36 HOUSEKEEPING PRACTICES

36.1 HOUSEKEEPING AND EDUCATIONAL CONTROLS

36.1.1 Definition

Housekeeping measures are those measures that keep pollutants from ever becoming introduced to the runoff. This includes covering chemical storage and handling areas, sweeping up chemical spills, berming (bunding) chemical storage areas; mitigating the dumping of household and yard trash into the drainage system. Education is included as a housekeeping practice, although it is not actually a practice in itself.

Many of these measures do however relate to and work in conjunction with source control and treatment controls. Control of urban stormwater quality should not rely only on end-of-drain solutions, such as the treatment measures described in Chapters 34 and 35. Improved housekeeping practices will be of great benefit by preventing pollutant loads from entering the stormwater runoff.

This Chapter discusses the opportunities and points out the distinctions between the nature of these strategies as well as the relevant roles and responsibilities of the various stakeholders.

The numbers of operation and maintenance activities that are carried out are too numerous to be fully covered in this manual. There are some guiding principles that can be used by businesses, industries and property owners to develop BMPs for housekeeping controls themselves. These guiding principles can also be used by Local Authorities, in conjunction with other legislative requirements to assess development for ecologically sound practices.

Some of the material in this Chapter has been adapted from the California Stormwater BMPs (CDM, 1993) and "Stormwater Management Manual for the Puget Sound Basin" produced by Washington State Department of Ecology in 1992. The inclusion of these materials is gratefully acknowledged.

There is as yet relatively little experience in such programs in Malaysia. Therefore, in writing this Chapter it has been necessary to draw partly on experience in Australia and North America. It is expected that as Malaysian experience increases it will be possible to update this Chapter with more relevant local material.

36.1.2 Types

Housekeeping and educational quality controls fall into three main categories. These are:

(a) Government Activities

All levels of Government, particularly Local Authorities have a significant role to play in the planning, promotion, coordination and enforcement of housekeeping and educational stormwater quality control measures.

Activities that local authorities might be involved in include:

- Legislation, regulation, and building controls,
- Playing a lead role in education,
- Operation and maintenance of treatment stormwater quality control measures,
- Adopting best management practice for all of the Authority's own operational and maintenance activities affecting stormwater quality.

(b) Private and Business Activities

The activities of private citizens and businesses directly and indirectly affect stormwater runoff quality. Community education is one of the methods used to attempt to change this behaviour.

(c) Community Education

Community education covers everything from school and student curriculum activity through to broader community education programs, all aimed at promoting the use of Best Management Practices for source control. This education should be designed to promote changes in the behaviour of the community so that it adopts practices that minimise stormwater pollution. Community education is discussed in detail in Chapter 37.

36.1.3 Strategic Principles

Invariably the development of good housekeeping and educational controls requires the co-operation of a wide range of government and non-government organisations to produce effective and coordinated programs. Experience in Australia and North America shows that these are most effectively implemented on a catchment wide basis, with reference to and co-ordination with state and national controls and programs.

Experience in Australia and the USA shows that many of the housekeeping and educational stormwater control measure require the alteration of people's awareness and behaviour. The achievement of this objective requires the coordinated effort of a large number of organisations from government, the community and private enterprise.

This experience has lead to the development of a number of strategic principles that should be followed to achieve even modestly successful outcomes. The strategic planning principles used for developing housekeeping options must be practical, well targeted, coordinated, measurable, flexible and managed.

(a) Practical

Any such program must be practical, that is, it must:

- Be readily implemented within existing or attainable resources.
- Be realistic in scope; over-ambition in such initiatives generally leads to early failure.
- Be fundable through existing or attainable sources.

(b) Targeted

There must be a clear understanding at the outset of:

- The goals for the program (what will be considered a successful outcome?).
- The participants to be involved (including their roles and responsibilities).
- The program for the strategy (including milestones and completion dates).

These may vary of course from local to catchment-wide targets.

For housekeeping and educational measures targets may necessarily be best estimates as, unlike the treatment control measures, there are generally fewer precedents by which to gauge success. Use of measures, such as, awareness surveys may assist in assessing change over longer periods of time.

(c) Co-ordinated

Most of these initiatives have a strong element of cross relationship. It is, therefore, essential to ensure that any such programs complement one another. Thus, for instance, the litter education campaign run by one Local Authority will be of little effect if the litter collection processes of another Local Authority in the catchment work against it.

Key elements in the co-ordination include:

- Maintaining a co-ordination body (Catchment Management Committee (CMC) or Stormwater Management Plan (SMP) Steering Group).
- Development of catchment-wide and sub-catchment specific strategies.
- Ensuring co-ordination across Local Authority boundaries, and amongst Government agencies.

One of the key considerations must be to ensure that any committee/major program has a coordinator with adequate time available to act on implementing actions.

(d) Measurable

Any program or initiative that is introduced must be measurable in terms of performance or the success of results will remain largely conjecture. This is especially important for housekeeping and educational options where the results are often more difficult to gauge or recognise.

For instance in an education program on litter reduction it will be important to decide:

- What are the goals? (Percentage reduction at key outlets?).
- What will we measure? (Community awareness or litter exports?).
- How will we measure progress? (Measuring litter export, or surveys to assess change in awareness?).
- Where will we measure the results ? If there is a physical measure, what is a practical range of locations at which to test ?.
- How often will we measure the results ? With educational campaigns the effectiveness is likely to be longer term and thus change may be slow.

Behavioural change takes a long time. Time frames of five years or greater may be common and therefore measurements should be phased accordingly.

(e) Flexible

The program must be designed in such a way that its success is not solely dependent on a range of “fixes” that might undermine its success. In other words it should be able to evolve as the success or otherwise of the program progressively grows. Finally the program must have a support base within the community if it is to succeed. Involvement of the community in developing and running the program is crucial.

(f) Managed

It is important that continuity of management is maintained throughout the implementation and administration of the housekeeping and educational control measures.

An approach that has worked effectively in the USA and Australia has been the formation of Catchment Management Committees or Trusts. Under this model a coordinating committee is appointed for the catchment as a whole. Local government authorities largely fund this committee. Often there are several authorities that have part of their jurisdiction in the catchment area. These local authorities pool their resources to produce documentation, pay for consultation services, share information and experience and set and enforce policy.

36.1.4 Implementation

The implementation of housekeeping controls, as discussed above, involves a large number of organisations. Within the planning procedures discussed in earlier chapters, it is expected that there would be the development of housekeeping elements to the Strategy plans and Master plans. A major component of this strategy would be the creation of management bodies such as Catchment

Management Committees. The major contributor to these committees would be local authorities.

36.2 SOURCE CONTROL PRINCIPLES

It is better to reduce, and where possible eliminate the causes or sources of pollution by good housekeeping and source control, rather than treat the effects downstream. This method places the onus for pollution control on the polluter. This can lead to permanent solutions resulting from simple changes in practice.

A number of issues that relate to everyday activities that are performed by the general public are included below.

- **Bin it securely -** Make sure litter cannot blow or fall out of bins or recycling containers, otherwise it will be washed into the stormwater drain system.
- **Animal Droppings -** Imagine thousands of domestic animals and think about many tonnes of droppings produced every day. Some of it is washed into stormwater drains. Animal droppings from pets contain bacteria and nutrients. *The message itself* must state how to avoid the problem, e.g. "carry a plastic bag when you walk the animal, collect the waste and dispose of in a rubbish can." (this action is now mandatory in many Western cities)
- **Organic Matter and Leaves** - Start a compost heap or use leaves as garden mulch. Debris can block drains and cause local flooding. Rotting organic matter pollutes waterways with excess nutrients.
- **Painting Clean-up** - Never clean brushes or rinse paint containers into a street gutter or drain. For water-based paints, paint out brushes on scrap materials and rinse into the garden or into an older container. Oil-based paints and solvents should be collected and disposed of at a chemical collection point.
- **Washing the car** - By washing your car on a grassed area you will help keep your local streets clean. Otherwise, soapy water flows down the gutter and ends up in the nearest river. The increased nutrients from detergents contaminate our waterways.
- **Changing motor oil -** It takes only one litre of oil to contaminate one million litres of water. If you do your own oil change, don't pour it into the street gutter. Local authorities should establish collection centres, which will take oil. And of course, vehicles should be maintained so they don't leak oil or water.
- **Fertiliser and Pesticides** - Avoid applying fertiliser and pesticides in areas where they could be readily washed away into drains, particularly when storms are predicted.
- **Landscaping and Construction** - Construction controls are covered in Part H of this Manual.

It is important at this point to note that Government authorities **must** provide the services that enable citizens to conveniently engage in these activities. If this is not done there will be no encouragement for people to change their behaviour. Examples of necessary services include:

- Rubbish bins in parks for people to dispose of animal droppings
- Conveniently located deposit places for recycled oil, paints, solvents and other chemicals
- Green waste composting facilities

36.2.1 Guiding Principles

The guiding principles for developing the source control BMG's are:

(a) Alter the Activity

The preferred option is to alter any practice that may contaminate surface water or ground water by either not producing the pollutant to begin with or by controlling it in such a way as to keep it out of the environment. Examples would be recycling used oil rather than dumping it down a stormwater drain or recovery and reuse of chemical reagents in industries such as paper milling and electro-plating.

Illicit or unintentional connection of indoor drains to the stormwater drain, rather than to the sanitary or process sewer is a significant source of stormwater contamination.

(b) Enclose the Activity

If the practice cannot be altered, it should be enclosed in a building. Enclosure accomplishes two things. It keeps rain free coming into contact with the activity, and since drains inside a building must discharge to sanitary or process wastewater sewers or a dead-end sump, any contamination of runoff is avoided.

(c) Cover the Activity

Placing the activity inside a building may be not feasible or prohibitively expensive. A less expensive structure with only a roof may be effective although it may not keep out all precipitation. Internal drains must be connected to the sanitary sewer to collect water used to wash down the area as well as any rain that may enter along the perimeter.

(d) Segregate the Activity

Segregating an activity that is the most significant source of pollutant from other activities that cause little or no pollution may lower the cost of enclosure or covering to a reasonable level.

(e) Discharge Wastewater to Sewer

It may be possible in certain situations to connect the area to the public sanitary sewer subject to the approval of the local Sewer Authority. Alternatively, drains maybe connected to a business's own process wastewater treatment system. In either case, surface areas subject to stormwater runoff must be excluded from the treatment system to avoid overloading.

36.3 THE ROLE OF LOCAL AUTHORITIES

The primary stormwater management role largely rests with local authorities. The planning, construction, maintenance and operation of most stormwater systems are undertaken by local authorities. This role has traditionally focused on managing flood flows to minimise risks to public health and property damage, although an increasing emphasis is being placed on stormwater quality management. However, the local authorities also have a leading role in the management of water quality in stormwater systems.

36.3.1 Overview

There are a number of simple and practical maintenance activities which local government authorities can implement at minimal cost to achieve significant improvement in the quality of stormwater run-off. Proper planning of operational procedures for each activity is the key element to success in minimising the impact each may have on the stormwater quality.

Careful long term planning and the coordination of activities can achieve increases in efficiency whilst achieving more effective stormwater quality control.

An important component of proper planning is the carrying out of inspections (audits) to identify the major sources of pollution and the rate of build up of these pollutants. Information from the inspections can be used to either modify operational activities (e.g. target problems with increased frequencies) or the method of operation. (e.g. when mowing the edge of open drains, ensuring grass is cut away from the waterway). The results from the audits can become the specification requirements for that activity. These then need to be continually monitored and reviewed so that the activities continue to meet the goal of reducing pollutants entering the stormwater system.

Monitoring can be carried out through inspections, reviewing the number and type of complaints and through contract reporting mechanisms. Good record keeping and the use of computer technology are important to be able to interpret information so that it may be applied to the specified standards. For example by recording quantities of materials swept for each road/designated area the frequencies and the effectiveness of any changes in that frequency can be determined in terms of cost and benefit.

In undertaking **maintenance activities** the key element is the prevention of waste material entering the stormwater drainage system. The effect of pollution can be significantly reduced through better maintenance practices and flexible programming such as adjusting and concentrating programs to "hit" areas of maximum pollution potential prior to a storm (e.g. sweeping kerb and channel, pit cleaning and cleaning up litter).

The following section notes a range of good practices, which could be adopted for the major activities undertaken by local government.

36.3.2 Training

Community and business/commercial education are covered in Chapter 37; these principles should be extended to the Authority's own staff to improve their knowledge and thereby ensure proper enforcement of building controls, as well as correct operation and maintenance of equipment.

Successful improvement to stormwater quality is largely dependent on the understanding and skills of the staff implementing the practices highlighted in this Manual. Proper training of staff at all levels in these practices will assist greatly in meeting the guideline objectives to improve stormwater quality in the open waterways and restrict pollutants entering the stormwater system.

(a) Good Practice Guidance

- Staff work groups to review current work practices and develop appropriate new work practices.
- Develop key performance indicators as part of the review process. Train staff to routinely check activities and the stormwater system.
- Regular training updates – continuation.
- Periodically audit employee work practices and develops programs to regularly review work performance.
- Provide general information (awareness) to staff, and target issues and technical developments.
- Write contracts that provide sub-contractors with clear instructions for their operation in accordance with guidelines.

36.3.3 Enforcement

Local authorities have a unique and significant role to play in enforcing consent conditions in development and building approvals, and ensuring that requirements specified in local Master Plans are satisfied. These conditions and requirements should be extended to include stormwater management.

This enforcement can be effected through a combination of approval processes, supervision/inspection and fines. Regular inspections must be made to enforce the regulations, otherwise businesses will not comply. The cost of these inspections can be minimised by combining them with other regulatory inspections, such as for building permits and fire safety.

(a) Approval Processes

It is possible at this stage to ensure that BMP guidelines are planned into new developments. Approval can be conditional on the inclusion of appropriate BMPs being included in the design.

(b) Supervision/Inspection

As construction of development proceeds regular inspections can be carried out to ensure that construction phase BMPs (discussed in Part H of this Manual) are adhered to as well as ensuring that the designed operational BMPs are correctly installed. Written instructions can be used as a first step in enforcing rectification of faults and omissions.

(c) Fines

Statutory fines can be used as a measure to enforce non-compliance with BMP requirements. Local Authorities can be well placed to enforce this aspect of enforcement due to their role in the approval, inspection and acceptance of development.

Activities that require regular checking and are potentially a major source of pollution are wet markets, stalls and night markets. These activities should be required to adopt suitable BMPs (see later in this Chapter) and have them regularly inspected and enforced.

36.3.4 Co-ordination

Decisions taken by local authorities on stormwater management issues should be made in consultation with the relevant Catchment Management Committee or other appropriate organisation.

Local authorities also have a coordination role when other organisations, such as JKR, are responsible for some stormwater systems within a catchment.

36.3.5 Waste Minimisation

Local Authorities must plan for the disposal of litter and other pollutants such as sediment trapped in stormwater treatment measures. These activities are covered in more detail in Section 36.5.14.

36.4 THE ROLE OF PROPERTY OWNERS

All persons, businesses and other organisations have an obligation to prevent stormwater pollution. The Environmental Quality Act, 1974 provides that "no person shall, unless licensed, emit, discharge or deposit any waste into any inland waters in contravention of any applicable conditions." Part VIII of the Local Government Act (LGA) provides for the control of activities or nuisance that may pollute "any stream, channel, public drain or other water course within the Local Authority area". Other relevant legislative requirements are covered in Chapter 5.

Improvements to the practices and activities carried out by all property owners, businesses and others, as well as by all levels of Government, is a primary form of source control which can lead to improvements in stormwater quality. Methods of improving current practices are described in the next Section.

36.5 OPERATIONS AND MAINTENANCE ACTIVITIES

The guidelines in this section has been adapted from California Stormwater BMPs (CDM, 1993), “Managing Urban Stormwater: Source Control” produced jointly by NSW Environment Protection Authority and NSW Department of Land and Water Conservation in draft form in August 1997. The incorporation of this material is gratefully acknowledged.

36.5.1 Pothole Patching/Bitumen Works

Pothole patching /bitumen works /bitumen spraying etc should be undertaken in a manner to limit the amount of overspray, excess screenings, loose pavement materials, soil dug up and excess bitumen from entering the stormwater drainage system.

The rapid patching of potholes can reduce the amount of pavement material that is washed into the stormwater system.

(a) Good Practice Guidance

- Remove all excess material before leaving the site.
- Place only required amount of screenings on bitumen.
- Immediately after sealing and rolling, sweep and collect all excess screenings by using a vacuum sweeper or equivalent.
- Install temporary inlet filters to side entry pits if there is a threat of material entering the drainage system.
- Bitumen spraying should not be undertaken in windy conditions.

36.5.2 Concrete and Segmental Paving Works

All residues and wastes generated from segmental paving and concrete works should be prevented from entering the stormwater drainage system. Where this is not possible, as in concrete footpath cutting activities, the work practices need to be reviewed to minimise pollution occurring.

(a) Good Practice Guidance

- Site mixing of concrete or mortar to be carried out in a designated site capable of containing excess water.
- When using concrete pump from a roadway or area where excess material can enter the drainage system provide appropriate bunding to trap any spill material.
- Site cleaned before leaving site.
- Concrete mixing equipment should be washed down in approved facility and not in roadways, footpaths or reserves.
- Allow concrete waste and concrete slurry to set before disposal off site to an approved waste disposal site.
- Waste water from brick and concrete cutting activities should be contained and either recycled or allowed to dry and be disposed of.

36.5.3 Footpath Maintenance

Footpath materials removed in the course of the repair work should not be allowed to enter or wash into the stormwater drainage system.

(a) Good Practice Guidance

- Remove and dispose of all old concrete, packing material and soil from the site.
- Remove any cover material and boxing from the site once concrete has cured.
- Stockpiled material, such as packing sand, gravel or crushed rock and excavated material to be used as backfill at the end of the job, to be placed away from any drainage flow path and be covered to prevent washing into the drainage system.

36.5.4 Disposing of Excess Concrete

(a) Good Practice Guidance

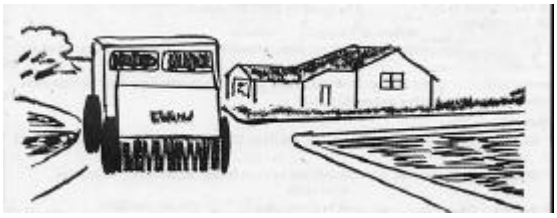
- Dispose of excess unused concrete at nominated disposal sites.
- Do not dispose of excess unused concrete into a stormwater pit or drainage system.

36.5.5 Stabilisation of Eroding Areas

Erosion in existing urban areas can occur due to a range of human activities, including informal walking and vehicular tracks, and eroding batters. This can result in the generation of sediment pollution to waterways.

Details of watercourse bank stabilisation techniques are provided in Part I of this manual. Other erosion protection measures are described in Part H.

36.5.6 Mechanical Street Cleaning



Street cleaning (sweeping) can have a positive impact on the amount of certain pollutants (particularly litter) entering the stormwater system. Roads comprise approximately 70% of urban impervious surface also carparks, footpaths and all other hard standing areas, provide the greatest medium for the collection of the bulk of the pollutants that enter the stormwater drainage system. The adoption of good practice in street cleaning will significantly contribute to a reduction in certain pollutants entering the stormwater system.

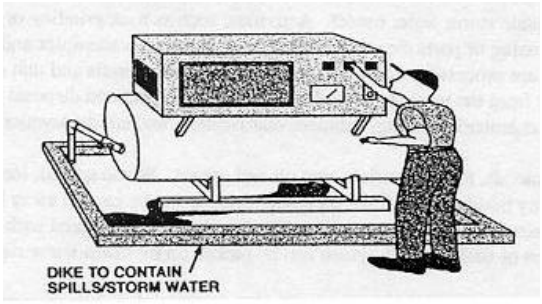
Coordination and integration of this activity with other maintenance activities is important to maximise the benefit in reducing pollutants. Street sweeping should be part of a regular program as well as an integral part of construction and other maintenance activities.

(a) Good Practice Guidance

- Audit the accumulation rates of litter, silt, debris, leaves etc to provide a full understanding of the problem and quantum of material.
- Assess all maintenance and operational activities to determine their potential pollutant source onto these hard standing areas (e.g. grass cutting, vegetation pruning).
- Following the audit and assessment of maintenance activities prepare maintenance programs, including street sweeping programs, which include consideration of all factors. Vegetation type, terrain, rain characteristics, prevailing winds and topography should also be considered.
- Sweeping programs should also include an allowance for sweeping to follow grass cutting in areas adjacent to hard standing areas.
- Frequency of sweeping.
- All residential streets swept at an interval not exceeding one (1) week.
- All roads adjacent to shopping areas or areas of high pollutant concentration swept daily.

- Immediately prior to predicted 'initial flush' (monitor weather patterns and forecasts so that thorough cleaning occurs before major rainfall, particularly after a long dry spell).
- Develop and distribute information to the community on street sweeping schedules to encourage off street carparking or develop schedules to sweep these areas during off peak periods.
- Install temporary parking restrictions in areas of greatest pollution to assist in leaving these areas free of vehicles at the time of sweeping.
- Establish database recording system for recording and monitoring kilometres swept and quantities of material collected and adjusting programs to maximise the collection of pollutant material.
- No flushing of footpaths, kerbs etc unless into specifically designed storage/filtration system prior to entry into stormwater system.
- In areas where a mechanical sweeper cannot access either hand sweep or cover inlets and flush material to designated location and then remove material.
- Adjust/modify sweeping schedules to maximise the period when there are fewer vehicles parked in a street. i.e. sweep around schools prior to or after school hours and shopping centres either early morning or late evening.
- Street sweepers are not to discharge waste water or material into drainage system.

36.5.7 Plant and Equipment Maintenance



Mechanical plant and equipment are sources of pollutants such as lubricants, coolants, fuel, etc. Where possible and practical plant should be stored under cover to minimise the potential for pollutants entering the stormwater system. Where this is not practical regular inspections and use of drip pans etc are required to catch the oil spillages etc.

Washing and cleaning of plant produces extremely high concentrations of pollutants. Equipment, such as triple interceptor devices, for the capture, treatment and disposal of wash water should be installed to ensure none of this material can enter the stormwater system without prior treatment.

(a) Good Practice Guidelines

(i) Storage

- Assign responsibility for the regular inspection of all plant and equipment.
- Where possible plant, vehicles and equipment should be parked under cover to reduce the potential of rainwater washing pollutants into the stormwater system.
- Establish a database for the recording of plant inspections.
- Designate parking areas for each vehicle for ease of identification if leaks are found.
- Identify, record leakages and arrange for vehicle to be repaired.
- Develop procedures for the identification, reporting, repairing and cleaning up of leaking fluids or spilled materials.
- Inspect storage and parking areas at least weekly.

(ii) Cleaning/Washing

- Keep equipment clean.
- Provide designated specific wash area.
- Pave wash area.
- Grade and kerb wash area to ensure no wash water can enter storm water system.
- Where required to wash on the job select grassed area.
- Provide signage for staff that identifies area and prohibits changing oils, washing with solvents etc.

(iii) Fuelling

Vehicle fuelling areas should be designed and operated to minimise the potential for the contamination of fuel into the stormwater system.

- Concrete paved area for fuelling area (bitumen deteriorates from fuel or oil spillage).
- Any spills to be cleaned up using "dry" method.
- Maintain supply of dry clean up material adjacent or within fuel area.
- Paved areas to be designed so that any spillages cannot directly enter stormwater system.
- Fuel areas to be covered to reduce potential of stormwater run-off washing fuel area.
- Post signs to instruct operators not to "top off" or over fill fuel tanks.
- Inspect fuel area daily and identify any leakage's etc.
- Do not hose area for cleaning.
- All spillage's etc to be contained within the fuelling area and collected treated and disposed of via approved methods.

(iv) Vehicle Maintenance

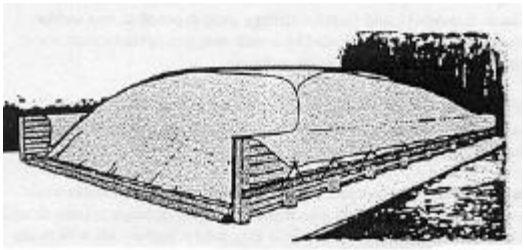
- Wherever possible perform vehicular maintenance in an indoor garage, not in an outdoor parking area.
- If performed outdoors, designate specific area, keep clean at all times, and us dry clean up practices and ensure site is correctly drained to prevent contaminants from entering the stormwater drainage system.
- To assist in preventing stormwater pollution:
  - Keep equipment clean.
  - If working on equipment outdoors, keep drip trays or containers under the vehicles at all times while being worked on.
  - Drain fluids from any retired vehicles kept on-site for scrap or parts.
  - Change motor oil, and perform vehicular maintenance only in the designated vehicle maintenance area.
- Keep drip trays under vehicles at all times when working on them.
- Place drip trays as soon as a leak is identified.
- Do not change oil or perform vehicle or equipment maintenance in a parking lot or storage yard unless unavoidable. On these occasions special care should be taken to ensure no leakage or spillage can enter the stormwater system.

36.5.8 Storage of Solid Materials

Pollution from stored materials generally occurs from either rainfall falling directly onto the material and washing into the stormwater system or from water flowing through the stored material. Materials include small or large stockpiles of any uncompacted matter such as crushed rock, gravel, packing and bricklayers sand, loose timber, screenings, prunings, etc.

If the raw material, by-product or product is a liquid refer to the previous BMP. This section covers solid material. This BMP is for material such as gravel, sand, topsoil, compost, logs, sawdust, wood chips, timber and other building materials, concrete and metal products.

(a) Good Practice Guidance

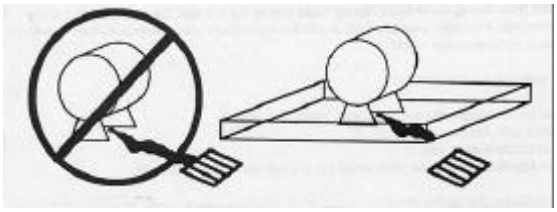


Select from the following practices appropriate to the type of materials:

- Build a covered area. The area upon which the materials is stored should be paved or;
- Place temporary plastic sheeting over the material as illustrated or;
- Pave the area and install a drainage system.
- Store materials on paved surface.
- Store materials under a roof. Where this is not practical cover material with plastic or other suitably secured sheeting material.
- Non-roofed material storage areas should be designed to not allow direct run-off into stormwater system.
- Provide kerbing or bunding around material storage areas to prevent stormwater runoff going directly into stormwater system.
- Prevent stormwater from washing through a materials storage area by locating on a high site or redirecting stormwater away from the site.
- Where practical paved areas should drain into a water storage basin.
- Stormwater from the area should be treated using an approved treatment system. This is the preferred option for log storage. The paved area should be sloped in a manner that minimises the pooling of water on the site, particularly with materials that may leach pollutants into stormwater and/or ground water such as compost, logs and wood chips. A minimum slope of 1.5 percent is recommended. Kerbing should be placed along the perimeter of the area to prevent the run-on of uncontaminated stormwater from adjacent areas as well as runoff of stormwater from the stockpile area.
- Catchbasins should not be used, as they tend to rapidly fill with the manufacturing material. Rather, the area should be sloped to drain stormwater to the perimeter where it can be collected, or to internal drainage "alleyways' where material is not stockpiled.
- Locate temporary materials storage sites on a paved surface, preferably on a mounded site that will prevent storm water run-off washing through the stored materials.
- Regularly inspect (not less than 6 monthly) storage areas and liquid containers for damage, leaks etc.
- Store scrap metal under cover and regularly dispose of to scrap metal dealer.
- Hazardous material should be kept either indoors or under cover.
- Ensure stormwater inlets are protected from any spillages or leaks.
- Move the materials to a permanent storage site as soon as possible.
- Clean up any material washed out from the site.

- Store hazardous materials in accordance with current regulations.

36.5.9 Liquid Storage in Above-ground Tanks



Any business, which stores liquids in aboveground tanks, should comply with the following practices.

Storage of reactive, ignitable, or flammable liquids must comply with the relevant Fire Code. The following practices are to complement, not conflict with the relevant Fire Code. Belowground tanks should comply with Authority requirements.

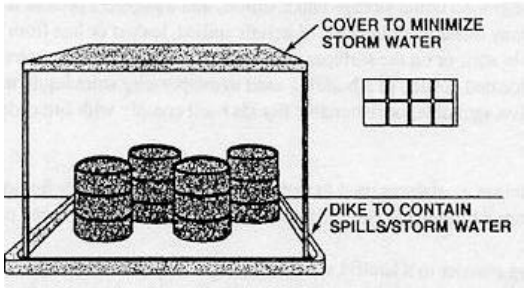
(a) Permanent Tank Storage

- The tank should include an overfill protection system to minimise the risk of spillage during loading.
- Permanently installed tanks should be surrounded by berms. The berm should be of sufficient height to provide a volume that is the greater of either 10% of the total enclosed tank volume or 110% of the volume contained in the largest tanks.
- The berms and the surface within the berm area should be sufficiently impervious to prevent loss of the stored material in the event or spillage.
- Outlets from the tank area should have positive control to prevent uncontrolled discharge from the tank area of spilled chemicals or petroleum products.
- The outlet should have a dead-end sump for the collection of small spills. The sump should be cleaned weekly to minimise the potential for contamination of stormwater and/or ground waters.
- During the wet season, accumulated stormwater should be released frequently.
- For petroleum tank farms, the stormwater should pass through an API or CPI-type oil/water separator.
- If a tank is to be located in an area where firearms may be discharged.
- Concrete encapsulation (or equivalent) should be used to protect the inner tank.
- Tanks should be guarded against vehicles through the use of bollards or traffic barriers.
- All installations should be done per the relevant Fire Code and the National Electric Code.

(b) Small Portable Tank Storage

- Where portable, double-hulled tanks are used to contain fuels for servicing vehicles, a berm system as described above need not be used.
- A secondary containment system (or equivalent) similar to that shown should be used whenever liquids are temporarily stored in a portable tank.
- The containment system should be a bermed impervious area (using either heavy plastic or concrete. The minimum storage volume should be 100% of the total tank volume.

36.5.10 Container Storage of Liquids, Food Wastes or Dangerous Wastes



A container is any portable device in which material is stored. These practices apply to container(s) located outside a building used to temporarily store accumulated food wastes, vegetable or animal grease, used oil, liquid feedstock or cleaning chemical, or Dangerous Wastes (liquid or solid) unless the business is permitted by the relevant Authority to store the wastes.

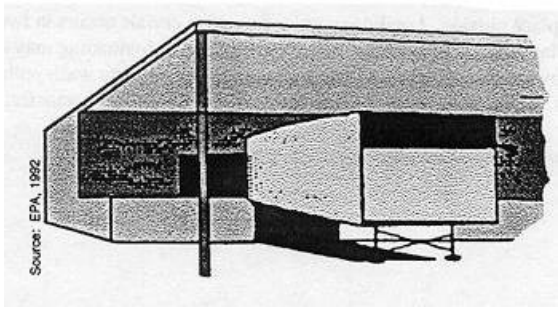
(a) Good Practice Guideline

- Containers used to store dangerous waste, food waste, or other liquids should be kept inside a building unless this is impracticable due to site constraints or relevant Fire Code requirements. If the containers are placed outside, the requirements of this BMP must be met.
- Dumpster used to store items awaiting transfer to a landfill (such as used oil filters) should be placed in a lean-to structure. Dumpster should be in good condition without corrosion or leaky seams. See below for the exact requirements.
- If waste container drums are stored above ground, they should be kept in an area such as a service bay. If drums are kept outside, they must be stored in a lean-to type structure to keep rainfall from reaching the drums. See below for the exact requirements.
- Garbage dumpsters should be replaced if they are deteriorating to the point where leakages occurring. They should be kept under cover to prevent the entry of stormwater.

Storage of reactive, ignitable, or flammable liquids must comply with the relevant Fire Code. The following practices should complement, not conflict, with current relevant Fire Code requirements.

- Containers should be located in a designated area.
- The designated area should be paved, free of cracks and gaps and impervious in order to contain leaks and spills.
- For liquid wastes, tanks should be surrounded by berms. The berm should be of sufficient height to provide a volume that is the greater of either 10% of the total enclosed tank volume or 110% of the volume contained in the largest tank.
- The designated area should be covered.
- The area inside the kerb should slope to a drain. If the material being stored is controlled by the relevant Fire Code, or is used oil or Dangerous Waste a dead-end sump should be installed.
- For all other liquids the drain should be tied to the sanitary sewer if available. Otherwise, process treatment or a dead-end sump should be used subject to local Sewer Authority or permit requirements. The drain must have positive control (for example, a locked drainage valve or plug) to prevent release of contaminated liquids.
- If the business is using roll-containers (for example, dumpster) that are picked up directly by the collection truck, a fillet can be placed on both sides of the kerb to facilitate moving the dumpster.
- Where material is temporarily stored in drums, a containment system can be used. If a tank is to be located in an area where firearms may be discharged, concrete encapsulation (or equivalent) should be used to protect the inner tank.
- Containers mounted for direct removal of a liquid chemical for use by employees must be placed inside a containment area as described above. A drip pan should be used at all times.
- Drums stored in an area where unauthorised persons may gain access must be secured in a manner that prevents accidental spillage, pilferage or any unauthorised use.
- If the material is a Dangerous Waste, the business owner should comply with any additional regulatory requirements not presented above.
- If a storage area is to be used on-site for less than 30 days, a portable secondary system can be used in lieu of a permanent system as described above.
- An employee trained in emergency spill cleanup procedures should be present when Dangerous Wastes, liquid chemicals or other wastes are loaded or unloaded.

36.5.11 Loading and Unloading Areas



Unloading and loading areas are generally heavily trafficked with a variety of goods/materials continually being moved around. These areas are a high pollution risk from spillages, machinery operation and breakage's.

(a) Good Practice Guidance

- All loading areas should be located indoors where possible.
- All loading areas, as a minimum requirement, need to be protected from contamination with stormwater.
- Cover loading/unloading areas.
- Transport vehicles should be continually checked for leaked motor fluids.
- All drivers/operators to be responsible for any leaks/spillage's due to their plant or operation and should immediately clean up any spillages.
- Develop and implement procedures for the prompt cleaning up of any spillages, etc.
- A sump system to trap pollutants should be installed in hazardous material handling areas.
- Pave all areas.

36.5.12 Loading and Unloading of Liquids

If loading or unloading occurs of liquids in containers or direct liquid transfer occurs, then the following BMPs apply.

Consistent with relevant Fire Code requirements and to the extent possible, unloading or loading of liquids should occur in the manufacturing building so that any spills that are not completely retained can be discharged to the sanitary sewer, process treatment or a dead-end sump consistent with local Sewer Authority and permit requirements.

Practices are described below for areas where loading is done outside and loss to stormwater drains could occur.

(a) Contained Liquids at Loading and Unloading Docks

- Loading/unloading docks should have overhangs or door skirts that enclose the trailer end.

- The loading/unloading area is to be designed to prevent run-on of stormwater.
- The owner should retain on site the necessary materials for rapid cleanup of spills.

(b) Rail Transfer to Above/Below-Ground Storage Tanks

- To minimise the risk of accidental spillage, the owner should have a written “operations plan” that describes procedures for loading and/or unloading. Employees should be trained in its execution and it should be posted or otherwise made easily available to employees.
- As a part of the operations plan, or as a separate document, the owner should have an Emergency Spill Cleanup Plan.
- Drip pans should be placed at locations where spillage may occur such as hose connections, hose reels and filler nozzles. Drip pans should always be used when making and breaking connections.
- A drip pan system as illustrated should be installed within the rails to collect spillage from tank cars.
- An employee trained in spill containment and cleanup should be present during loading/unloading.

(c) Tanker Truck to Above/Below-Ground Storage Tanks

- To reduce the risk of spills, the owner should have a written "operations plan" describing procedures for loading and/or unloading Employees should be trained in its execution.
- The operations plan will include an emergency spill cleanup plan. Cleanup materials should be readily available and employees will be trained in their use.
- The area on which the transfer takes place should be paved If the liquid is reactive, with asphalt (for example, petrol) concrete should be used to pave the area.
- The transfer area should be designed to prevent the run-on of stormwater from adjacent areas. This may be achieved by sloping the pad and surrounding area in a appropriate manner, or with a small, flattened kerb (like a small speed bump) around the 'uphill' side of the transfer area.
- The transfer area should be designed to prevent the runoff of any spilled liquids from the area. This can be accomplished by sloping the area to a drain. The drain should be connected to a dead-end sump or to the sanitary sewer subject to the requirements of the local Sewer Authority. For the latter two situations, a positive control valve should be installed.
- If the transfer area is connected to the sanitary sewer, a spill containment sump should be installed between the spill containment pad and the sewer connection. The sump should be large enough to include 200 litres of storage space, grit sedimentation volume and manual drain shut-off valve. Instructions in its use should be prominently posted. Alternatively, an API or CPI oil/water separator sized in accordance with Chapter 33 can be used.
- Drip pans should be placed at locations where spillage may occur such as hose connections, hose reels and filler nozzles. Drip pans should always be used when making and breaking connections.

36.5.13 Building Sites

Building activities result in substantial potential for pollution. Dust, paint, solvents, steel filings, timber residue and other wastes are produced as a result of the building and maintenance activities. Project or site managers responsible for work activities should understand the nature of the materials they are working with and the potential these materials have to pollute the stormwater system. They should take responsibility for accidents that contaminate the drainage or waterway system.

Simple practical maintenance techniques will reduce the risk of pollutants entering the stormwater system.

Buildings generate a substantial amount of stormwater due to their large impervious roof areas. It is important that building stormwater systems are maintained in a manner that does not allow pollutants to enter the stormwater system.

(a) Good Practice Guidance (Building Repairs)

- Store building materials under cover or in contained areas.
- Clean building site daily.
- Spread ground cloth prior to scraping, sanding, painting to collect dust and paint residue etc.
- Mix material indoors.
- Secure site to ensure that no leakage's or spillage's from paint or solvent materials can enter the stormwater system.
- Treat a paint spill as a chemical spill.
- Do not use water for cleaning site.
- Clean water based paint equipment where residue can not enter stormwater system.
- Clean oil based paint equipment where material can be collected and disposed of as hazardous waste.
- Outdoor spray painting is not to be undertaken on windy days.

(b) Good Practice Guidance (Building Stormwater system)

- Stormwater drains to be either connected directly into a stormwater system or passes via a grassed area of

sufficient size to accommodate the size of storm required.

- Inspect building stormwater system at least annually.
- Clean drain inlets, spouting, downpipes and pipes at least twice per year.
- Identify debris/sediment "hot spot" areas and program inspections and removal of materials to minimise the potential for blockages, etc.
- Arrange cleaning of spouts, inlets etc prior to "initial flush"' at known "hot spots".
- After each major storm inspect inlets etc and remove debris and sediments.

36.5.14 Waste Collection

Kerb side waste collection and recycling collections generate considerable amounts of pollutants through spillages from the refuse receptacles and within the collection and emptying processes.

Street and park litterbins can provide a continual source of pollutants if the type of bin, its location and frequency of emptying is not given proper consideration.

The amount of litter created is a function of wind, lack of care by recycling and garbage operators and householders and the type of collection systems used. Other issues creating the litter can include spillages from unstable smaller bins, dogs scavenging and the general "pace" of the collection operation.

(a) Good Practice Guidance (Collection Operation)

- Use vehicles which are fitted with lifting and emptying mechanisms which minimise the risk of spillage.
- Collection contractor to immediately clean up all spillages from operation using dry methods.
- Collection contractor to immediately notify Council of the location of any spilled material not resulting from the collection operation.

(b) Good Practice Guidance (Plant and Equipment)

- Keep garbage compactor, recycling collection vehicles etc, on paved areas.
- Pick up litter, rubbish dropped and sweep storage areas regularly.
- Do not use a hose to clean plant and equipment unless stormwater drains are protected.
- Where possible store waste collection vehicles under cover (nearly all plant leaks).

(c) Good Practice Guidance (Recycling Containers)

- Fully enclosed including a lid e.g. mobile garbage bin.
- Sufficient size to cater for the volume of material deposited between collections Cater for all recyclable materials including newspaper.

(d) Good Practice Guidance (Green Waste)

- The major concern is to reduce the potential of pollutants into the stormwater system by ensuring materials deposited for collection do not pose a threat and do not get washed into the drainage system.
- Preferable for green waste to be stored in a fully contained receptacle (e.g. mobile bin).
- If green waste is deposited (not in a container) on nature strips it should be collected as near as possible on the same day. Where spillage's identified, follow up with street sweeper to reduce pollutants.
- All residue from on-site chipping to be collected or swept so that it does not enter the stormwater system.

(e) Good Practice Guidance (Hard Rubbish Collection)

- Program collection of hard rubbish so that all materials remain on nature strip for minimum periods (<1 week).
- Establish local laws prohibiting the storage of hard rubbish materials on nature strips to restrict the period of storage to no longer than 7 days prior to the nominated collection date.

(f) Good Practice Guidance (Litter Collection)

- Select bins that look clean, attractive and are easily identifiable.
- The aperture of the bin should be small enough to discourage illegal dumping yet acceptable for normal litter.
- Bin size should be based on minimising emptying frequency whilst again discouraging illegal dumping.
- Bins should be located near the source of the litter.
- Frequency of emptying should be determined to ensure that bins do not overflow. Also, clearing contractor should be responsible for clean up of litter within specified radius of the bin.
- Bin not to exceed 75% full capacity before clearing.
- Pick up any spilt rubbish within 3 metres of the bin.
- Undertake initial audits to identify where heavily used bins are near drainage pits make special reference to these bins in the cyclic program of clearance.

36.5.15 Fuel Stations

In addition to general service petrol stations, fuelling may also occur at 24-hour convenience stores, construction firms, warehouses, car washes, and businesses with fleet vehicles. Fuelling also occurs at port facilities and

industrial complexes where mobile equipment is used. Fuels contain organic compounds and metals that adversely affect aquatic life.

(a) Good Practice Guideline

- The fuel island should be paved using Portland cement concrete, not asphalt and be designed to contain fuel spills. The fuel island should be designed as a spill containment pad and sized to prevent the runoff of spilled fuel and the run on of stormwater from surrounding pavement.
- Liquids spilled on the fuel island should be collected in drains and treated as described in Chapter 33. The pad should be sloped towards the drains. All requirements of the Department of Environment and the relevant Fire Code shall be complied with.
- The fuel island should be covered to prevent the direct entry of rainfall onto the spill containment pad. The roof/canopy should, at a minimum, cover the spill containment pad and preferably extend several additional feet to prevent windblown rain from entering.
- Spills should be prevented whenever possible. The owner or operator should develop an emergency spill cleanup plan and have responsible designated person(s) available either on site or on call at all times. Suitable cleanup materials should be kept on site to allow prompt cleanup should a spill occur.
- Educate employees and customers on the proper use of fuel dispensers. Post signs in accordance with the relevant Fire Code. Install 'No Topping Off' signs; topping off gas tanks causes spillage and vents gas fumes to the air. Make sure that the automatic shut-off on the gas nozzle works.
- Temporary fuel tanks used to fuel vehicles in the field should be placed in a bermed, impervious (using heavy mil plastic or concrete) area. The bermed area should be large enough to contain the greater of 10% of the total enclosed combined tank volume or 110% of the largest tank volumes.

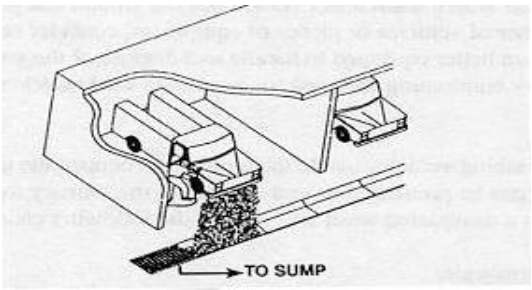
(b) Exceptions

In industrial complexes or port facilities where very large mobile equipment is used such as log loaders, the fuel island need not be covered. However, the pad must be designed in a manner that prevents the run-on of stormwater from adjacent areas. The pad must also be designed in a manner that allows the collection of all rain that falls on the pad.

36.5.16 Vehicle/Equipment Washing and Cleaning

If vehicle and/or equipment washing or steam cleaning is done on premises, the following measures are required.

Washing of highway vehicles equipment and parts such as construction equipment, should occur in a building or in a designated area such as that described below. This requirement refers to all methods of washing in which water is used including low-pressure water, high-pressure water and steam.



Wash water from cleaning activities contains significant quantities of oil and grease, suspended solids, heavy metals, and organics, as well as pollutants from the detergents.

Oil/water separators tend to be ineffective because the surfactants in detergents chemically stabilise free and dispersed oil.

(a) Good Practice Guideline

- Wash water from vehicle and equipment cleaning should be discharged to the sanitary sewer. All requirements of the local Sewer Authority and/or other permit requirements must be met prior to discharge. The owner should conduct washing in one of the following locations in order of preference:
  - (i) At a commercial washing business in which the washing occurs in an enclosure and drains to the sanitary sewer or;
  - (ii) Inside the owner's vehicle or equipment building which is plumbed to drain to the sanitary sewer or;
  - (iii) In a building the owner has constructed specifically for washing of vehicles and equipment which is connected to the sanitary sewer or;
  - (iv) In an outside area without walls and/or roof designated by the vehicle owner as a wash area, meeting the requirements outlined below.

(b) Requirements for Uncovered Wash Areas

- A wash area without walls and/or roof is the least desirable option. Building roofs and walls prevent entry of precipitation, and walls contain wash water. These standards are designed to prevent release of petroleum compounds and metals into the environment and minimise the discharge of precipitation to the sanitary sewer. If the owner chooses to conduct washing operations in an outside

area the owner should establish a designated wash area with the following features:

- Paved, preferably with concrete, and constructed as a spill containment pad to prevent the run-on of stormwater from adjacent pavement areas. The spill containment area should be graded so that all water is collected in a containment pad drain system. The drain system may be perimeter drains, trench drains or catchment drains. The containment pad should be sized to extend out a minimum of four feet on all sides of the vehicles and/or equipment being washed.
- All wash water should discharge to the sanitary sewer, process treatment or a dead-end sump. All requirements of the local Sewer Authority and/or other permit requirements must be met prior to discharge.
- The discharge should be treated by one of the following methods:
  (i) Pass through a oil/water separator as directed by the local Sewerage Department. Although the detergents in the wash water will tend to disperse the oil, a well-maintained oil/water separator will protect against deliberate dumping. A positive control valve must be fitted, or
  (ii) Discharge to a containment storage with a positive control valve, live containment volume and overflow with oil/water separation. The live storage volume should be sized in accordance with Chapter 33.
- The discharge pipe should have a positive control valve that is shut when washing is not occurring, thereby preventing the entry of stormwater. This valve may be manually operated but a pneumatic or electric valve system is preferable. Signs should be posted to inform people of the operation and purpose of the valve. The valve may be on a timer circuit where it is opened upon completion of a wash cycle. The timer would then close the valve after the sump or separator is drained. The recommended time period for the timer would be the time required to drain the sump live storage at the design oil/water separator inflow rate from the sump.
- In areas where the wash water cannot be discharged to a sanitary sewer, wash water should be collected in a dead-end sump, tank, or other device and transported to the nearest sanitary facility for proper disposal.
- A concrete spill containment pad is recommended for steam cleaning.
- The wash area should be well marked at petrol stations, multi-family residences and any other business where vehicles may be washed by non-employees. Included in the posting will be a statement forbidding the changing of oil in the wash area. The location of the nearest oil recycling facility should be posted.

(c) Exceptions

- At existing petrol stations where it is not possible to have the designated area discharge to a sanitary sewer, the station can, whenever extensive vehicle washing is occurring (such as washing cars. to raise charity funds), place a temporary plug in the stormwater drain and pump the accumulated water to the nearest sanitary sewer.
- Local authorities can help this solution by making the equipment available and obtaining the approval of the local Sewer Authority if the sewers are not owned by the local government responsible for the public stormwater drains.
- Dealerships of new and used cars or trucks may wash the vehicles in the parking stalls as long as only water is used. The dealership can also use the temporary plug system outlined above for petrol stations.
- Truck washes at industrial sites, which are used to prevent the tracking of dirt, sediment and floatable materials such as wood, onto public streets can discharge to the stormwater drain. However, the wash water should pass through a GPT or oil/water separator. Soaps and other cleaners should not be used if the wash water is discharged to the stormwater drain.

36.5.17 Emergency Spill Clean-up Plans

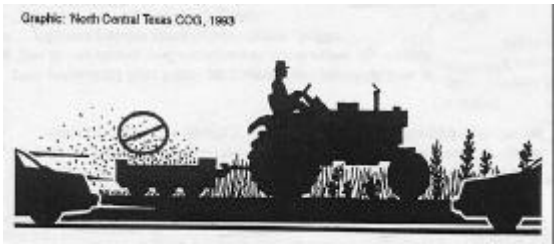
Owners of facilities engaged in storing, processing, or refining oil and/or oil products and chemicals should have a spill cleanup plan. Minimum requirements for the plan are as follows:

- The first part of the plan shall contain a description of the facility including the owner's name and address, the nature of the facility activity and the general types of chemicals used in the facility.
- The plan should contain a site plan showing the location of storage areas for chemicals, the locations of stormwater drains, and the direction of slops towards those drains, and the location and description of any devices to stop spills from leaving the site such as positive control valves.
- The plan should describe notification procedures to be used in the event of a spill, such as key personnel, and agencies such as the Department of Environment and the local Sewerage Department.
- The plan should provide instructions regarding cleanup procedures.
- The owner should have a designated person with overall spill response cleanup responsibility.
- Key personnel should be trained in the use of this plan. All employees should have basic knowledge of spill control procedures.
- A summary of the plan should be written and posted at appropriate points in the building, identifying the

spill cleanup coordinators, location of cleanup kits, and phone numbers of regulatory agencies to be contacted in the event of a spill.

- Cleanup of spills should begin immediately.
- No emulsifier or dispersant should be used.
- In fuelling areas: absorbent should be packaged in small bags for easy use and small drums should be available for storage of absorbent and/or used absorbent.
- Absorbent material should not be washed down the floor drain or storm sewer.
- Emergency spill containment and cleanup kit(s) should be located at the facility site The contents of the kit should be appropriate to the type and quantities of chemical liquids stored at the facility. The kit might contain appropriately lined drums, absorbent pads, and granular or powdered materials for neutralising acids or alkaline liquids. Kits should be deployed in a manner that allows rapid access and use by employees. This plan should he updated regularly.
- The Environment Department and the local Sewer Authority shall be notified immediately if the spill may reach sanitary sewers, or surface water.

36.5.18 Parks, Gardens and Public Spaces



Improvements in work practices within this area can reduce the amount of pollutants entering the stormwater system. Unfortunately to date grass cuttings, leaves, prunings and other material have not been readily recognised as pollutant materials. These materials can significantly damage the waterway system as they cause excess oxygen demand in receiving waters, reducing dissolved oxygen levels.

(a) Planning and Co-ordination

In the preparation of a Management Plan for each major park/garden, the future and current development and maintenance work practices that may effect the quality of stormwater need to be considered.

Identify/assess potential pollutant risks for individual parks/gardens taking into consideration such factors as:

- Potential for effect of stormwater flows across the park.
- Proximity of park/garden to a defined open waterway. If the potential of contamination is high, there may be a need to consider other maintenance techniques such as use of a catcher where grass material could pollute sensitive areas.
- Type of park/garden and its potential to produce pollutants (Playground, open area, natural reserve, etc.).
- Type of usage (e.g. playground with large areas of softfall, which can be readily spread).
- Volume of people (potential for other pollutants such as litter).
- Existing planting layout including use of indigenous grasses, and the amount of open grass areas directly adjacent to open waterways.
- Maintenance methods where specialist equipment may be required (e.g. grass catcher) and where development of treatment controls to trap pollutants should be undertaken.

Determine work practices as outlined within the guidelines to meet the various risk categories of each park.

Coordinate mowing/pruning activities adjacent to kerb and channel with the street sweeper operation so that even after the initial clean up by the work crews a sweeper is following up to ensure thorough collection of waste materials.

(b) Grass Cutting

- Prior to grass cutting remove all loose litter, rubbish or debris from the area to be mowed.
- Cut grass so that mower throws grass cuttings away from a waterway, open drainage structure and kerb and channel.
- Sweep up grass cuttings, leaves, prunings etc left on car parks, roadways, footpaths etc at the completion of the days work or earlier if rain imminent.
- Where practical use a catcher in areas of high pollution risk.
- Replace high maintenance grass areas with low ground cover.
- Reduce grass mowing activities in sensitive areas adjacent to open waterways or drainage pathways by:
  - Use of indigenous grass where possible, or
  - Replacing grass with low ground cover where appropriate or practical.

(c) Filtration

- Establish low ground cover adjacent to open waterways/drains to assist in filtering surface water flow.

(d) Flora (Plant) Selection

- Choose appropriate plant species that add to the balance between flora and fauna to the area (Where practical simulate nature).

- Choose plants that have minimal leaf loss in areas near waterways/drainage systems.

(e) Fertilisers and Herbicides

- Use slow release organic fertilisers where possible.
- Avoid areas where wash off can result in the fertiliser entering the drainage system.
- Avoid spraying adjacent to open waterways or on windy days.

(f) Garden Development and Maintenance

- Remove litter after completion of works (litter includes all gardening and tree pruning materials resulting from the days activities e.g. weeds, left over mulch, excess soil, tree prunings etc.).
- Use mulch covers over garden areas to assist in absorbing and filtering water flows.
- Use natural grasses and appropriate selected indigenous plantings for better infiltration.

36.5.19 Wet Markets, Stalls and Night Markets

Many the activities associated with these public markets are a source of stormwater pollution. The generation of waste is the major source. The nature of the facilities at these markets can vary considerably.

Wash water from cleaning activities contains significant quantities of oil and grease, suspended solids, heavy metals, and organics, as well as pollutants from the detergents.

Generally the following should apply, however other good practice guidelines may be adapted as suitable.

(a) Wash Down

- Wash water from cleaning should be discharged to the sanitary sewer. All requirements of the local Sewer Authority and/or other permit requirements must be met prior to discharge. Wash water should be disposed of in one of the following ways, in order of preference:
- In an enclosure which drains to the sanitary sewer or;
- In a building the owner has constructed specifically for washing;
- In an outside wash area with the following features:
  - Paved with concrete, and constructed as a spill containment pad to prevent the run-on of stormwater from adjacent pavement areas. The spill containment area should be graded so that all water is collected in a containment pad drain system. The drain system may be perimeter drains, trench drains or catchment drains.
  - All wash water should discharge to the sanitary sewer, process treatment or a dead-end sump. All requirements of the local Sewer Authority and/or other permit requirements must be met prior to discharge.

(b) Exceptions

- At existing markets where it is not possible to have the designated area discharge to a sanitary sewer, the operator can place a temporary plug in the stormwater drain and pump the accumulated water to the nearest sanitary sewer.
- Local authorities can help this solution by making the equipment available and obtaining the approval of the local Sewer Authority if the sewers are not owned by the local government responsible for the public stormwater drains.

(c) Solid Waste Handling

- A designated solid waste disposal area should be allocated. Large bins or dumpsters should be used to store waste awaiting collection.
- Dumpsters used to store waste awaiting collection should be placed in a lean-to structure. Dumpsters should be in good condition without corrosion or leaky seams.
- Garbage dumpsters should be replaced if they are deteriorating to the point where leakages occurring They should be kept under cover to prevent the entry of stormwater.

36.6 MAINTENANCE OF URBAN STORMWATER SYSTEMS

Maintenance of urban stormwater systems is usually the responsibility of the Local Authority.

Proper maintenance of public and private stormwater facilities is necessary to insure that they serve their intended function. Without adequate maintenance, sediment and other debris can quickly clog facilities, making them useless. Rehabilitation of such facilities is expensive, and in the case of infiltration systems may be impossible. Polluted water and sediments removed during the cleaning operation must be properly disposed of as discussed under the relevant chapters.

36.6.1 Drainage System Maintenance

Maintenance of the existing stormwater systems should be planned and coordinated to achieve maximum effect in reducing pollutants. Frequent inspections and cleaning of known "hot spots" will assist in reducing material being transported within the system and ultimately disposed of into waterways. The frequency of cleaning these sites should be determined and placed on a regular program.

Drainage maintenance includes inspection, cleaning and repair of open and piped drains, pits, and outfall structures.

(a) Good Practice Guidance

- Inlets, stormwater detention and treatment systems should be inspected at least annually.
- A representative of the local government Authority should also inspect private facilities at least annually to insure compliance by the owner of the maintenance requirements.
- Any deterioration threatening the structural integrity of the facilities should be immediately repaired. These include such things as replacement of clean-out gates, pit lids, and rock in emergency spillways.
- Warning signs (e.g. 'Dump No Waste -Drains to Ground Water', 'Streams', 'Lakes' etc.) should be painted or embossed on or adjacent to all stormwater drain inlets. They should be repainted as needed.
- Debris should be regularly removed from surface basins used for either peak-rate control or stormwater treatment.
- Parking lots should be swept when necessary to remove debris.
- Determine the accumulation rates of litter, silt, debris, etc in the drainage system. This can be achieved through measuring actual quantities of material collected. Identify stormwater drain inlets/pits that require cleaning more frequently than minimum for additional cleaning or require change in design.
- Program cleaning with frequency to suit rate of filling up with litter, silt etc.
- Review maintenance programs, including pit cleaning, inlet cleaning etc to take into consideration factors such as type of trees in vicinity, terrain, rain characteristics, topography, etc.
- Determine "Hot Spots" and frequency of cleaning required.

36.6.2 Waterway Maintenance

Material that is illegally dumped in waterways can result in pollution and possibly increase flood levels. Dumped material may include car bodies, batteries, tyres, hazardous material/waste, metallic items (e.g. shopping trolleys) and vegetation. Removing this material increases the aesthetic value of the waterway. The dumping of vegetation can also result in the spread of exotic vegetation in riparian zones.

In addition, eroding banks can provide a significant additional source of sediment and other pollutants to waterways. This erosion may be due to increased flow rates due to urbanisation and mitigating flows upstream of the erosion area may be required, in addition to bank stabilisation. Erosion is a normal process in watercourses and erosion only needs to be addressed when rates are higher than those, which would occur under "natural" conditions.

(a) Good Practice Guidance

- Identify dumping "Hot Spots" by regular inspection.
- Remove all dumped material (not just material likely to contribute to water pollution).
- Stabilise all eroding banks.

36.6.3 Stormwater Treatment Facility Maintenance

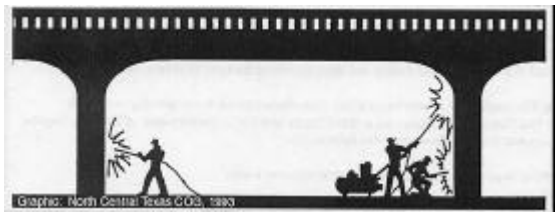
All stormwater treatment measures require maintenance to ensure their pollutant removal efficiency does not reduce over time. The actual maintenance activities and frequency of maintenance will vary with the type of structure and the catchment characteristics. This is discussed further in the relevant chapters for each type of device. There are difficulties associated with predicting the frequency of maintenance, with a monitoring program being an appropriate method for designing a maintenance schedule.

(a) Good Practice Guidance

- Determine the accumulation rates of litter, silt, and debris through measuring actual quantities of material collected.
- Where litter traps are installed ensure frequency of cleaning matches the rate of build up of materials as determined through the audit process.
- Review maintenance programs, including cleaning frequency to take into consideration local factors such as type of trees in the vicinity, season and rain characteristics.
- Use appropriate machinery to collect material and remove for disposal at a suitable site (e.g. suction sweeper, hand sweep and pick up sweepings, or other

machinery which does not sweep material into the drainage pits).

36.6.4 Bridge Maintenance



Road bridges provided with scuppers directly discharge untreated stormwater into waterways. Bridge maintenance can also result in the discharge of pollutants to waterways, either by waste material being washed into scuppers or by material directly falling into waterways.

For new bridges, appropriate siting can minimise impacts on sensitive receiving waters. In addition, the use of scuppers can be avoided on short bridges or bridges crossing sensitive waterways, and stormwater directed to the ends of the bridge for treatment. If scuppers are used, compensatory treatment could also be provided.

(a) Good Practice Guidance

- Clean scuppers on a regular basis to minimise accumulation of sediment and debris.
- The scuppers should not be directly cleaned into the waterway.
- Use suspended traps, vacuums or booms in the water to capture paint rust, and other chemical when bridges are being maintained. Some of these wastes may be hazardous.
- Include bridges over waterways in street sweeping programs (refer to Section 36.5.6).