (2) of the Clean Waters Act are of particular importance in the context of biosolids application in deciding whether there is a need to apply to the EPA for a pollution control approval. These sections are reproduced in Schedule 6 for reference.

If the proposed application of biosolids to land involves the installation, construction or modification of apparatus, equipment or works for any of the activities described in section 19 (1) of the Clean Waters Act, a pollution control approval must be obtained from the EPA. The application of biosolids products (usually in large quantity) to agricultural land, forests or old mine sites is likely to require EPA approval.

If the proposed application of biosolids does not involve the installation, construction or modification of apparatus, equipment or works, a pollution control approval need not be obtained. And, the application of Unrestricted Use products such as compost onto home lawns and garden would be unlikely to require EPA approval.

For biosolids application planning purposes, eight weeks may be required for the processing of the approval. The Biosolids Application Report (Schedule 5, Form 3) must be prepared and submitted with the appropriate fee for the application of the approval on Form 5 (an approval application form to be obtained from the EPA).

Under Section 17K of the Pollution Control Act, the EPA may grant an application for an approval either conditionally or unconditionally or it may refuse the application.

The issued approval only applies to the site described in the approval application. The holder of the issued approval must forward a Certificate of Compliance to the EPA once construction is completed.

iii) Determine the Need to Apply for a Pollution Control Licence

Premises which are scheduled under the Clean Air Act and the Noise Control Act require pollution control licences to operate.

The Clean Waters Act does not schedule premises. However, it makes it an offence to pollute waters. Sections 16 (1) and (2) are reproduced in Schedule 6 for reference. The application of

biosolids to land may amount to the offence of polluting waters. To avoid committing that offence, the proponent should apply under section 17A of the Pollution Control Act to the EPA for a pollution control licence. Upon receiving an application for a pollution control licence, the EPA, under section 17D, may grant the application conditionally or unconditionally or refuse the application. In exercising its powers under section 17D, the EPA shall have regard to the matters set out in section 17D (4), which is also reproduced in Schedule 6 for reference.

For biosolids application planning purposes eight weeks may be required for the processing of the licence application. The Biosolids Application Report (Schedule 5, Form 3) must be prepared and submitted with the application of the licence (on a licence application form to be obtained from EPA). Renewal of licence is not required for a one-off land application.

iv) Apply Biosolids Products on Land

Biosolids products shall be applied to land so as not to pollute water, and in accordance with licence conditions.

v) Reporting to the EPA

The holder of EPA approval or licence should forward, where appropriate, the following to the EPA:

a) Biosolids classification information by producers and re-processors. Forwarded to the EPA on request
b) Form 1—Annual Biosolids Producer Report to the EPA; and/or
c) Form 2—Annual Biosolids Re-processor Report to the EPA.

vi) Licence Application

With each licence application the EPA requires the applicant to prepare and submit a biosolids application report. The producer or re-processor may, by agreement, prepare the biosolids application report on behalf of the applier. The biosolids application information shall be in the form of Biosolids Application Report (Schedule 5, Form 3).

4.8 SPECIAL REQUIREMENTS FOR SPECIFIC USES

i) Research

Approved research and development trials are exempt from the requirements of Section 4 of the guidelines for the application of biosolids products to the land. All research and development trials which propose to be exempted from the requirements of this section must be approved in writing by the EPA.

ii) Special Approvals

For situations which fail to meet the requirements of the guidelines, special approvals may be granted by the EPA following submission to the EPA of the non-complying circumstances.

4.9 BEST MANAGEMENT PRACTICES

The management practices detailed below have been included to assist biosolids producers, re-processors and appliers in the development of their beneficial use programs. These practices have been found to assist operators in meeting environmental performance objectives and increasing the public acceptance of biosolids beneficial use.

Product Quality

Appliers need to be clear when approaching potential users of biosolids about the value of the product. If farmers, for example, are promised a growth response for their crops that does not eventuate, they are unlikely to try the product again and this information is passed on to other growers.

Biosolids products which are produced for the retail market should meet accepted industry standards, for example, those standards set down by the Australian Standards Association for potting media, compost, mulches and other soil conditioner. Care must be taken that composted biosolids products which are sold are weed free and meet industry compost maturity standards.
Foreign objects such as plastics, glass, blades and sharps should not be present in biosolids destined for reuse.

Site Selection, Assessment and Management

When choosing a site for biosolids application and storage facilities, consideration should be given to the proximity of the site to residences, recreational areas, industrial sites or sensitive areas. Odorous biosolids products which are land applied must be transported and land applied in such a way to avoid public nuisance.

Consideration should be given to the transport route to minimise public nuisance in both urban and rural areas. The access to the site should be chosen carefully in order to avoid creating a traffic hazard during the delivery period to the site.

During the soil sampling of the site the appearance of the soil (soil morphology) and other land features should be recorded on the NSW Soil Data Card (Abraham & Abraham 1993) at each sampling site.

Biosolids should not be applied on the surface during periods of rain or when the ground is saturated. Conversely in periods of dry weather soil conditions may result in an unsatisfactory level of incorporation.

Field staff should be trained in calibrating equipment used to determine biosolids application rates and have an understanding of the requirement of the guidelines. Biosolids spreading machinery should be calibrated to ensure that the biosolids application rate is correct.

Transport of Biosolids

Transporters of waste for fee or reward are required to be licensed under the *Waste Disposal Act 1970* when transporting waste within, into or out of the Sydney Metropolitan Waste Disposal Region. Applications for these licences are available from the EPA Licensing Section.

To minimise the risk of spills, vehicles used to transport dewatered and alkaline biosolids products which have a solids content of 15% or greater should be:

- fitted with grain locks
- include water tight seals on rear tailgates
- cover the load (e.g. with a tarpaulin).

It is generally considered unsafe to transport biosolids with a solids content of less than 15% in open trailers. Liquid biosolids should be transported in a suitable tanker. The transport of raw sludge in fully enclosed tankers must be conducted in a manner to ensure that odour does not cause

a nuisance en route. These vehicles should not be used for backloading foodstuffs for animal or human consumption.

Truck cleaning facilities should be provided at both the sewage treatment plant and end-use sites. Truck tailgates and tyres should be cleaned before leaving the site to ensure biosolids are not spilt on roadways. For products which are dry and meet stabilisation Grade A, the cleaning of vehicles, with water may not be necessary.

Incident Management Plans

An incident management plan should be developed to ensure rapid clean-up of spillages both en route to the site and at the end-use site. It is important that the local' council, where the biosolids are being applied, has input into incident management plans; In the event of a spill the local council and the local office of the EPA should be informed. A dry clean-up for spills is preferred.

Occupational Health and Safety

Biosolids producers and re-processors should produce occupational health and safety plans to ensure workers handling biosolids products are adequately protected from and informed of risks.

Public Acceptance

The acceptance of a biosolids land application program by the community is integral to the success of the program. There are numerous case studies where public opposition to projects has resulted in unfavourable media attention. Opposition may arise where affected people, such as nearby residents have not been adequately informed.

The end-users in any land application program need to be well informed of the guideline requirements and their role in the application e.g. spreading and/or incorporation. Application of biosolids products may affect neighbouring properties due to truck movements and potential odours. If neighbours are not well informed before the application they may become unduly concerned about the environmental and health consequences of an application. Informing neighbours before delivery can avoid potential conflict later. Farmers and other land holders usually have an existing relationship with their neighbours and are therefore generally the best people to make the initial notification of their intention to apply biosolids.

SECTION 4

Disposal of Biosolids Products

The NSW Government actively encourages the reuse of biosolids over disposal practices. However, it is recognised that in certain cases reuse may not always be feasible. Hence, the option must exist for biosolids to be disposed of. Biosolids are generally disposed of to land because: there is no market for reuse; economies of scale prevent/detract from the reuse of biosolids; or the biosolids are of a quality that it is not suitable for reuse in the immediate market.

In disposing of biosolids by surface application or to landfill, the main constraints include managing any change to the environment (in particular, soils, surface waters and groundwater), protecting public health and developing a sustainable process. To satisfy these constraints in using biosolids for beneficial land application, requirements are placed on their nutrient, contaminant and microbiological characteristics, and their application rate. Additional constraints include:

- protecting livestock health
- minimising the potential for toxicity to crops, pastures and forests and ensuring sustainable yields
- protecting foods grown for human consumption and animal feeds from contamination
- minimising the potential for harmful effects to vegetation in landscaped and rehabilitated areas, home gardens, and public open space.

Due to these additional constraints, the requirements for biosolids quality, application rates, and management practices will differ between beneficial land application and disposal practices.

Biosolids products from all sewage treatment plants in NSW may be disposed of by:

1. surface land disposal (either direct surface application or incorporation) within the boundaries of a sewage treatment plant or on land which is identified for disposal purposes and owned and maintained by the producer, for example, the owner/operator of the plant (see section 5.1 for requirements), or
2. landfill disposal (see section 5.2 for requirements).

It should be noted that long-term stockpiling of biosolids on STP sites is not considered to be an appropriate disposal method. Temporary stockpiling can be undertaken before final disposal of the biosolids.

5.1 SURFACE LAND DISPOSAL

5.1.1 Types of Biosolids Products Suitable for Surface Land Disposal

All classes of biosolids, including Not Suitable For Use products, may be disposed of by surface land disposal within the boundaries of a sewage treatment plant, or on land where the zoning permits disposal and the land is owned by the producer of the biosolids, provided that:

- the application will not result in pollution of surface waters and groundwater
- the potential for off-site migration of contaminants is low

- the disposal site is not used for agricultural purposes, public open space or other purposes which are not compatible with biosolids disposal
- adequate buffer zones can be maintained around the disposal site (refer to section 5.1.6)
- approvals for the activity have been obtained from the EPA and all other relevant government agencies.

5.1.2 Assessment of Potential Impacts of Surface Land Disposal

Before proceeding with a proposal for the surface disposal of biosolids, or continuing with current surface disposal methods, the biosolids producer should be satisfied that the disposal practice will not have a significant impact on the environment, and that any potential impacts can be effectively managed.

As part of the assessment process, the biosolids producer should:

1. Determine the concentration of metals (as in table 3.1) and nutrients (total phosphorus and nitrogen) in the biosolids. The frequency of testing should be as described in table 3.2.
2. Calculate the volume of biosolids to be disposed of and frequency of disposal.
3. Consider the depth to groundwater, proximity to surface waters, and soil characteristics of the land disposal site. This information can be based on relevant existing local and regional data. Where such information is not available, the producer may wish to liaise with the EPA for advice on what data may need to be collected and the level of detail required.
4. Assess the potential for the disposal practice to affect surface waters and groundwater.
5. Establish safeguards to manage/mitigate potential groundwater and surface water impacts, and restrict the migration of contaminants.
6. Consider the effect of the disposal practice on the amenity of neighbouring properties (i.e. effect of odour or pests).

In those cases where the proposed surface disposal of biosolids is likely to result in pollution of surface waters or groundwater, or loss of amenity, and there are no practical and effective safeguards to manage the impact, alternative methods of disposal (or use) should be found.

In addition to undertaking the assessment, biosolids producers should submit plans for any surface land disposal activities to the EPA for approval. The assessment should be submitted with the plan.

It should be recognised that the surface disposal of biosolids may result in elevated levels of contaminants within the soil site. As such, the disposal site may require remediation before a change to a more sensitive land use.

Sites used for the surface disposal of biosolids may be declared as unhealthy building land under the *Unhealthy Building Land Act 1990* if the EPA is of the opinion that the erection of a building would be prejudicial to human health. Assessment of potential health effects would be based on the level of soil contamination. EPA consent is required under the Act for the erection of buildings on the land. The EPA can also require that remedial measures be taken before the land can be built upon.

5.1.3 Management Practices

Table 5-1 sets out recommended management practices for the surface land disposal of biosolids (excluding those products classified as Unrestricted Use). These practices are aimed at protecting amenity, human health and water quality outside the disposal area.

5.1.4 Activity Constraints

Table 5-2 sets out those activities which should not be undertaken on lands used for the surface disposal of biosolids. These constraints do not apply to Unrestricted Use biosolids. As indicated by table 5-2, biosolids disposal sites should not be used for agricultural purposes. If a producer of biosolids intends to pursue agricultural activities on a disposal site, the biosolids must be applied and managed in accordance with Section 4 of the guidelines.

5.1.5 Areas to be Avoided for the Surface Disposal of Biosolids

Where practical, the areas characterised by the features listed in table should not be used for the surface disposal of biosolids. Where such areas are used, care should be taken in disposing of the biosolids and safeguards put in place to minimise the potential for environmental impacts (in particular, the pollution of surface and groundwater).

Biosolids should also not be disposed of by surface land disposal in sensitive areas (refer to section 4.2).

5.1.6 Buffer Zones

The buffer zones listed in table 5-4 should be provided for all proposals for surface disposal which are outside the boundaries of sewage treatment works. Consideration should be given to establishing such buffer zones for surface disposal practices at sewage treatment works sites.

TABLE 5-1

Management Practices for the Surface Disposal of Biosolids

Item	Management Practices
Incorporation/Covering of Biosolids	In those cases where the biosolids may cause nuisance odours or have the potential to attract vectors, the biosolids should be covered or incorporated into the soil.
Stockpiling	Stockpile areas at the sewage treatment plant should be designed with adequate drainage controls and the provision of an impervious base for the hardstand area. Temporary stockpile areas may be used where biosolids are being stockpiled on a short-term basis only before reuse or disposal. Drainage from stockpile areas should be managed to prevent pollution of waters e.g. diversion of stockpile area drainage water to the tertiary ponds or head of the works, or used as irrigation water within the sewage treatment plant.
Run-off	Stormwater run-off from the disposal site should be controlled to prevent contamination of surface waters by run-off diversion or run-off collection controls.

TABLE 5-2

Recommended Constraints on Lands Used in Surface Land Disposal of Biosolids

Item	Activity Constraint
Human Food Crops and Animal Feed	Crops for human consumption and animal feed should not be grown on the land.
Animal Withholding	Animals for human consumption should not be permitted to graze the land.
Public Access	Public access to the site should be restricted.

TABLE 5-3

Areas for Caution or to be Avoided in Surface Land Disposal of Biosolids

Characteristic	Areas for Caution or to be Avoided
Slope Drainage	Greater than 10 degrees (18%).
	Soils which are waterlogged, very slowly permeable or extremely permeable (refer to Schedule 3).
Flood Plains	Areas within the 1 in 100 year floodline.
Sensitive Areas	Refer to table 4-2.
Groundwater	Areas where there is a potential to pollute groundwater (see section 4.3).

TABLE 5-4

Recommended Buffer Zones for Areas Used in Surface Land Disposal of Biosolids

Area	Recommended Minimum Width of Buffer Zone (m)		
	Flat (<3% or <2^0)	**Downslope (>3% or >2^0)[1]**	**Upslope[1]**
Surface Waters	50	100	5
Drinking Water Bores	250	250	250
Other Bores	50	50	50
Access Roads & Fence Lines	5	5	5
Animal Enclosures	25	50	25
Sensitive Areas	500	1,000	250

Note:
1. Downslope refers to the protected area which is below the biosolids application area. Upslope refers to the protected area which is above the application area.

5.1.7 Record Keeping Requirements

The producer of the biosolids should keep a record of all surface disposal activities. Records kept for each batch of biosolids which are disposed of should include:

- biosolids quality data (section 5.1.2, #1)
- the volume of biosolids disposed (section 5.1.2, #2)
- the location of biosolids disposal site
- the date of disposal
- a plan showing where the biosolids were placed on the disposal area (if not applied to entire site).

5.1.8 Statutory Approvals

Approval to surface dispose of biosolids should be obtained from the EPA. Development consent and environmental impact assessment may also be required under the *Environmental Planning & Assessment Act 1979*. Local councils wishing to dispose of biosolids must also obtain approval from the DLWC. Details relating to relevant statutory requirements are addressed in section 4.7.

The requirements relating to biosolids surface disposal will be progressively introduced into statutory mechanisms such as EPA Pollution Control Approvals and Licences.

5.2 LANDFILL DISPOSAL OF BIOSOLIDS PRODUCTS

Biosolids may require disposal if they are classified as Not Suitable For Use, or they are not classified, or there is no market for the classified product.

Disposal of biosolids to landfill must conform to EPA landfill requirements. Biosolids should only be disposed of to a licensed landfill. Refer to *Environmental Guidelines: Solid Waste Landfills* (NSW EPA 1996) for information.

To determine the type of landfill that the biosolids should go to, the concentration of contaminants and the leaching characteristics of the biosolids must be determined. The latter is done using the US EPA toxicity characteristic leading procedures (TCLP) test. If the results from such tests exceed the EPA acceptance requirements, the biosolids must be treated to required standards before disposal.

Sampling and analysis for biosolids disposal is to be repeated at intervals of one sample per 300 dry tonnes of biosolids production from each STP for analytes that are acceptable to the EPA.

Advice on analytes to be tested, landfill acceptance requirements and other requirements for consent for disposal can be obtained from the EPA Waste Regulation Section, Operations, License and Audit Branch, and Waste Management Branch.

SCHEDULE 1

Biosolids Sampling & Analysis Procedures

The sampling procedures outlined in this Schedule are for collecting samples of biosolids and biosolids products from a variety of sewage treatment plants, intermediate storage locations and re-processing plants. The sampling and subsequent analysis of biosolids products is necessary to grade and classify the biosolids according to the contaminant and microbiological requirements specified in the guidelines.

The guidelines require laboratory tests to be conducted for:

- analytes listed in the contaminant specifications
- analytes listed for the assessment of nutrients
- microbiological and other physico/chemical tests for stabilisation grading.

The sampling methodologies are based on principles in L.H. Keith (1988) and methods in both US EPA (1989a) and US EPA (1989b). Modifications are included for improved practicality.

1.1 HOW TO SAMPLE

Sampling may be performed using single grab samples or combining a number of individual grab samples. The frequency of sampling is determined by the requirements of Schedule 2.

1.1.1 Grab Sampling

Grab sampling consists of collecting a single sample for each different and segregated biosolids product produced during a facility's normal daily operations. A grab sample is a sample collected over a short period (usually less than 15 minutes) during the daily operation of a facility or from within a small volume of stored material.

1.1.2 Composite Sampling

For the continuous sampling regime individual grab samples may be separated in time (temporal) and stored until the final grab sample is collected (figure S1-1). For example, a sewage treatment plant which under the continuous sampling regime should be sampled every five weeks may take a single grab sample every week and store these samples until the fifth sample has been collected. The five grab samples are then thoroughly mixed to produce a single composite for analysis. Each grab sample in the composite should contain equal dry-weight quantities.

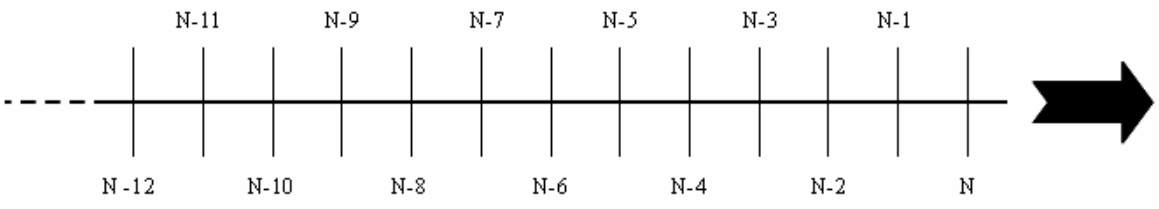
Care should be taken in storing samples, and samples taken for nutrient analysis should not be stored for long periods due to ammonia volatility.

For batch sampling the individual samples may be separated by space (spatial) and then combined to produce a single sample for analysis (figure S1-2). Each composite sample must represent a maximum of 100 dry tonnes of biosolids product.

The technique of obtaining composite samples should be constant for each of the individual grab samples within a batch and also between batches. The number of sub-samples should not change over time between batches.

FIGURE S1-1

Temporal Composite Sampling



GRAB SAMPLES **COMPOSITE SAMPLES**

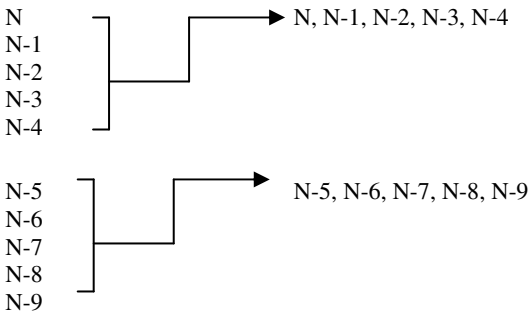
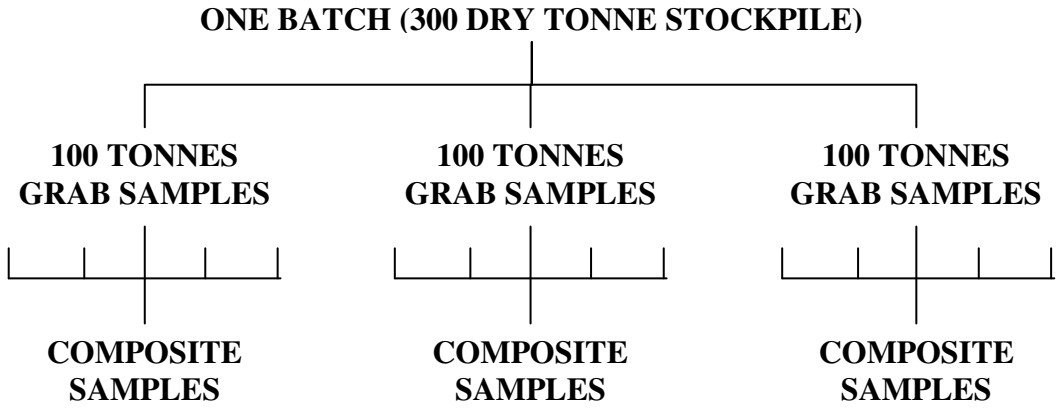


FIGURE S1-2

Spatial Composite Sampling



The final biosolids product is defined as the biosolids product after conditioning, removing a significant amount of water ("dewatering") and further processing but before reuse/disposal (i.e. before land application, landfill, distribution and marketing, or storing in a lagoon—"lagooning").

1.1.3 Product Classification For Sampling

All samples collected will be single or composite samples of the final biosolids product or products. Individual samples will be collected for each distinct type of biosolids segregated and reused or disposed of. Individual biosolids types are classified in two categories:

- ♦ _ liquid products – defined as any biosolids which have the capacity to flow and be conveyed via pump
- ♦ _ solid products –defined as non-flowable.

Liquid and solid subcategories may evolve when biosolids produced during various plant processes are segregated, and used or disposed of individually, as opposed to being blended before treatment and use or disposal. Each of these final biosolids products will be considered as a different and individual sample. Therefore, a plant may have a variety of final biosolids products: liquid and/or solid, blended or individual. Each type of biosolids product requires sampling.

1.2 WHERE TO SAMPLE

1.2.1 Liquid Biosolids Collection Point

Sampling From Digesters & Tanks

To ensure that representative samples are obtained, sampling points within the process piping require the following:

i) The sampling withdrawal tap is to be at least 6 cm in diameter and no further than three metres from the discharge side of the biosolids pumps. In the process trains, the most representative sample is from a tap on the discharge side of biosolids pumps, where the material is well mixed.

ii) If the location under (i) above is not possible, a sample may be drawn from a tap on a pipe containing biosolids that is distant from the biosolids pump provided the tap is located on the side of the pipe and the velocity is not less than 0.6 of a metre per second.

At the sample point, collect liquid biosolids into a 20 litre pail. Ensure enough sample is collected to fill the sample container. When drawing the liquid biosolids from a digester or tank ensure that:

- ♦ where possible, the digester or tank has been mixed or recirculated for an appropriate time to ensure adequate mixing
- ♦ the facility's operation staff start and run the pump for five minutes to clear the line of stagnant biosolids
- ♦ the biosolids flow for several seconds from the tap (or sample outlet) before sampling to flush out materials that may have accumulated within the tap.

Sampling from Lagoons

As far as practicable, biosolids in lagoon storage should be mixed before sampling. The number of samples which need to be collected should be determined by the required total volume, sampling frequency and compositing ratio. Make an estimate of the volume of biosolids in the lagoon and in the average solids content to calculate the total dry tonnes. Once the sample number has been determined the sampling locations should be chosen in an unbiased way and preferably at evenly spaced locations, at various depths, in a grid pattern. At each sampling location withdraw a biosolids sample.

Extreme caution should be exercised when sampling lagoons. Safety procedures should be prepared before sampling being undertaken.

If a lagoon has been emptied sampling may be conducted in the future by sampling inflow to the lagoon in the manner outlined above, under Sampling From Digesters & Tanks.

1.2.2 Solids Collection Point

Samples are to be collected directly from the final biosolids treatment processes. These processes include, but are not limited to:

Belt Filter Press/Centrifuge/Vacuum Filter

Each process continuously removes water from biosolids. The grab samples are to be collected from the discharge chute.

When one or a combination of these dewatering devices are encountered and used to dewater the same biosolids product type, collect one composite sample as follows:

If just one dewatering unit is present, a sufficient amount of biosolids is collected in the pail directly from the discharge chute. The biosolids are then mixed and transferred to the sample containers.

If two or more dewatering units (any combination) are present, collect amounts of biosolids in proportion to the throughput from each dewatering unit and combine in a pail before mixing as in (i).

Plate & Frame Press

Plate and frame press is a batch process and intermittently discharges cake. Dewatering continues in the press until plates are full. The unit is then opened and the cake is dropped into a storage bin. Collect grab samples directly from the storage bin using a scoop.

Drying Beds

Drying beds (including drying lagoons, cement pads, sand beds, vacuum assisted drying beds) are batch processes. Divide the drying bed into one or more sectors. Collect at least one sample per 100 dry tonnes. Care should be taken not to withdraw large amounts of the drying bed sand when the sample is collected. The grab sample container is filled from a pail that has been partly filled with material taken with a scoop and/or coring device and mixed.

Compost Windrows

Divide the pile into one or more sectors each no more than 100 dry tonnes and collect at least one sample from each sector. The sample container is filled from a pail containing the individual sub samples that have been taken with a scoop and/or coring device and thoroughly mixed.

There are benefits in composite sampling for little additional cost. These benefits are better estimates of the mean value due to reduced variance (or standard deviation). The costs are the small additional field work required to actually withdraw the grab samples and subsequent mixing. Also there is a decrease in flexibility as the procedure requires the compositing ratio (number of grab samples in a composite) to be maintained on each sampling occasion.

The benefits usually decrease as the compositing ratio increases as other sources of variation (laboratory analysis or transport) will dominate. A ratio of 5:1 (five grab samples to make one composite) is suggested.

1.3 SAMPLING EQUIPMENT

This section lists the sampling supplies and equipment to be used for sampling at sewage treatment plant, off-site storage facility or re-processing facility. Kits are prepared, ready for use before sampling begins.

Contact with biosolids sample:

- high impact plastic coolers with lids

- cleaned sample containers (all sample containers will have been quality control analysed by the supplier)
- 20 litre stainless steel pails
- stainless steel scoops
- stainless steel corers
- stainless steel ladles

Non-contact with biosolids sample:

- clear tape
- writing material
- packing materials (bubble wrap)
- shipping materials (cartons)
- dry ice
- clear plastic zip-lock bags
- heavy gauge plastic bags
- sampling crates
- packing tape
- first aid kit
- transport instructions
- appropriate transportation forms
- sampling log book
- knife
- soap
- disinfectant
- bucket for cleaning
- disposable polyethylene gloves
- odour neutralising agent.

1.3.1 Sample Contamination

To remove any potential for sample contamination:

- all sampling equipment is to be made of stainless steel, with sampling residues completely removed by tap water, and rinsed with deionised water and kept dry before use
- polyethylene gloves must be worn to prevent sample contamination, as well as providing worker safety
- as the samples are for multi-analytical purposes, all sample containers should be made from borosilicate glass, except for microbiological sample containers which can be polyethylene. The lid should be screw cap with an aluminium based liner
- sampling containers should be cleaned as follows:
  - non-microbiological containers - rinsed with dilute nitric acid followed by deionised water then with alcohol followed by hexane and left to dry. Lids to be rinsed with water, alcohol followed by hexane and left to dry
  - microbiological containers - rinse containers and lid with deionised water; loosely screw on the cap leaving adequate steam inside the container; tape over cap and part of container with a single piece of autoclave indicator tape; hold autoclave at 121°C, 18 PSI for 15 minutes.

1.4 SAMPLE IDENTIFICATION

- before sample collection, each sample container should be labelled with non-smearing, non-removable labels
- numbers sets should be used for each sample point, for example 1a, lb, lc
- labels should have the following details:
  - date
  - batch number
  - sample number
  - biosolids product types
  - sample points
  - contacts
  - phone number
  - facility address

After labelling, a piece of wide clear film should be applied to protect the label from dirt and liquids. If a label is incorrectly marked, it should be replaced. Do not write over a labelling mistake.

1.5 SAMPLE COLLECTION

At each sampling point collect 1 litre samples for product > 2% solids, and 2 litres for product < 2% solids for each designated grab sample. These grab samples are then mixed to form the composite sample. Hermetically close the lid; rinse the outside of the container with a household disinfectant solution; store sample in a cool location away from the sun before transportation.

A system of collecting duplicate samples in case of sample breakages or retesting of unusual results, is recommended though not mandatory. Duplicate samples must be identified with a new sample number or suffix.

1.5.1 Sampling For Microbiological Testing

- collect five representative grab samples of 100 g each in sterile containers
- extract 20 g from each of the five grab samples into a sterile container to make a composite sample of 100 g
- label and transfer composite samples to the laboratory via chain of custody procedures; ensure the sample is tested within 8 hours and the sample is transported at ambient temperature of around 20°C
- test for microbiological requirements of Schedule 1.10.

1.6 SAMPLE RECORD KEEPING

The person responsible for sampling should establish, with the plant manager, the number of biosolids product types leaving the plant for final reuse or disposal, and the sample points for each biosolids type as designated above.

A pre-sampling report should be prepared, and include:

- biosolids product types
- sample points
- contacts
- phone numbers

- facility address
- directions to the facility
- necessary safety equipment required (hard hat or safety shoes).

A copy of the pre-sampling report should be provided to the plant manager, one copy retained by the person responsible for sampling and one copy placed on a file.
The person responsible for sampling should keep the following record in a sampling report:

- batch number
- sample date
- name and address of facility
- name of contact at the facility
- sample identification number
- sample point description
- basic descriptions of wastewater solids treatment processes
- final biosolids reuse or disposal method/s
- number of samples in the consignment.

Unexpected sampling difficulties encountered on-site should be immediately recorded on the sampling form, and the plant manager (or designate) notified immediately.

1.7 PREPARATION FOR TRANSPORTATION

Because testing is usually done at a distant laboratory and some of the material may be transported with other goods, the following procedure is required for sample integrity and assurance against breakages:

- all sample containers should be sealed by applying a piece of clear wide tape around the top, preventing the lid from popping or unscrewing. Wrap each sample container with *a* piece of bubble wrap. The bubble wrap should be secured with a piece of shipping tape.
- place one layer of bubble wrap on the bottom of the cooler
- line cooler with a large heavy gauge plastic bag
- pack each non-microbiological sample container into the cooler
- add ice to coolers (except for microbiological samples). All ice should be packed in zip-lock bags to help prevent any leaking during shipment
- with sample containers and ice inside the cooler, tie the heavy gauge plastic bag (to help prevent leaks)
- add more bubble wrap to fill the remaining space in the cooler
- fill out a Sample Destination Form in triplicate with the following details:
  - date
  - batch number
  - sample number
  - biosolids product types
  - sample points
  - contacts
  - phone numbers
  - facility address

- receiving laboratory
- type of tests required
- signature of the dispatch officer

- place the completed Sample Destination Form (duplicate enclosed) in a plastic envelope, inside the cooler on top of the samples and keep one copy for the file
- close cooler and secure lid with shipping tape
- transport each cooler no later than after four hours storage
- sample transfer is to be kept to a minimum
- upon arrival at the laboratories, samples will be preserved at 4°C or analysis begun as appropriate within 48 hours of the sample collection for non microbiological samples. Microbiological analysis should proceed within 8 hours of sample collection.

1.7.1 Sample Shipment From Distant Locations

- all samples must be shipped from the field on the day of collection, using an overnight commercial delivery service. If circumstances prohibit this, samples (other than microbiological samples) must be kept on ice and shipped in the most expedient method available. Microbiological samples must be sent immediately
- the shipment box must be of sturdy construction and insulated to provide the proper environment for preserving the samples at < 4°C (e.g. a regular, 100 litre cooler). All sample containers should be securely packed in the shipment box with additional bubble wrap where necessary. The outside of the shipment container should have:
  - a shipping label with the complete address of the receiving laboratory, including the name of the person receiving the samples
  - a box number to indicate to the receiver exactly how many sample boxes are included in the shipment
  - "Fragile" and "This End-Up" labels.

1.8 FIELD CUSTODY PROCEDURE

- at the receiving laboratory, the consignment is immediately checked against the Sample Destination Form accompanying each consignment
- verified samples are registered and the Sample Destination Form checked off by the laboratory receiving officer
- the laboratory receiving officer should immediately fax or send the Sample Destination Form back to the dispatch officer to acknowledge receipt of sample.

1.9 ANALYTICAL TESTING

All biosolids analysis is to be carried out by methodologies based on methods tabulated in tables S 1- 1 and S1-2. These analysis are to be carried out by laboratories registered by NATA or other EPA recognised quality assurance accreditation organisation for the specific test(s). The US EPA methods suggested invariably need modifications to determine analytes in biosolids and hence will need to be validated for accreditation by NATA.

Standard reference materials (SRMs) should be used by laboratories analysing biosolids products. SRMs are materials similar in composition to test samples. They are calibrated against at least three methods, one of which must be the method approved by the NSW EPA Lidcombe Water Laboratory.

The most current SRMs for heavy metals and organochlorine analysis in a sludge matrix are available from Sydney Water, Residuals Management Unit, Burwood Office (Wong et al. 1993; Wong et al. 1996).

Methods for tests regarding stabilisation grading and nutrient determination required by the guidelines are given in table S1-1. The specifications of the contaminant grading and a list of suggested analytical methods are provided in table S1-2, the list is not exhaustive and other methods calibrated against NSW EPA methods are equally acceptable.
The methods acronyms in tables S1-1 and S1-2 are:

APHA—American Public Health Association, the 18th edition (1992) is cited here US

EPA—United States Environmental Protection Agency

AS—Australian Standards
AGAL—Australian Government Analytical Laboratories

CAS—Chemical Abstract Services, the CAS number for the organochlorines is used internationally to identify chemical substance.

TABLE S1-1

Methods For Stabilisation Grading & Nutrient Determination

Test	Unit	Purpose	Suggested Methods	Method Description
Total Kjeldahl Nitrogen	mg/kg	For batch application calculation	APHA 4500 US EPA 351.2,3,4	Acid digestion and distillation
Total Solids	%	(a) for conversion of determinants from wet weight to dry-weight (b) for batch application calculation	APHA 2540 G	Drying and ashing, gravimetric
Volatile Solids Specific Oxygen Uptake Rate	%	For stabilisation grade calculation Unit: mg 0_2/hr/g total solids	Procedures in *Environmental Regulations and Technology—Control of Pathogens and Vector Attraction in Sewage Sludge,* EPA-625/R-92/013	Drying and ashing, gravimetric
Acidity	pH	For batch application calculation (alkaline biosolids) For soil analysis	Dilute to 1% solids and measure By APHA 4500 Calcium chloride method (Rayment & Higginson 1992)	pH probe
Total Phosphorus Available	mg/kg	For batch application calculation For soil analysis	US EPA 200.8 (version 4.4) APHA 4500-P Bray method	ICP–MS Calorimetric
Conductivity (as a measure of salinity)	dS/cm	For batch application calculation	APHA 2510 B NSW Agriculture (S)	Dilute to 1% and measure by conductivity meter

TABLE S1-2
Methods & Specifications For Contaminant Grading

Analyte	Grade[1]				Suggested Methods	Method Description
	A	B	C	D		
Chromium	100	250	500	600	US EPA 200.7 (CLP-M)	ICP-AES
Copper	100	375	2,000	2,000	US EPA 200.8	ICP-MS
Lead	150	150	420	500	US EPA 7190,7210,7420,7520,7950	FAAS
Nickel	60	125	270	300		Sample preparation US EPA 3050
Zinc	200	700	2,500	3,500		
Arsenic	20	20	20	33	US EPA 200.8 (Revision 4.4)	ICP-MS
Cadmium	3	5	23	32	US EPA 7060,7060A,7131,	GFAAS
Selenium	5	8	50	90	7131A,7740	Sample preparation US EPA 3050
Mercury	1	4	15	19	AGAL 1CP-MS method for US EPA 200.8 (Revision 4.4) APHA 3122 B US EPA 7471	ICP-MS or Cold Vapour AAS CVAAS
Aldrin Dieldrin	0.02	0.2	0.5	1.0	US EPA 1618 US EPA 8080	GC-EC
HCB	0.02	0.2	0.5	1.0	US EPA 1618 US EPA 8080	GC-EC
Lindane	0.02	0.2	0.5	1.0	US EPA 1618 US EPA 8080	GC-EC
Heptachlor epoxide	0.02	0.2	0.5	1.0	US EPA 1618 US EPA 8080	GC-EC
4,4'DDD 4,4'DDE 4,4'DDT	05	0.5	1.0	1.0	US EPA 1618 US EPA 8080	GC-EC
PCBs as Arochlors 1242 & 1254	0.3	0.3	1.0	1.0	US EPA 1618 US EPA 8080	GC-EC

Note:
1. Concentration in mg/kg dry weight.

1.10 MICROBIOLOGICAL TESTING

Microbiological testing for biosolids is to be performed in accordance with Australian Standards:

- Examination for Specific Organisms Salmonellae AS 1766.2.5-1991
- Coliforms and E. Coli AS 1766.2.3-1987.

If the biosolids sample is treated by a chemical such as lime, the lime may have to be removed (in this case by neutralisation) immediately after sampling if the microbial tests are to be valid. Failure to remove the lime extends the treatment time, and the high pH may interfere with the microbial test.

SCHEDULE

2 Grading, Sampling & Compliance Procedure

2.1 CONTAMINANT GRADING, CLASSIFICATION SAMPLING & COMPLIANCE

This schedule sets out the procedure for classifying biosolids products for both sampling modes. The sampling and testing requirements have been developed to ensure biosolids products are graded and classified with an acceptable degree of accuracy. The EPA requires that biosolids be graded in such a manner that no more than 10% of those that shouldn't be passed, are passed. This corresponds with a 10% probability of error in classifying biosolids as acceptable (i.e. lower than the threshold). Producers or re-processors may propose alternative sampling plans to the EPA provided that 90 percentile contaminant concentrations will not exceed the threshold with 90% certainty.

2.2 BATCH SAMPLING

Contaminant grading of biosolids products from batch operations is done by taking three (or more if desired) samples from the subject batch, and calculating the mean plus a given number of standard deviations of concentration for each contaminant. To calculate the contaminant concentration **(Q):**

Q = m + a x s (Equation 1)

m = the mean of n samples (no historical data)

s = the standard deviation calculated using **all** relevant historical data, given in Step 5 of Calculating Standard Deviation—The Batch Rule (2.2.1)

a = a coefficient derived from table S2-1 for single grab samples or derived from equation 2 for composite samples.

TABLE S2-1

Sample Number Coefficients

Sample Size	3	4	5	6	7	8	9	10
Coefficient (a)	2	1.92	1.85	1.8	1.76	1.73	1.71	1.68

For five samples per batch the equation becomes (m + 1.85 s).

Where composite sampling has been used, the standard deviation of laboratory analyses is expected to be significantly smaller than would otherwise be the case. In this case, the following equation should be used to determine the value of the coefficient (a).

$$a = (\sqrt{g} \times 1.28) + \frac{1.28}{\sqrt{n}} \quad \text{(Equation 2)}$$

where

n = the number of samples sent to the laboratory for analysis

g = the number of grab samples in each composite sample.

Note that the same number of grab samples should always be taken for each composite sample.

When the (Q) concentrations are compared with the contaminant acceptance concentrations for each biosolids product grade in table 3-1 (in Section 3), the biosolids product can be graded A, B, C, D or E. The procedure is set out in table S2-2.

TABLE S2-2

Contaminant Grading of Biosolids For Batch Sampling Mode

Step	Description of Step	Further Explanation
1	Take at least 1 sample/100 dst or part thereof, with a minimum of 3 samples/ batch e.g. 430 dst would require 5 samples.	Each contaminant in table 3- 1 to be analysed for each sample. More samples may be taken to reduce risk of failure, if desired.
2	Calculate mean *(m)* of the *n* samples and standard deviation (s) from all relevant historical data.	For each contaminant. Local (batch) mean is used. Long-term standard deviation is used.
3	Calculate the (Q) concentrations.	For each contaminant.
4	Select a target contaminant grade(T), and its associated acceptance concentrations(Q).	That is, adopt Contaminant Grade A, B, C,D or E (table 3- 1) as your target grade.
5	Compare (Q) with T.	For each contaminant.

6	Undertake Contaminant Grading:
	If (Q)#T Target Grade OK
	If (Q) >T Failed Target Grade
		If any contaminant fails, target grade is **not** achieved.

7	If failed target grade return to step 4.	Try the next grade.
8	When it is time to sample the next batch, repeat from step 1.	

2.2.1 Calculating Standard Deviation—The Batch Rule

Based on long-term estimates of the variation within batches, the rule for determining s is given below.

1 Take *n* samples, where *n* is at least 3 (each sample may be a composite of g sub samples).

2 Calculate the mean, *m,* of the samples, and the batch variance, b^2.

3 $N_t = N_{t-1} + (n - 1)$.

4 $$V_t = \frac{[V_{t-1} \times N_{t-1} + b^2(n - 1)]}{N_t}$$

V_t is the current estimate of the pooled within-batch variance.

5 $s = \sqrt{V_t}$

To initialise the system, let: $V_0 = 0$ and $N_0 = 0$

6 Q= m + a x s, where: t = batch index

t-1 = the number of batches of sludge that have been classified

V = variance

N = degrees of freedom

b^2 = variance of current batch

n = number of samples analysed in this batch.

Example of Calculation of Standard Deviation for Batch Sampling Mode

The copper analytical results of a batch of biosolids are shown below. These samples were each a single grab.

Batch One—Copper (mg/kg):

Sample 1:	Sample 2:	Sample 3:	Mean:	b (Standard Deviation):
1,800	1,600	1,650	1,683.3	104.1

The variance (V_t) for Batch One:

$$V_t = \frac{[V_{t-1} \times N_{t-1} + b^2(n - 1)]}{N_t}$$

where: $N_t = N_{t-1} + (n - 1)$

$N_1 = N_{1-1} + (3-1)$

$= N_o + 2$

$= 2$

$$V_1 = \frac{[V_{1-1} \times N_{1-1} + b^2 (3 - 1)]}{N_1}$$

$$= \frac{[0 + (104.1)^2 \times 2]}{2}$$

$= 10,836.8$

Batch Two—Copper (mg/kg):

Sample 1:	Sample 2:	Sample 3:	Mean:	b (Standard Deviation):
1,700	1,640	1,780	1,706.7	70.2

$N_2 = N_1 + (n-1)$

$N_2 = 2 + 2$

$N_2 = 4$

$$V_2 = \frac{10,836.8 \times 2 + 70.2^2 \times 2}{4}$$

$= 7,882.4$

$s = \sqrt{7,882.4} = 88.8$

2 . 3 CONTINUOUS SAMPLING

Contaminant grading of biosolids products from continuous sampling is done by taking one sample at an interval defined by table S2-5 and calculating a target grade coefficient (C_t) for each contaminant, as set out in table S2-4. The procedure in table S2-4 indicates whether the next sample must be taken on a low frequency basis, a high frequency basis or will not comply with the target grade. Preparation for using the continuous sampling mode is set out in table S2-3.

TABLE S2-3

Preparation For Continuous Sampling Mode

1 Establish the daily biosolids production rate in tonnes/day for the sewage treatment plant.

2 Establish a biosolids contaminant data base by taking 17 samples of the continuous stream at the high frequency in accordance with table S2-5.

OR

If a database of greater than 17 relevant data points already exists for the sewage treatment plant, then the existing data may be used.

3 Using all of the relevant data available (17 data points or greater) calculate mean (m) and standard deviation (s). If more than 17 data points are available, **all** data points must be used in the calculation of mean (m) and standard deviation (s).

The analysis of samples while in high frequency mode must be conducted only for the contaminant which failed the contaminant grade. The other contaminants continue to be sampled and analysed according to the low frequency mode.

The sampling frequency is a function of the daily biosolids production rate and proximity of the contaminant concentrations to the threshold. Table S2-5 presents the high and low sampling frequencies based on biosolids production.

2.3.1 Calculating The Standard Deviation—The Continuous Rule

Use the formulas below to update the values for the mean (m) and the variance (V) after each sampling event.

$$m_t = \frac{m_{(t-1)} \times (t-1) + X_t}{t}$$

where: t = the number of samples taken up to this point

X_t = the contaminant concentration,

then use the following value for the mean to calculate the variance:

$$V_t = \frac{(t-2)\, V_{t-1} + (X_t - m_t)^2 + (m_t - m_{t-1})^2}{t-1}$$

$$s = \sqrt{V_t}$$

And then use s to calculate C_t in the usual manner.

TABLE S2-4

Sampling Frequency & Compliance For Continuous Sampling Mode

Step	Item	Description—For All Contaminants
1	Calculating X_t	Take one sample of the biosolids stream and analyse to establish the contaminant concentration (Xt) of the sample.
2	Calculating s	Include the result (X_t) of this sample in your sewage treatment plant data base and recalculate the mean (m) and the standard deviation (s).
3	Establish T	For the contaminant grade (A, B, C or D) adopt the threshold (T) (table 3-1) as required.
4	Establish C_P	To calculate the grade coefficient (C_t) you need to establish (C_p) which relates your current sample result with the previous sample result. Establish Cp as following: Where this is the initial sample set: $C_p = 3.5$ Where C_t (previous) <0: $C_p = 0$ Where $0 \leq C_t$ (previous) ≤ 7.0: $C_p = C_t$ (previous) Where C_t (previous) > 7.0: $C_p = 7.0$
5	Calculating C_t	Calculate C_t, where $C_t = C_p + \frac{X_t - (T - 1.78s)}{s}$ where $s > 0$ $C_t = 7$ where $s = 0$ and $X_t > T$ $C_t = 0$ where $s = 0$ and $X_t \leq T$
6	Assess Compliance	Grade the contaminant based on the calculated threshold coefficient If Ct > 3.50 contaminant fails Grade. If there is no lower target grade, then grade as Grade E. If Ct ≤ 3.50 Target Grade OK, Go to step 7.
7	Determine Sampling Frequency	Determine Sampling Frequency based on the calculated threshold coefficient: If C_t <0.47 or C_t > 6.53 sample the next sample at low frequency (refer to table S2-5). If $0.47 \leq C_t \leq 6.53$ sample the next sample at high frequency (refer to table S2-5).
8		Calculate for each target grade.
9		Repeat this procedure for all contaminants.

Note:
The sampling regime is designed to reduce the frequency of sampling when the sample contaminant values (Xt) are well away from the contaminant threshold (T); and increase the frequency of sampling when sample contaminant value at time t, (Xt) is close to the contaminant threshold (T).The sampling frequency is determined by calculating the target grade coefficient (Ct).

TABLE S2-5

Minimum Sampling Frequency For Continuous Sampling Mode

Sampling Frequency	Low Frequency	High Frequency
Sample Number/Mass of biosolids production (dry solid tonnes)	1 per 120 dry solid tonnes	1 per 40 dry solid tonnes

Example of Calculation of Standard Deviation for Continuous Sampling Mode

The results of the first 17 samples are:

Sample:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Cd (mg/kg)	20	22	24	26	15	18	20	24	28	35	40	42	35	34	33	32	34

For these results: $t = 17$

$m = 28.35$

$s = 7.98$

$s^2 = 63.68 (= V)$

The eighteenth sample is then taken:

Sample:	18
Cd (mg/kg)	25

Calculate the new mean using the following formula:

$$M_t = \frac{M_{(t-1)} \times (t-1) + X_t}{t}$$

$t = 18$; $X_t =$ contaminant concentration

$$M_{18} = \frac{28.35 \times 17 + 25}{18}$$

$$= 28.16$$

Calculate the variance using:

$$V_t = \frac{(t-2)\, V_{t-1} + (X_t - M_t)^2 + (M_t - M_{t-1})^2}{t-1}$$

$$V_{18} = \frac{(18-2) \times 63.68 + (25-28.16)^2 + (28.16 - 28.35)^2}{17}$$

$$= 60.33$$

$$S = \sqrt{60.33}$$

$$= 7.77$$

Assuming a target grade of D, calculate C_t using:

$$C_t = \frac{C_P + X_t - (T - 1.78\, S)}{S}$$

Where T = target threshold (for Cd, T = 32)

Using $C_p = 3.5$

$$C_{18} = \frac{3.5 + 25 - (32 - 1.78 \times 7.77)}{7.77}$$

$$= 4.38$$

C_{18} = target grade coefficient.

Therefore the sample fails the target grade and is graded as E.

2.4 DATA HANDLING

2.4.1 Historical Data

Historical data back to the last significant change in the mean of standard deviation of biosolids quality should be used. If the biosolids quality is improving, then the database can be reset.

2.4.2 Values Below Detection

When data is reported at below the detection limit, **half the value of the detection limit** should be used in contaminant grade calculations. For results which are consistently below the detection value (e.g. organic compounds in soils) a value less than half the detection limit may be substituted if it is justified to the EPA and is consistent with good statistical practice.

2.4.3 Treatment of Outliers

An outlier is an observation that does not conform to the pattern established by other observations (Hunt et al. 1981). Outlier results can be detected visually (Thompson 1993) or by statistical calculation. As a minimum requirement, examine the data visually as follows. Construct a time plot or a standard boxplot from historical results from each batch. The number of historical batches should be limited to five. Examine the values of the latest batch against the historical data.

A point is never to be excluded on statistical grounds alone (Fisher 1922). Once observed, an assessment has to be taken as to whether the outlier arises from transcription or transmission errors, faulty measurement, calibration problems or other human errors. If the outlier still appears genuine then this value is kept for contaminant grading calculations.

SCHEDULE 3

Soil Sampling & Analysis Procedures

Soil sampling and analysis is required to establish the measured in-situ soil contaminant concentration (MISCC) of a site proposed for biosolids application. Soil sampling and analysis is required before the application of biosolids onto a new site and again before subsequent applications.

3.1 SAMPLING REGIME FOR AGRICULTURAL & FORESTRY APPLICATIONS

3.1.1 Before Initial Biosolids Application

This soil sampling strategy and the field-based land requirement classification system were developed by the Organic Waste Recycling Unit of NSW Agriculture. Sites should be sampled using an unbiased sampling pattern such as a rectangular or triangular grid (McBratney 1991). Sites should be no more than 250 metres apart. The grid may start at a convenient location with the proposed application site. For a 20 hectare site this strategy will require a minimum of four soil profiles; and for sites less than 10 hectares at least two soil profiles should be sampled. Soils should be sampled to at least 90 cm. The depths for sampling should be 0-15 cm, 15-30 cm, 30-60 cm and 60-90 cm.

Once the sites have been sampled and described, a soil type map of the site should be prepared using topographic and geological information to infer boundaries, as shown in figure S 3-1. Soil type should be determined on the basis of a recognised soil classification system, for example the Great Soil Group, Northcote or Australian (Isbell 1993). The areas considered suitable for biosolids application based on the site characteristics criteria in tables 4-4 and 4-12, should be identified. All surface and profile soil samples in suitable areas that fall into one map class (e.g. Great Soil Group with the same parent geology (State et al. 1968) should be combined or bulked together at each sampling depth and tested for the metals contained in table S 3-1. For sites which are receiving biosolids products applications at low rates (biosolids component of < 5 dst/ha) there is no requirement for testing of the samples taken at depth (15-90 cm). The organic compounds are required to be tested in all topsoil samples.

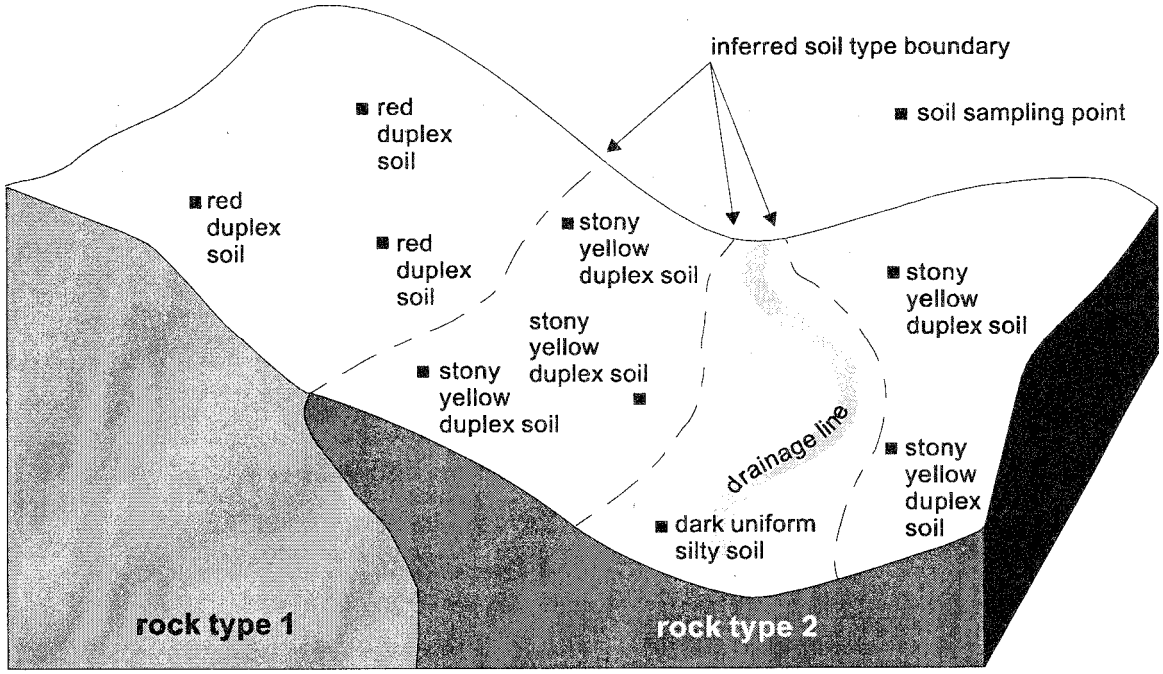
Where metal concentrations are close to the maximum allowable soil contaminant concentrations shown in table 4-5 (Section 4), the area should be re-sampled more intensively before biosolids application, and more than one composite should be taken for each soil map unit. If, after the second sampling, the composite samples from the same map class show similar results to the first sampling, it is likely that the sampling strategy is adequate. However, where composites from the same map class are very different, then the sampling strategy should be reviewed again.

Avoid sampling any unusual zones such as old or present fence lines, dung patches, spots where piles of timber have been burnt, trash heaps, places where fertilisers have been stacked or spilled, swampy areas and soil near roads or buildings.

This sampling should involve approximately one day's field work per 50 hectares for an experienced land assessor and field assistant.

FIGURE S3-1

Determining Soil Class Boundaries



Note:
This example uses geological boundaries to determine soil class boundaries following a grid sampling program.

3.1.2 Before Subsequent Biosolids Applications

The topsoil should be sampled according to soil type based on the previous soil survey. For each soil type, take 20-40 sub-samples at 0-15 cm and combine to produce one composite sample. The sampling pattern should be conducted in the form of a figure eight across the site.

3.2 SAMPLING REGIME FOR LAND REHABILITATION

The sampling of sedimentary rock material covering coal seams or mineral veins areas ("overburden" areas) on open cut coal mines should be conducted by obtaining one composite sample (20-40 sub samples at 0-15 cm) for every 10 hectares. The overburden area should be sampled and tested for the metals contained in table S3-1 before topsoil spreading. Where topsoil is being used on the overburden area, the topsoil layer should be sampled and tested in the same manner. Testing for organic compounds is required in the topsoil but not in the overburden material.

The application of biosolids on washery reject materials, tailing dams or spoil materials from metalliferous dams may require more intensive sampling due to the possible different composition of these sites. More intensive sampling is also required where metal concentrations are close to the maximum allowable contaminant concentrations in table 4.5 or table 4-13 (Section 4). The local Soil Conservation office- of the Department of Land and Water Conservation will provide advice regarding a suitable soil sampling strategy for these areas.

TABLE S3-1

Analytical Requirements For Soil Samples

Conductivity' (dS/m)	Macro-components: Total nitrogen Total phosphorus Available phosphorus (Bray)
$pH_{(calcium\ chloride)}$	
Micro-components: Total arsenic Total cadmium Total chromium Total copper Total lead Total mercury Total nickel Total selenium Total zinc	Organic contaminants: Aldrin Dieldrin Chlordane Heptachlor HCB Lindane BHC DDT DDE DDD PCB

Note:
1. A 5 to 1 solution of soil extract.

The composite sample should weigh 1 kg. If it is much greater, reduce it by:

- mixing the sample thoroughly on a flat sheet, removing large stones
- heaping into a mound and carefully divide the heap into four with a piece of board
- discarding two diagonally opposite quarters, retain and mix thoroughly the remaining two
- repeating the procedure until the sample is 1 kg
- placing the sample in an appropriate container (Schedule1, 1.3.1) and label clearly with waterproof pen.

3.2.1 Field Based Land Requirement Tables for Agricultural Sites

The following requirements for landform and soils have been developed to help with selecting sites for biosolids application. The information takes into account risk factors such as potential nitrate movement into the hydrological system and plant uptake of heavy metals. Irrigation use was considered in the development of the criteria. This information may be used in conjunction with the soil contaminant thresholds in the guidelines to identify suitable sites for biosolids application.

Sites may be classified (classes 1 to 4 below) on the basis of the most limiting feature of the landform or soil quality. Landform and soil quality requirements are presented in tables S3-2 and S3-3.

Class 1 Land where all soil and land features are described as having nil or slight limitations; and which is most likely to handle multiple applications of all biosolids products at maximum allowable rates without the risk of developing serious on- or off-site effects.

Class 2 Land where one or more of the soil or land limitations is considered moderate; and which will be limited in the number of biosolids applications that can be made without the risk of developing serious on- or off-site effects, or which will be limited in the range of products suitable for use.

Class 3 Land where one or more of the soil or land limitations is considered severe; and which will be suitable for only a few applications of biosolids at maximum allowable rates or for only a limited range of biosolids products.

Class 4 Land not suitable for biosolids application.

TABLE S3-2

Landform Requirements for Biosolids Application

Property	Limitations			
	Nil or Slight Class 1	Moderate Class 2	Severe Class 3	Very Severe Class 4
Slope (%)[a]	< 8	8-10	10-15	> 15
Flooding[b]	None	Rare	Common	
Landform[c]	Hill crests and concave side slopes	Convex side slopes	Foot slopes	Drainage plains and incised channels
Surface rock outcrop (%)[d]	Nil	0-2	2-10	> 10

Notes:
a. Increases risk of surface flow of water and movement of soil or biosolids downslope.
b. Biosolids left at or near the surface may be picked up by flood waters.
c. Foot slopes and drainage plains are prone to erosion and seasonal wetness.
d. Surface rock will interfere with biosolids incorporation and damage machinery.

Criteria for classifying sites, set out in table S3-3, is based on the assumption that dewatered cake is used. In cases where lime amended products are to be used, the criteria for hydraulic conductivity and soil pH do not apply.

TABLE S3-3
Soil Requirements for Biosolids Application

Property	Limitations			
	Slight Class 1	**Moderate Class 2**	**Severe Class 3**	**Very Severe Class 4**
Saturated hydraulic conductivity (mm/hr) of most restrictive layer in top 90 cm[a]	Ks 2-20 (moderately permeable soils)	Ks 0.5-2 (slowly permeable soils)	Ks 50-100 (very highly permeable soils)	Ks < 0.5 (very slowly permeable soils)
		Ks 20-50 highly permeable soils)		Ks >100 (extremely permeable soils)
Depth to seasonal high water table (cm)[b]	>90	60-90	45-60	< 45
Depth to bedrock or hardpan (cm)[c]	>90	60-90	45-60	< 45
Salinity (dS/m) (0-45cm)[d]	ECE < 2	ECE 2-4	ECE 4-8	ECE> 8
Chloride precipitate in silver nitrate test	Not detected	Detected (faintly)	Detected	Detected
Raupach pH (0-10 cm)[e]	6.5 or greater	5.5-6.5	4.5-5.5	< 4.5
Minimum Raupach pH (0-45 cm)[e]	6.0 or greater	5.0-6.0	4.0-5.0	< 4.0

Notes:
A test for Ks is not always considered necessary; Ks can be estimated by an experienced person.
a) Slowly and very slowly permeable soils can create a potentially anaerobic situation that can reduce plant growth, induce nitrogen loss and reduce the potential of the applied biosolids, and also increase the risk of run-off Highly to extremely permeable soils will not immobilise excess nutrients or contaminants, thereby posing a risk to groundwater.
b) Where it is evident from soil sampling that a seasonal high watertable occurs at depths of less than 90 cm, it is likely that plant growth will be adversely affected. Presence of a shallow watertable may also indicate soil conditions which favour movement of nutrients and contaminants into the groundwater. In this case the depth to regional groundwater should also be assessed.
c) Bedrock close to the surface increases the risk of run-off after significant rainfall events, presenting a risk to surface waters. Where the underlying bedrock is fractured, there is also a risk of soluble contaminants in biosolids reaching groundwater.
d) Biosolids may increase salinity. At ECE levels >4, many plant species will not grow. At ECE >8, most plant species will not grow.
e) Site is too acid if pH <4.5 (0-10 cm) or pH <4.0 (10-45 cm). If lime amended biosolids are used, classes 3 and 4 are not relevant, and class 4 becomes class 3.

SCHEDULE 4

Procedures For Determining Biosolids Application Rate

Unrestricted Use biosolids products are not restricted in their application rate and may be freely used, even as soil replacement products. Restricted Use biosolids may be applied to land, with certain restrictions on the application rate depending on the land use of the application site. Two types of restrictions apply to the maximum biosolids application rate, the NLBAR and the maximum CLBAR. The lower of the two application rates is the maximum allowable biosolids application rates, unless special conditions apply (see section 4.4.4 and 4.4.5).

Lime amended biosolids should only be applied at a rate estimated to raise soil pH to ensure satisfactory crop growth rather than at an application rate based on the nitrogen content of the limed biosolids product.

The methods for determination of NLBAR and CLBAR are presented below.

4.1 NITROGEN LIMITED BIOSOLIDS APPLICATION RATE

4.1.1 Agriculture

The NLBAR, in dry solids tonnes per hectare, is based on the crop requirements and the available nitrogen (N) content of the biosolids. **Mean nitrogen results** should be used from each batch (see section 3.3.3).

NLBAR (t/ha) = Crop Requirement (kg/ha) / Available Nitrogen (kg/t).

The available nitrogen content of the biosolids includes the soluble nitrogen (nitrate/nitrite), ammonium nitrogen and a fraction of the organic nitrogen content of the biosolids based upon the estimated nitrogen mineralisation rate (MR) in the first year following application.

$$\text{Available Nitrogen (Year 1)} = \frac{\text{Ammonium N} + \text{Oxidised N} + (\text{Organic N} \times \text{MR})}{5}$$

Where: Organic Nitrogen = Total Kjeldahl Nitrogen — Ammonium Nitrogen

If the results of biosolids sampling indicate that the oxidised nitrogen component is consistently less than 5% of the total nitrogen then the frequency of analysis for oxidised nitrogen may be reduced.

TABLE S4-1

Biosolids Nitrogen Mineralisation Rate

Biosolids Type	Nitrogen MR (% in the first year of application)
Anaerobically digested	15%
Aerobically digested	25%
Composted	10%

On sites which receive frequent biosolids applications, the residual nitrogen in the soil should also be determined and taken into account in calculating the NLBAR.

For agricultural applications, the NLBAR for biosolids application rate will vary depending on the crop and location. Table S4-2 contains indicative nitrogen and phosphorus requirements for various crops and pasture species which have been obtained from NSW Agriculture. The maximum agricultural application rate is 1,200 kg N/ha.

TABLE S 4-2

Crop & Pasture Nutrient Requirements

Crop or pasture	Nitrogen Uptake (kg/ha)	Phosphorus Uptake (kg/ha)
Canola	125	12
Grain sorghum	100	15
Maize	193	48
Oats	102	15
Wheat	117	9
Fescue	336	56
Phalaris	300	35
Perennial rye-grass	210	18

The values contained in table S4-2 are intended as a guide. Since the nutrient requirements of a crop or pasture depend on soil characteristics, climatic conditions and management practices, advice on soil and climatic conditions should be obtained from the local NSW Agriculture agronomist or a professional agronomist to determine the site-specific rate for agricultural uses.

4.1.2 Land Rehabilitation

The application of biosolids for mine-site rehabilitation is typically conducted as a **single** application rather than repeated applications. To provide an adequate source of nutrients and organic matter to establish vegetation on these disturbed or degraded sites, the annual nutrient requirements of the pasture or tree species may be exceeded. The maximum total nitrogen load allowable on land rehabilitation projects is 1,200 kg N/ha, based on total Kjeldahl nitrogen as a once-only application. **If repeated applications are intended, the NLBAR must be determined on the basis of annual nitrogen requirements.**

4.1.3 Forestry

The nitrogen requirement varies over the life of the forest stand. It is affected by stand age, management and naturally occurring nutrients. Therefore, it is based upon the observed suitable rate from research trials. Suitable rate is defined by a positive growth response and a negligible environmental effect.

Trials conducted by NSW State Forests on pine plantations have shown that 30 dry tonnes per hectare (equivalent to 350 kg available nitrogen in the first year) is the minimum rate required for a growth response comparable to a standard application of mineral fertiliser. No pollution of surface water has occurred at this rate.

The optimum application rate for maximizing growth response while minimising environmental effect is still being established. State Forests is conducting trials with rates of up to 80 dry tonnes per hectare (equivalent to 950 kg available nitrogen in the first year). All research trials include a contingent catchment management strategy in the event of significant (i.e. worst case) leaching.

4.2 MAXIMUM CONTAMINANT—LIMITED BIOSOLIDS APPLICATION RATE

The maximum CLBAR is the rate, in dry solids tonnes per hectare, which will cause the limiting contaminant to achieve the Maximum Allowable Soil Contaminant Concentration (MASCC).

The maximum CLBAR for an application is established by calculating CLBAR for each contaminant using the following equation:

$$CLBAR = \frac{MASCC - MISCC}{BCAC} \times SM$$

Where:

CLBAR	=	contaminant-limited biosolids application rate (dry tonnes/ha)
MASCC	=	maximum allowable soil contaminant concentration (mg/kg)
MISCC	=	measured in-situ soil contaminant concentration (mg/kg)
BCAC	=	biosolids contaminant application concentration (m+s) for batch or (X_t+s) for continuous (mg/kg)
SM	=	incorporated soil mass per hectare (dry tonnes/ha)

The CLBAR for each individual contaminant can be compared in a tabulated format. The contaminant with the lowest calculated CLBAR is the limiting contaminant and its CLBAR is the maximum rate that may be used.

Two examples of the calculation for maximum CLBAR are provided. Table S4-3 presents the example for agricultural land. Table S4-4 presents the example for non-agricultural land. In table S4-3 the organochlorine pesticides (OCPs) are the limiting contaminant. The CLBAR due to the OCPs is 40 dry tonnes per hectare. In table S4-4 cadmium and selenium are the limiting contaminants. The CLBAR due to cadmium and selenium is 74 dry tonnes per hectare.

To complete the calculation table, it is necessary to know the in-situ soil contaminant concentrations (from Schedule 3) and the biosolids contaminant application concentrations (see Schedule 2). The table values for soil are based on the samples taken before the proposed biosolids application as described in Schedule 3. The table values for the biosolids contaminant application concentrations are determined as **the mean plus the standard deviation** of the samples taken from the biosolids being applied.

Note that the contaminant concentrations (m+s) for batch sampling or (X_t+ s) for continuous sampling are conservative, protective values. This approach provides a high degree of protection to the soil. The practice of testing soil quality before each application means that this conservatism is not compounded to future applications.

Proforma calculation tables, similar to tables S4-3 and S4-4 for calculating the maximum contaminant-limited biosolids application rate, are provided in tables S4-5 and S4-6.

When two biosolids products are being applied to a site (e.g. alkaline biosolids and dewatered anaerobic cake), the CLBAR determination should be done sequentially by calculating the contaminant loading for one product (based on the expected application rate) and using an estimate of the post application contaminant levels as the basis for the contaminant loading for the second biosolids product. The NLBAR for the site can be determined in a similar manner by using the nitrogen content of the products.

The incorporated soil mass is used to estimate the final soil contaminant concentration in the first 7.5 cm of the soil regardless of whether the biosolids are incorporated or not (i.e. forestry applications).

TABLE S4-3

CLBAR for Agricultural Land

Contaminant	Maximum Allowable Soil Contaminant Concentration (mg/kg)	Measured In-situ Soil Contaminant Concentration (mg/kg)	Available Capacity of Soil to Assimilate Contaminants (mg/kg)[1]	Biosolids Contaminant Application Concentration (m+s) or (X_t+s)(mg/kg)[2]	CLBAR (dry tonnes/ha)[3]
	Column 1	**Column 2**	**Column 3 = Col 1 - Col 2**	**Column 4**	**Column 5 = SM x Col 3 / Col 4**
Arsenic (As)	20	1	19	6.2	3,065
Cadmium (Cd)	1	0.05	0.95	4.6	207
Chromium (Cr)	100	9	91	203	448
Copper (Cu)	100	10	90	1,349	67
Lead (Pb)	150	25	125	307	407
Mercury (Hg)	1	0.02	0.98	10	98
Nickel (Ni)	60	35	25	97	258
Selenium (Se)	5	3	2	14	143
Zinc (Zn)	200	40	160	1,466	109
DDT/DDD/DDE	0.5	0.2	0.3	0.9	333
Aldrin	0.02	0.01	0.01	0.25	40
Dieldrin	0.02	0.01	0.01	0.25	40
Chlordane	0.02	0.01	0.01	0.25	40
Heptachlor	0.02	0.01	0.01	0.25	40
Hexachlorobenzene	0.02	0.01	0.01	0.25	40
Lindane	0.02	0.01	0.01	0.25	40
BHC	0.02	0.01	0.01	0.25	40
PCBs	0.3	0.1	0.2	0.2	1,000
Maximum CLBAR (t/ha)					**40**

Assumptions:		
	Soil bulk density (dry tonnes/m^3)	1.333
	Incorporation depth (m)	0.075
	Incorporated soil mass (SM), dry tonnes/ha	1,000

Notes:

1. *Available capacity of soil to assimilate contaminants without exceeding column I.*
2. *Measured biosolids contaminant concentration based on mean (m) plus standard deviation(s) of samples tested.*
3. *Contaminant-limited biosolids application rate (CLBAR) for a specific site, calculated for each contaminant in dry tonnes per hectare. The lowest CLBAR calculated is the limiting biosolids application rate. Soil mass (SM) is the amount of soil in dry tonnes per hectare which is incorporated with the biosolids (soil bulk density x incorporation depth x 10,000 m2/ha).*

TABLE S4-4

CLBAR For Non-agricultural Land

Contaminant	Maximum Allowable Soil Contaminant Concentration (mg/kg)	Measured In-situ Soil Contaminant Concentration (mg/kg)	Available Capacity of Soil to Assimilate Contaminants (mg/kg)[1]	Biosolids Contaminant Application Concentration (m+s) or (X_t+s)(mg/kg)[2]	CLBAR (dry tonnes/ha)[3]
	Column 1	**Column 2**	**Column 3 = Col 1-Col 2**	**Column 4**	**Column 5 = SM x Col 3 / Col 4**
Arsenic (As)	20	10	10	13	769
Cadmium (Cd)	5	3	2	27	74
Chromium (Cr)	250	52	198	490	404
Copper (Cu)	375	125	250	1,850	135
Lead (Pb)	150	50	100	307	326
Mercury (Hg)	4	1	3	16	188
Nickel (Ni)	125	66	59	180	328
Selenium (Se)	8	6	2	27	74
Zinc (Zn)	700	320	380	2,100	181
DDT/DDD/DDE	0.5	0.3	0.2	0.9	222
Aldrin	0.2	0.1	0.1	0.5	200
Dieldrin	0.2	0.1	0.1	0.5	200
Chlordane	0.2	0.1	0.1	0.5	200
Heptachlor	0.2	0.1	0.1	0.5	200
Hexachlorobenzene	0.2	0.1	0.1	0.5	200
Lindane	0.2	0.1	0.1	0.5	200
BHC	0.2	0.1	0.1	0.5	200
PCBs	0.3	0.1	0.2	0.2	1,000
Maximum CLBAR (t/ha)					74
Assumptions: Soil bulk density (dry tonnes/m^3)					1.333
Incorporation depth (m)					0.075
Incorporated soil mass (SM), dry tonnes/ha					1,000

Notes:

1. *Available capacity of soil to assimilate contaminants without exceeding column I.*
2. *Measured biosolids contaminant concentration based on mean (m) plus standard deviation(s) of samples tested.*
3. *Contaminant-limited biosolids application rate (CLBAR) for a specific site calculated for each contaminant in dry tonnes per hectare. The lowest CLBAR calculated is the limiting biosolids application rate. Soil mass (SM) is the amount of soil in dry tonnes per hectare which is incorporated with the biosolids (soil bulk density x incorporation depth x 10,000 m^2/ha)*

TABLE S4-5

Pro-forma Calculation for CLBAR for Agricultural Land

Contaminant	Maximum Allowable Soil Contaminant Concentration (mg/kg)	Measured In-situ Soil Contaminant Concentration (mg/kg)	Available Capacity of Soil to Assimilate Contaminants (mg/kg)[1]	Biosolids Contaminant Application Concentration (m+s) or (X_t+s)(mg/kg)[2]	CLBAR (dry tonnes/ha)[3]
	Column 1	**Column 2**	**Column 3 = Col 1 - Col 2**	**Column 4**	**Column 5 = SM x Col 3 / Col 4**
Arsenic (As)	20				
Cadmium (Cd)	1				
Chromium (Cr)	100				
Copper (Cu)	100				
Lead (Pb)	150				
Mercury (Hg)	1				
Nickel (Ni)	60				
Selenium (Se)	5				
Zinc (Zn)	200				
DDT/DDD/DDE	0.5				
Aldrin	0.02				
Dieldrin	0.02				
Chlordane	0.02				
Heptachlor	0.02				
Hexachlorobenzene	0.02				
Lindane	0.02				
BHC	0.02				
PCBs	0.3				
Maximum CLBAR (t/ha)					

Assumptions:	Soil bulk density (dry tonnes/m^3)	1.333
	Incorporation depth (m)	0.075
	Incorporated soil mass (SM), dry tonnes/ha	1,000

Notes:
1. Available capacity of soil to assimilate contaminants without exceeding column I.
2. Measured biosolids contaminant concentration based on mean (m) plus standard deviation(s) of samples tested.
3. Contaminant-limited biosolids application rate (CLBAR) for a specific site calculated for each contaminant in dry tonnes per hectare. The lowest CLBAR calculated is the limiting biosolids application rate. Soil mass (SM) is the amount of soil in dry tonnes per hectare which is incorporated with the biosolids (soil bulk density x incorporation depth x 10,000 m^2/ha).

TABLE S4-6

Pro-forma Calculation for CLBAR for Non-agricultural Land

Contaminant	Maximum Allowable Soil Contaminant Concentration (mg/kg)	Measured In-situ Soil Contaminant Concentration (mg/kg)	Available Capacity of Soil to Assimilate Contaminants (mg/kg)[1]	Biosolids Contaminant Application Concentration (m+s) or (Xt+s)(mg/kg)[2]	CLBAR (dry tonnes/ha)[3]
	Column 1	Column 2	Column 3 = Col 1 —Col 2	Column 4	Column 5 = SM x Col 3 / Col 4
Arsenic (As)	20				
Cadmium (Cd)	5				
Chromium (Cr)	250				
Copper (Cu)	375				
Lead (Pb)	150				
Mercury (Hg)	4				
Nickel (Ni)	125				
Selenium (Se)	8				
Zinc (Zn)	700				
DDT/DDD/DDE	0.5				
Aldrin	0.2				
Dieldrin	0.2				
Chlordane	0.2				
Heptachlor	0.2				
Hexachlorobenzene	0.2				
Lindane	0.2				
BHC	0.2				
PCBs	0.3				
Maximum CLBAR (t/ha)					

Assumptions:	Soil bulk density (dry tonnes/m^3)	1.333
	Incorporation depth (m)	0.075
	Incorporated soil mass (SM), dry tonnes/ha	1,000

Notes:

1. Available capacity of soil to assimilate contaminants without exceeding column I.

2. Measured biosolids contaminant concentration based on mean (m) plus standard deviation(s) of samples tested.

3. Contaminant-limited biosolids application rate (CLBAR) for a specific site, calculated for each contaminant in dry tonnes per hectare. The lowest CLBAR calculated is the limiting biosolids application rate. Soil mass (SM) is the amount of soil in dry tonnes per hectare which is incorporated with the biosolids (soil bulk density x incorporation depth x 10,000 m^2/ha).

SCHEDULE 5

Reporting Forms

Form 1 Annual Biosolids Producer Report

Form 2 Annual Biosolids Re-processor Report

Form 3 Biosolids Application Report

Biosolids Products Application Program Participation Agreement

FORM 1

ANNUAL BIOSOLIDS PRODUCER REPORT TO THE EPA

Reporting Period: / / to / /

A copy of this report is to be completed for each sewage treatment plant operated by the biosolids producer.

Name of Sewage Treatment Plant: _____

TABLE 1-1

Destination of Biosolids Produced (Dry Tonnes)

Biosolids Destination	Unrestricted Use	Restricted Use	Not Suitable for Use	Unclassified
Direct to Unrestricted Use				
Direct to Applier via _____ (intermediate storage)				
Direct to Re-processor				
On-site Storage (retained on-site)				
Off-site Storage				
On-site Disposal				
Landfill				
Total				

Please nominate the limiting contaminants for each classification of biosolids produced:

Classification:	Limiting Contaminants:

Further Comments:

_____
_____
_____
_____

For Restricted Use Biosolids Products, the record of the land application sites which have received biosolids either directly from the producer or their contracted applier must be completed on the reverse.

TABLE 1-2

Summary of Land Application Sites

EPA Approval (Licence no. where applicable)	Site Location	Biosolids Product Type & Classification (i.e. cake, RS2)	Mass (dry tonnes)	End Use

TABLE 1-3

Summary of Storage & Disposal Sites for Biosolids Products

Biosolids Destination	Company and Location	Mass of Biosolids Delivered (dry tonnes or product tonnes)[1]
Re-processors		
Landfill Operators		
Off-site Storage (including other STPs)		
Applier		
Landfill		
	Total	

Note:
1. If presenting biosolids mass data in product tonnes, indicate the typical total solids content of the product and bulk density.

Please note that landfill operators should report all biosolids received in their EPA landfill reports.

FORM 2

ANNUAL BIOSOLIDS RE-PROCESSOR REPORT TO THE EPA

Reporting Period: / / to / /

Name of Re-processing Facility: _____

Location: _____

Re-processing Method/s: _____

TABLE 2-1

Source of Biosolids

Biosolids Producer	Sewage Treatment Plant	Mass of Biosolids Delivered (dry tonnes)

TABLE 2-2

Biosolids Product Produced

Biosolids Product Type	Classification	Mass of Biosolids Products (dry tonnes or product tonnes)[1]

Note:
1. If presenting data in product tonnes indicate the typical total solids content.

For Restricted Use Biosolids Products, the record of the land application sites which have received biosolids either directly from the re-processor or their contracted representative must be completed below. Record keeping is not required for Restricted Use 1 biosolids products applied to public contact sites and urban landscaping.

TABLE 2-3

Summary of Land Application Sites

EPA Approval (Licence no. where applicable)	Site Location	Biosolids Product Type & Classification (i.e. cake, RS2)	Mass (dry tonnes or product tonnes)	End Use
		Total		

TABLE 2-4

Summary of Storage & Disposal Sites for Biosolids Products

	Company and Location	Mass of Biosolids Delivered (dry tonnes or product tonnes)
Landfill Operators		
On-site Storage		
Off-site Storage		
Other (specify)		
	Total	

FORM 3

BIOSOLIDS APPLICATION REPORT

Biosolids Application Report No: _____

Complete **Section A** for each site/property that has an area or areas to be approved/licensed for biosolids application.
Complete **Section B** for each proposed biosolids application area/paddock within a site/property.

SECTION A: SITE IDENTIFICATION

Site Location: _____

Site Name: _____

Address: _____

_____

Shire _____

Locality_____ Km to (nearest town): _____

Property Owner / Manager: _____

Contact Person: _____

Phone: _____ Fax: _____

Postal Address: _____

_____

_____

PREVIOUS APPLICATION

Has the site been approved / licensed previously? (circle) Yes / No

If Yes, specify Licence Number: _____

Sensitive Areas

Are there any Sensitive Areas as listed in table 4-2 of the guidelines within or adjoining the proposed application areas? (circle) Yes / No

Describe:

_____

_____

_____

_____

SECTION B: APPLICATION AREA / PADDOCK DETAILS

This section is to be completed for each proposed application area / paddock which is to receive biosolids.

Site Name: _____

Proposed Application Area Name: _____

Number of previous applications: _____

Year/s of previous application: _____

Total biosolids applied to date: _____ dst/ha

Objective of Biosolids Application

Nutrient Application (circle) Yes / No

Soil Amendment (circle) Yes / No

pH Adjustment (circle) Yes / No

Existing Environment

Land use

Grazing (circle) Yes/No

Cropping (circle) Yes/No (specify)

Forestry (circle) Yes/No

Open cut mine (agricultural end use) (circle) Yes / No

Other (specify): _____

Land form

Description (Soil Data System): _____

	Units (% or degrees)	Minimum	Maximum
Slope			

Number	Soil Type	Geology
1		
2		
3		

Soil Classification Systems Used: _____

Number of soil cores described and sampled: _____

Biosolids Application Plan

Application Area

Name: _____ Area: _____ ha

Outline property boundaries and all application areas on a 1:25,000 topographic map/s and attach to this application report. Show location of soil sampling sites and distribution of soil types if more than one soil type occurs.

Hydrology

Indicate clearly on the topographic map and/or a separate application area map the location of dams, creeks and any other surface waters within the application site and 1,000 metres downstream of the proposed application area. Also indicate on the map established run-off and flow paths.

Are any of the dams, creeks or other surface waters within the catchment used for:

Domestic purposes (circle) Yes / No Stock (circle) Yes / No Irrigation (circle) Yes / No

If Yes to any of the above, indicate on the topographic or application area map the location of each and their individual uses.

Groundwater

Are there any proposed application sites where the groundwater is less than 3 metres? (circle) Yes / No

If groundwater is less than 3 metres, provide technical advice that the proposed application is acceptable in terms of environmental impact.

Provide information on bores located within 5 km of the area:

Bore No. (or local name if not registered)	**Zone Eastings/Northings**	**Depth (m)**	**Standing Water Level (m)**	**Yield (L/s) (including year of yield result)**	**Water Quality**	**Strata Details**	**Current Water Use**

Further Comments: _____

_____

_____

Existing Vegetation

Improved pasture (circle) Yes / No Native pasture (circle) Yes / No Fodder crops (circle) Yes / No

Plantation forest (circle) Yes / No Native forest (circle) Yes / No

Other (specify):_____

Proposed vegetation: _____

Incorporation Method

Injection (circle) Yes / No

Disc Plough (circle) Yes / No

Deep Ripping (open cut mines only) (circle) Yes / No

Other (to be approved by EPA):_____

Application Timing

Proposed Month/s of Application:_____

Period of Application: _____ weeks

Proposed Stockpiling Commencement Date: _____

Biosolids Source* and Classification

Source 1: _____

Classification: _____ Product Type: _____

Source 2: _____

Classification: _____ Product Type: _____

Source 3: _____

Classification: _____ Product Type: _____

*The source of biosolids products is permitted to change, provided that classification requirements are met and loading rates are recalculated before application.

Summary of Nutrient & Contaminant Loadings

NLBAR = _____ dry tonne/ha CLBAR =_____ dry tonne/ha

Limiting containment = _____ Proposed Application Rate: _____ dry tonnes/ha

Average solids content: % (wt/wt)_____

Total wet tonnes to be applied (based on average solids content):_____wet tonnes

List of Attachments

1. 1:25,000 topographic map showing property boundaries, bore location and number, application area(s) and direction of run-off.
2. site map drawn to scale including location of stockpile areas and their storage capacity. For mine sites the sediment control basins should also be included.
3. Soil analysis in accordance with Schedule 3 including a summary of mean contaminant levels in the soil used for calculating the CLBAR.
4. Calculation Table for Contaminant Limited Biosolids Application Rate (format should be similar to S4-3).
5. Nitrogen Limiting Biosolids Application Rate (NLBAR) determination including nitrogen content of biosolids.
6. Biosolids Products Application Program Participation Agreement.

PARTICIPATION APPLICATION

BIOSOLIDS PRODUCTS APPLICATION PROGRAM

I, _____(site owner/manager), hereby agree to accept biosolids product and grant permission to _____ (applier) to use the lands owned/managed by me and described below consisting of approximately _____ ha for the application of biosolids products from _____ (producer).

I understand that the biosolids product will be applied only in compliance with the requirements of the NSW Environment Protection Authority. I also understand that _____ (applier) will obtain soil analyses of the land and that the biosolids application will be limited to those areas and quantities which are approved by the Environment Protection Authority.

I further allow the agents of _____ (applier),the Environment Protection Authority, Department of Health, Department of Land and Water Conservation, State Forests and NSW Agriculture and (producer) access to my land for the purpose of applying biosolids, obtaining samples for analysis and inspection.

I understand that _____ (applier) does not guarantee specific delivery dates for the biosolids nor crop yields. I understand that incorporation of the biosolids must be conducted within 36 hours of the application for surface applied product.

If I wish to cancel this agreement I will do so by giving _____ (applier) thirty (30) days written notice.

Signed: _____ (land owner) Date: _____

Other Government Departments Informed of Application

NSW Health Department

Name: _____ Phone: _____

NSW Agriculture

Name _____ Phone: _____

Department of Land & Water Conservation

Name: _____ Phone: _____

State Forests

Name: _____ Phone: _____

Local Council

Name: _____ Phone: _____

I certify that I have personally examined and am familiar with the information submitted in this report and all attached documents and that based upon my inquiry of those individuals responsible for obtaining the information I believe that the submitted information is true, accurate and complete.

Name : _____ (Applicant/Organisation) Signature: _____

Title: _____ Date: _____

Name : _____ (Biosolids Producer) Signature: _____

SCHEDULE

6 Legislation

Clean Waters Act 1970

Section 16 ((1) & (2))

Section 19 ((1) & (2))

Pollution Control Act 1970

Section 17D (4)

CLEAN WATERS ACT

Section 16

(1) A person shall not pollute any waters.

(2) Without limiting the generality of subsection (1), a person shall be deemed to pollute waters if:

(a) the person places any matter (whether solid, liquid or gaseous) in a position where:

(i) it falls, descends, is washed, is blown or percolates; or

(ii) it is likely to fall, descend, be washed, be blown or percolate; into any waters, on to the dry bed of any waters, or into any drain, channel or gutter used or designed to receive or pass rainwater, floodwater or any water that is not polluted, or causes or permits any such matter to be placed in such a position; or

(b) the person places any such matter on the dry bed of any waters, or in any drain, channel or gutter used or designed to receive or pass rainwater, floodwater or any water that is not polluted, or causes or permits any such matter to be placed on such a dry bed or in such a drain, channel or gutter, and the matter would, had it been placed in any waters have polluted or have been likely to pollute those waters.

Section 19

(1) A person shall not:

(a) install, construct or modify any apparatus, equipment or work for:

(i) the discharge of pollutants into any waters;

(ii) the treatment of pollutants before and for the purpose of their discharge into any waters; or (iii) the storage, treatment of disposal, in a prescribed manner or in prescribed circumstances, of matter of a prescribed class or description; or

(b) carry out any work that constitutes the beginning of, or any subsequent step in, the installation, construction or modification of any apparatus, equipment or works of the nature referred to in paragraph (a), except in accordance with a pollution control approval or in accordance with a requirement under the regulations made pursuant to section 36(1)(f1).

(2) A reference in subsection (1) to the discharge of pollutants into any waters includes a reference to the discharge or other disposal of pollutants so that they fall, descend, are washed, are blown or percolate, or are likely to fall, descend, be washed, be blown or percolate, into any waters or onto the bed of any water, when dry.

POLLUTION CONTROL ACT

Section 17 D

(4) In exercising its powers under this section, the Commission shall have regard to:

(a) the pollution being or likely to be caused by the applicant and the impact of that pollution on the environment; and

(b) the practical measures which may be taken:

(i) to prevent, control, abate or mitigate that pollution; and

(ii) to protect the environment from defacement, defilement or deterioration as a result of that pollution.

SCHEDULE 7

Government Contacts

Environment Protection Authority

Department of Land & Water Conservation

NSW Agriculture

ENVIRONMENT PROTECTION AUTHORITY OFFICES

Office	Address	Phone & Fax
Albury	4th Floor, Albury City Council Chambers 553 Kiewa St ALBURY NSW 2640 Postal Address: PO Box 544	Phone: (02) 6041 4963 Fax: (02) 6041 4973
Armidale	Level 1, NSW Government Offices 85 Faulkner Street ARMIDALE NSW 2350 Postal Address: PO Box 494	Phone: (02) 6773 7000 Fax: (02) 6772 2336
Bathurst	NSW Government Offices 219 Howick Street BATHURST NSW 2795 Postal Address: PO Box 1388	Phone: (02) 6332 7600 Fax: (02) 6332 2387
Buronga	Unit 6/1 Silver City Highway BURONGA NSW 2739 Postal Address: PO Box 386	Phone: (03) 5022 1096 Fax: (03) 5021 0547
Dubbo	Level 2, NSW Government Offices 37-39 Carrington Street DUBBO NSW 2830	Phone: (02) 6884 9745 Fax: (02) 6882 9217
Gosford	Suite 14, William Court Cnr Paul Lane & William Street GOSFORD NSW 2250	Phone: (02) 4323 9875 Fax: (02) 4323 9879
Grafton	NSW Government Offices 49 Victoria Street GRAFTON NSW 2460 Postal Address: PO Box 498	Phone: (02) 6640 2500 Fax: (02) 6642 7743
Griffith	Suites 7-8, Level 1, Griffith City Plaza 130-140 Banna Avenue GRIFFITH NSW 2680 Postal Address: PO Box 397	Phone: (02) 6964 1880 Fax: (02) 6964 1885
Moree	Suite 15, Salina Court 161-165 Balo Street MOREE NSW 2400	Phone: (02) 6751 1519 Fax: (02) 6752 7946
Murwillumbah	Suite 2A, Warina Walk Building 114 Main Street MURWILLUMBAH NSW 2484 Postal Address: PO Box 723	Phone: (02) 6672 6134 Fax: (02) 6672 6134
Muswellbrook	Suite 1, 56 Brook Street MUSWELLBROOK NSW 2333	Phone: (02) 6541 2381 Fax: (02) 6541 1634

Newcastle	Ground Floor, NSW Government Offices 117 Bull Street NEWCASTLE WEST NSW 2302 Postal Address: PO Box 488G, NEWCASTLE 2300	Phone: (02) 4926 9971 Fax: (02) 4929 6712
Parramatta	Postal Address: PO Box 668 PARRAMATTA NSW 2124	Phone: (02) 9995 5000 Fax: (02) 9995 6900
Queanbeyan	Unit 4, Robert Lowe Building 30 Lowe Street QUEANBEYAN NSW 2620 Postal Address: PO Box 622	Phone: (02) 6122 3100 Fax: (02) 6299 3525
Sydney	59-61 Goulburn Street SYDNEY NSW 2000 Postal Address: PO Box A290, SYDNEY SOUTH 1232	Phone: (02) 9995 5000 Fax: (02) 9995 5999
Tamworth	Level 1 (Lower Ground Floor), Noel Park House 155-157 Marious Street TAMWORTH NSW 2340	Phone: (02) 6766 7871 Fax: (02) 6766 7493
Wollongong	Level 3, NSW Government Offices 84 Crown Street WOLLONGONG NSW 2500 Postal Address: PO Box 513, WOLLONGONG EAST 2520	Phone: (02) 4226 8100 Fax: (02) 4227 2348
Wyong	Shop 5, 64 Pacific Highway WYONG NSW 2259	Phone: (02) 4352 2762 Fax: (02) 4352 2760

DEPARTMENT OF LAND & WATER CONSERVATION CONTACTS

Regional Office	Address	Phone & Fax
Barwon Region	155-157 Marius St TAMWORTH NSW 2340 Postal Address: PO Box 550	Phone: (02) 6764 5900 Fax: (02) 6764 5982
Central West Region	181 Anson St (cnr Kite St) ORANGE NSW 2800 Postal Address: PO Box 53	Phone: (02) 6393 4300 Fax: (02) 6361 3839
Far West Region	45 Wingewarra St DUBBO NSW 2830 Postal Address: PO Box 1840	Phone: (02) 6883 3000 Fax: (02) 6883 3099
Hunter Region	Suite 6, 464 King St NEWCASTLE WEST NSW 2302 Postal Address: PO Box 2213, DANGAR 6364 NSW 2309	Phone: (02) 4929 4346 Fax: (02) 4929
Murray Region	8-20 Edwardes St DENILIQUIN NSW 2710 Postal Address: PO Box 205	Phone: (03) 5881 2122 Fax: (03) 5881 3465

Murrumbidgee Region	43-45 Johnston St WAGGA WAGGA NSW 2650 Postal Address: PO Box 10	Phone: (02) 6923 0400 Fax: (02) 6923 0520
North Coast Region	76 Victoria St GRAFTON NSW 2460 Postal Address: Locked Bag 10	Phone: (02) 6640 2000 Fax: (02) 6640 2185
Sydney South Coast Region	Level 3, 84 Crown St WOLLONGONG NSW 2500 Postal Address: PO Box 867 WOLLONGONG EAST NSW 2520	Phone: (02) 4226 8563 Fax: (02) 4226 8500

NSW AGRICULTURE CONTACTS—DISTRICT AGRONOMISTS

Office	Address	Phone & Fax
Albury	Government Offices 539 Kiewa St ALBURY NSW 2640 Postal Address: PO Box 49	Phone: (02) 6041 6500 Fax: (02) 6041 6499
Armidale	State Office Block 85 Faulkner St ARMIDALE NSW 2350 Postal Address: PO Box 991	Phone: (02) 6776 5000 Fax: (02) 6772 8664
Bathurst	NSW Government Offices 140 William St BATHURST NSW 2795 Postal Address: PO Box 1386	Phone: (02) 6334 8388 Fax: (02) 6334 8380
Bega	Rixon's Arcade 162 Carp St BEGA NSW 2550 Postal Address: PO Box 53	Phone: (02) 6492 1733 Fax: (02) 6492 1402
Berry	Pasture Research Unit 13 Schofields Lane BERRY NSW 2535 Postal Address: PO Box 63	Phone: (02) 4464 1251 Fax: (02) 4464 2113
Bourke	27 Mitchell St BOURKE NSW 2840 Postal Address: PO Box 531	Phone: (02) 6872 2077 Fax: (02) 6872 3046
Casino	NSW Agriculture 134 Barker St CASINO NSW 2470 Postal Address: PO Box 376	Phone: (02) 6662 2288 Fax: (02) 6662 1107

Cobar	Rangeland Management Research & Advisory Unit 16-18 Barton St COBAR NSW 2835 Postal Address: PO Box 286	Phone: Fax:	(02) 6836 2108 (02) 6836 3443
Condobolin	Agricultural Research & Advisory Station Trundle Road CONDOBOLIN NSW 2877 Postal Address: PO Box 300	Phone: Fax:	(02) 6895 2099 (02) 6895 2688
Cooma	39 Bombala St COOMA NSW 2630 Postal Address: PO BOX 798	Phone: Fax:	(02) 6452 3411 (02) 6452 4872
Coonabarabran	59 Cassilis St COONABARABRAN NSW 2357 Postal Address: PO Box 116	Phone: Fax:	(02) 6842 1452 (02) 6842 2190
Coonamble	62 Aberford St COONAMBLE NSW 2829 Postal Address: PO Box 60	Phone: Fax:	(02) 6822 1000 (02) 6822 1175
Cootamundra	NSW Government Offices 87-91 Cooper St COOTAMUNDRA NSW 2590 Postal Address: PO Box 132	Phone: Fax:	(02) 6942 4957 (02) 6942 3922
Cowra	Agricultural Research & Advisory Station Binni Creek Rd COWRA NSW 2794 Postal Address: PO Box 129	Phone: Fax:	(02) 6342 1333 (02) 6342 4543
Deniliquin	Agricultural Research & Advisory Station 449 Charlotte St DENILIQUIN NSW 2710 Postal Address: PO Box 736	Phone: Fax:	(03) 5881 9999 (03) 5881 3719
Dubbo	NSW Government Offices 37 Carrington Avenue DUBBO NSW 2830 Postal Address: PO Box 865	Phone: Fax:	(02) 6881 1270 (02) 6881 1295
Finley	241 Murray St FINLEY NSW 2713 Postal Address: PO Box 108	Phone: Fax:	(03) 5883 1644 (03) 5883 1570
Forbes	NSW Government Offices Camp St FORBES NSW 2871 Postal Address: PO Box 369	Phone: Fax:	(02) 6850 2922 (02) 6852 2047

Glen Innes	Agricultural Research & Advisory Station Wellingrove Rd GLEN INNES NSW 2370 Postal Address: Private Mail Bag	Phone: Fax:	(02) 6730 1900 (02) 6730 1999
Goulburn	NSW Government Offices 159 Auburn St GOULBURN NSW 2580 Postal Address: PO Box 389	Phone: Fax:	(02) 4828 6600 (02) 4822 3261
Grafton	Agricultural Research & Advisory Station Trenayr Rd GRAFTON NSW 2460 Postal Address: Private Mail Bag 2	Phone: Fax:	(02) 6640 1600 (02) 6644 7251
Griffith	Griffith Centre for Irrigated Agriculture Farm 217, Murray Rd HANWOOD NSW 2680 Postal Address: PO Box 1087, GRIFFITH NSW 2680	Phone: Fax:	(02) 6960 1300 (02) 6963 0255
Gunnedah	NSW Government Offices 35-37 Abbott St GUNNEDAH NSW 2380 Postal Address: PO Box 546	Phone: Fax:	(02) 6742 9240 (02) 6742 2940
Hay	177 Lachlan St HAY NSW 2711 Postal Address: PO Box 393	Phone: Fax:	(02) 6993 1608 (02) 6993 2177
Inverell	NSW Government Offices 127 Otho St INVERELL NSW 2360 Postal Address: PO Box 406	Phone: Fax:	(02) 6722 1388 (02) 6722 2537
Kempsey	31 Elbow St WEST KEMPSEY NSW 2440 Postal Address: PO Box 141	Phone: Fax:	(02) 6562 6244 (02) 6562 5614
Kyogle	2/38 Summerland Way KYOGLE NSW 2474 Postal Address: PO Box 54	Phone: Fax:	(02) 6632 1900 (02) 6632 1960
Manilla	114 Manilla St MANILLA NSW 2346 Postal Address: PO Box 71	Phone: Fax:	(02) 6785 1790 (02) 6785 2176
Moree	87-89 Balo St MOREE NSW 2400 Postal Address: PO Box 209	Phone: Fax:	(02) 6752 5111 (02) 6752 4859
Mudgee	90 Market St MUDGEE NSW 2850 Postal Address: PO Box 174	Phone: Fax:	(02) 6372 4700 (02) 6372 6870

Narrabri	Australian Cotton Research Institute	Phone:	(02) 6799 1500
	Wee Waa Rd	Fax:	(02) 6799 1503
	NARRABRI NSW 2390		
	Postal Address: Locked Bag 1000		
Nyngan	66A Cobar St	Phone:	(02) 6832 1305
	NYNGAN NSW 2825	Fax:	(02) 6832 1980
	Postal Address: PO Box 179		
Orange	161 Kite St	Phone:	(02) 6391 3100
	ORANGE NSW 2800	Fax:	(02) 6391 3336
	Postal Address: Locked Bag 21		
Organic Waste	University of Western Sydney	Phone:	(02) 4578 2666
Recycling Unit	Bourke St	Fax:	(02) 4578 2528
	RICHMOND NSW 2753		
	Postal Address: Locked Bag 4		
Parkes	Central West County Council Building	Phone:	(02) 6862 1000
	Church St	Fax:	(02) 6862 5430
	PARKES NSW 2870		
	Postal Address: PO Box 149		
Singleton	Hambledon Hill Rd	Phone:	(02) 6572 2197
	SINGLETON NSW 2330	Fax:	(02) 6572 4062
	Postal Address: PO Box 149		
Tamworth	Tamworth Centre for Crop Improvement	Phone:	(02) 6763 1100
	Calala Lane	Fax:	(02) 6763 1222
	TAMWORTH NSW 2340		
	Postal Address: RMB 944		
Taree	1 Macquarie St	Phone:	(02) 6552 7299
	TAREE NSW 2430	Fax:	(02) 6551 2253
	Postal Address: PO Box 253		
Temora	Agricultural Research & Advisory Station	Phone:	(02) 6977 3333
	TEMORA NSW 2666	Fax:	(02) 6977 2333
	Postal Address: PO Box 304		
Wagga Wagga	Pine Gully Rd	Phone:	(02) 6938 1999
	WAGGA WAGGA NSW 2650 Postal Address: PO Box PMB	Fax:	(02) 6938 1809
Walgett	89 Wee Waa St	Phone:	(02) 6828 1288
	WALGETT NSW 2832	Phone:	(02) 6828 2274
	Postal Address: PO Box 249	Fax:	(02) 6828 1741
Warren	Cnr Dubbo & Burton Sts	Phone:	(02) 6847 4507
	WARREN NSW 2824	Fax:	(02) 6847 3664
	Postal Address: PO Box 183		

Wellington	34 Swift St WELLINGTON NSW 2820 Postal Address: PO Box 99	Phone: Fax:	(02) 6845 1866 (02) 6845 3055
West Wyalong	Cnr Shire & Court Sts WEST WYALONG NSW 2671 Postal Address: PO Box 378	Phone: Fax:	(02) 6972 2244 (02) 6972 3839
Windsor	299 George St WINDSOR NSW 2756 Postal Address: Locked Bag 11	Phone: Fax:	(02) 4577 0600 (02) 4577 0650
Yanco	Yanco Agricultural Institute Trunk Road 80 YANCO NSW 2703 Postal Address: Private Mail Bag	Phone: Fax:	(02) 6951 2611 (02) 6955 7580
Yass	102 Meehan St YASS NSW 2582 Postal Address: PO Box 20	Phone: Fax:	(02) 6226 2199 (02) 6226 1581
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References

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Glossary

Agricultural Land: The current or future use of land for agriculture which includes horticulture, turf and any purpose of husbandry. This includes keeping or breeding livestock, poultry or bees, and growing fruit, vegetables, field crops or pastures. Home vegetable gardens and home gardens are also considered agricultural.

Aerobic Digestion: The biochemical decomposition of organic matter in sewage sludge into carbon dioxide and water by micro-organisms in the presence of air.

Anaerobic Digestion: The biochemical decomposition of the organic matter in sewage sludge into methane gas and carbon dioxide by micro-organisms in the absence of air.

Animal Enclosure: An enclosure for intensive husbandry of livestock such as pigs, cattle and poultry; and does not include grazing purposes.

Application Site: The area over which biosolids products are applied or used.

Applier: A person responsible for an operation which receives, transports and places biosolids or biosolids products on land for purposes other than domestic landscaping and gardening and public landscaping of parks, recreation areas and highway verges.

Batch: A clearly identifiable and traceable quantity of biosolids which may be classified according to the guidelines. Plant operators may select any sized batch.

Batch Sampling Mode: A procedure involving the intermittent sampling of batches of biosolids (e.g. during the unloading of biosolids lagoons).

Beneficial Use: The use of nutrients in biosolids at or below the agronomic loading rate or use of the soil conditioning properties of the biosolids.

Biosolids: Primarily an organic solid product produced by the municipal sewage treatment process, previously referred to as sewage sludge. Solids become biosolids when they come out of a digester or other treatment process and can be beneficially used. Until such solids are suitable for beneficial use they are defined as waste-water solids. The solid content in biosolids should be equal to or greater than 0.5% weight by volume (w/v).

Biosolids Contaminant Application Concentration (BCAC): The contaminant concentration used in calculating the Contaminant: Limited Biosolids Application Rate (CLBAR), and defined as a function of the standard deviation and the mean concentration of a contaminant in a sample population (usually a "batch" of biosolids).

Biosolids Products: Material containing any component of biosolids, including pure sewage biosolids in the form of liquid or cake, or materials such as compost, lime sludges or pellets.

Biosolids Products: Beneficial Land Application: The application in volumes of biosolids to an area whereby the use of nutrients in the products does not exceed the nutrient requirements of the crops, pastures or vegetation and/or the use of the beneficial characteristics of the organic matter in the biosolids.

Biosolids Products: Unrestricted Use: Products which can be applied in an unrestricted manner to all lands (excluding "sensitive" sites). Records must be maintained to verify the classification.

Biosolids Products: Restricted Use: Products which are restricted in their application as a result of the concentration of constituent contaminants or their stabilisation characteristics. Restrictions on the products include loading rates and management practices, as well as limitations on the future uses of land to which they can be applied.

Biosolids Products: Not Suitable for Use: Products which cannot be used on lands outside the boundaries of the source sewage treatment plant because their quality has not been shown to have reached the standard required.

Buffer Zone: An area of vegetated land located between an area of biosolids application and a drainage line, creek, river or sensitive area.

Bunded: A wall structure designed to retain run-off.

Classification: The process of assigning biosolids products to classes, based on their quality.

Composting: The aerobic, biological decomposition of the organic constituents of biosolids and other organic products under controlled conditions. The rate of composting is dependent upon a number of factors, but key factors include: moisture content, carbon to nitrogen ratio, aeration, temperature and microbial population.

Contaminant: Metals and organochlorine pesticides occurring in biosolids and soils. Regulated contaminants are listed in table 3-1.

Contaminant Acceptance Concentration: The maximum contaminant concentration of the biosolids product permitted to qualify for a designated contaminant grade.

Contaminant Grade: Classification category used to describe the quality of a biosolids product based on the concentration of its constituent contaminants.

Contaminant Limited Biosolids Application Rate (CLBAR): The limiting application rate at which biosolids can be applied without exceeding the maximum allowable concentration of any one contaminant.

Continuous Sampling Mode: Procedure involving the continuous sampling of biosolids from a sewage treatment plant or re-processing facility.

Dewater: Removal of a significant amount of water content. "Dewatered biosolids"—biosolids that have had a significant amount of water removed.

Enteric: Intestinal.

Final User: the occupier responsible for the land to which the biosolids product is applied (e.g. owner, fanner, mine operator or NSW State Forests).

Grading: A necessary input to classification. Grading of biosolids products is based on their constituent contaminants (contaminant grade), and degree of stabilisation (stabilisation grade).

Groundwater: Water saturating the voids in rocks; water in the zone of saturation in the earth's crust.

Hardstand: Compacted surface to minimise infiltration.

High Potential: Land with a high potential for public exposure is land that the public uses frequently, including a public contact site and rehabilitation site in a populated area.

Incorporation: The use of one pass of a disc plough under favourable moisture conditions, incorporation should be done as soon as possible, and the ultimate objective is to apply the biosolids on the day they arrive on site. For mine rehabilitation sites, the area should be ripped (12 passes) to minimise the amount of biosolids remaining on the land surface.

Karst Areas: Areas comprised substantially of soluble rocks such as limestone or dolomite and characterised by landforms produced by solution, abrasion or collapse, or by underground drainage (or by both).

Lagoon: A storage facility for liquid biosolids.

Land Disposal: The application of biosolids where beneficial use is not an objective. Disposal will normally result in application at rates which exceed the nutrient requirements of crops, pastures or plants, or the requirement for organic matter.

Land Application: The spraying or spreading of biosolids products onto the land surface, or their injection below the land surface.

Landscape Unit: An area of land used for agriculture with consistent geological features and uniform soil profiles and textures, pH proximity to waterable, slope and land-use.

Maximum Allowable Biosolids Application Rate: The maximum rate at which biosolids can be applied to a land area without exceeding the recommended maximum contaminant and nitrogen loadings of the soil.

Maximum allowable Soil Contaminant Concentration: The recommended maximum concentration of contamination in a soil (see table 4-5 and 4-13)

Measured In-situ Soil Contaminant Concentration: The actual concentration of contaminants in a soil.

Nitrogen Limited Biosolids Application Rate (NLBAR): The application rate at which biosolids can be applied without exceeding the annual nitrogen requirement of the crop or vegetation grown on the land.

Over-Burden: Sedimentary rock material covering coal seams and mineral veins.

Pathogens: Disease causing organisms, including certain bacteria, protozoa, viruses and viable helminth ova.

Permeability: The water movement through a soil profile.

Pollution: A state of contamination for which the water (soil or air) quality has deteriorated to a point where the ability of the water (soil or air) to support or maintain existing or potential uses is diminished.

Producer: Person responsible for the operation of the sewage treatment plant which produces biosolids, and for associated on-site and off-site storage facilities.

Public Contact Site: Land with a high potential for contact by the public, including public parks, field, cemeteries, plant nurseries and golf courses.

Occupied Dwelling: a room or suite of rooms occupied on the property receiving biosolids or adjoining the property.

Off-site Storage Facility: EPA approved storage facility for biosolids products under the control of the sewage treatment plant operator, re-processor or applier.

Re-processor: Responsible person for the operation of a re-processing facility.

Re-processing Facility: Establishment which receives biosolids from a sewage treatment plant operator (producer) or other re-processor and modifies the physical, chemical or microbiological form of the biosolids to produce a biosolids product for beneficial use.

Research: Investigative studies of the impact of applying biosolids products to the land which include clearly defined aims, experimental design, methodology and are subject to peer review.

Residential Zone: Land identified in an environmental planning instrument as being predominantly for residential use, including urban, village or living area zones, but excluding rural residential zones.

Sensitive Area: Land areas which are considered to be of ecological, natural, cultural or heritage value and worthy of preservation, listed in table 4-2.

Sewage Treatment Plant: The processing facility that treats sewage to render it acceptable for discharge into the environment and which, as a result, produces biosolids, effluent and minor residuals.

Sludge (sewage sludge): Solid, semi-solid or liquid residue generated during the treatment of sewage in a treatment works.

Solid Waste Landfill: Any landfill that accepts solid wastes.

Spadeable Biosolids: Biosolids that are able to be moved by a spade at normal outdoor temperatures.

Specific Oxygen Uptake Rate (SOUR): The mass of oxygen consumed per unit time per unit mass of total solids (dry weight basis) in the sewage sludge.

Stabilisation: The processing of biosolids to reduce or eliminate the potential for putrefaction and which, as a result, reduces pathogens, vector attraction and offensive odours.

Stabilisation Grade: Classification category used to describe the quality of a biosolids product based on its microbiological characteristics, vector attraction and potential to generate offensive odours.

State Forests: Sites which are dedicated forests under the *Forestry Act 1916.*

Strictly controlled: Situations where the application of biosolids products can only be done with the approvals of the relevant controlling authority, the owner or occupier of the sensitive area and the EPA.

Surface Land Disposal: Waste disposal area within sewage treatment plants (licensed and approved by the EPA) where the biosolids are not buried but applied to the surface at rates that exceed the requirements of beneficial land application or where the application has no intended beneficial use.

Surface Waters: Any river, stream, lake, lagoon, swamp, wetlands, unconfined surface water, dam or tidal waters. A river or stream may be perennial or intermittent, flowing in a natural channel with an established bed or in an artificially modified channel which has changed the course of the stream.

TCLP (Toxicity Characteristics Leaching Procedure) Test: An analytical test used to determine the leaching characteristics of a material under standardised conditions, as set out in the US EPA procedure.

Unstabilised Solids: Organic materials in sewage sludge that have not met stabilisation Grade A or B.

USEPA 40-CFR 503 Rule: A regulation by the US EPA, promulgated in 1993, which sets out the requirements for the final use and disposal of biosolids in three circumstances: land application for beneficial use, disposal to the land, and incineration.

Urban Landscapes: Urban landscapes involve landscaping undertaken for aesthetic or rehabilitation purposes within an urban environment, and include all public landscaping but not residential areas.

Vectors: Insects and animals, such as flies, mosquitoes and rodents, which are attracted to the putrescible organic material in biosolids and which may spread pathogens.

Volatile Solids: The amount of total solids in sewage sludge lost when the sewage sludge is heated at 550 degrees Celsius in the presence of excess air.

Watertable: The surface of an underground water body at which the pressure is atmospheric.

Windrow: A quantity of material like biosolids, organised in a pile and left to dry.

Windrow: A quantity of material like biosolids, organised in a pile and left to dry.

Acronyms & Abbreviations

AEMPR	Annual Environmental Management Plan Report
AGAL	Australian Analytical Laboratory
ANZECC	Australian & New Zealand Environment & Conservation Council
APHA	American Public Health Association
AS	atomic absorption
AWRC	Australian Water Resource Council
BCAC	biosolids contaminant application concentration
BHC	benzene hexachloride
CFR	Code of Federal Regulation
CFU	colony forming unit (of faecal coliform bacteria)
CKD	cement kiln dust
CLBAR	contaminant limited biosolids application rate
CSIRO	Commonwealth Scientific & Industrial Research Organisation
C_t	target grade coefficient
CVAAS	cold-vapour atomic absorption spectrometry
dst	dry solid tonnes
DWR	Department of Water Resources
EC	electrical conductivity
EIS	Environmental Impact Statement
EP	equivalent population
EPA	NSW Environment Protection Authority
FAAS	flame atomic absorption spectrometry
FIS	faunal impact statement
GC-EC	gas chromatograph—electron capture
GFAAS	graphite furnace atomic absorption spectrometry
ICP-AES	inductively coupled plasma—atomic emission spectrometry
ICP-MS	inductively coupled plasma—mass spectrometer
Ks	saturated hydraulic conductivity
LAWC	Department of Land & Water Conservation
LEP	Local Environmental Plan
MCC	mean contaminant concentration

MASCC	maximum allowable soil contaminant concentration
MEPA	Marine & Estuarine Protected Area
MISCC	measured in-situ soil contaminant concentration
MPN	most probable number
MR	mineralisation rate
N	nitrogen
NATA	National Association of Testing Authorities (Australia)
NLBAR	nitrogen limiting biosolids application rate
OCPs	organochlorine pesticides
pH	acid-alkaline balance
PCBs	polychlorinated byphenyls
PFU	plaque forming unit
PSI	pound per square inch
REF	Review of Environmental Factors
SDCC	standard deviation of contaminant concentrations
SEPP	State Environmental Planning Policy
SFNSW	State Forests of NSW
SM	incorporated soil mass per hectare
SOUR	specific oxygen uptake rate
SRM	standard reference materials
STP	sewage treatment plant
TN	total nitrogen
TCLP	toxicity characteristic leaching procedure
US EPA	US Environment Protection Agency
wt	weight
w/v	weight by volume
X_t	contaminant concentration of the sample