Water Sensitive Urban Design

IN INDUSTRIAL AND COMMERCIAL SITES

Purpose of this fact sheet:

This fact sheet provides advice to the development industry on applying Water Sensitive Urban Design for Industrial and Commercial sites in the Coastal Dry Tropics Region.

Characteristics of Industrial and Commercial Development

Large impervious areas

Industrial and commercial development is typically characterised by large impervious areas.

Industrial chemicals and other pollutants

Industrial areas can usually be further characterized by the presence of a wide range of industrial chemicals and other potential pollutants. Industrial areas therefore, often discharge large volumes of stormwater containing a wider, more toxic and more variable range of pollutants than stormwater from residential or commercial areas.

Variable water consumption

Water consumption and sewage generation on these sites can be highly variable, especially depending on the nature of the industrial activity. Commercial areas and warehouses typically consume small volumes of water and produce low amounts of sewage compared to other industrial sites where large volumes of process water are used and discharged to sewer (normally under license).

Road reserves and public realm

Developers of industrial precincts are also required to provide treatment for stormwater runoff from road reserves and public realm areas, as well as for any untreated stormwater runoff from allotments. The pollutant profile of these areas is generally compatible with simple conventional WSUD treatment measures.

KEY POINTS OF THIS FACT SHEET

This fact sheet provides advice to professionals in the development industry with

- An explanation of key water management issues in industrial and commercial areas,
- A guide to the process of designing an industrial and commercial site to minimise stormwater pollution and manage changes in hydrology

City of Townsville

WSUD options in Industrial and Commercial Development

Effective application of WSUD to industrial and commercial sites may be achieved by:

- Maximising stormwater harvesting and reuse opportunities.
- Structurally separating work areas from roofs and carparks. This prevents industrial pollutants from contaminating stormwater, so that standard urban stormwater treatment devices can be applied.
- Ensuring tenants have a greater understanding and appreciation of effective water management
- These principles can be applied to new and existing developments ranging from greenfield subdivision to small individual lots.

Stormwater harvesting

The viability of stormwater harvesting will be site specific and depend on the potential to capture, store and reuse stormwater at each site. Roofed areas within industrial and commercial areas will typically generate large volumes of water. This roofwater is typically of a quality suitable for many reuse purposes, although high nitrogen levels warrant treatment prior to storage in open water bodies.

Water usage can vary greatly across commercial and industrial sites depending on the use of the site. For sites with relatively low water use demand, it is recommended that alternative opportunities for local reuse be investigated.

Structural separation

WSUD can be used to achieve best practice stormwater management standards if pollution from industrial work areas is structurally separated from stormwater runoff pathways. Work areas include those areas where industrial pollutants could be stored, used, transferred or manufactured. For most industrial sites, work areas will comprise all parts of the site other than carparks and landscape areas.

Structural separation can be achieved by roofing work areas, directing wash-down to storage (which is subsequently pumped out as industrial waste) or sewer, and controlling activities undertaken in areas connected to stormwater drains.

If work areas are not separated, WSUD measures designed to treat the typical range of pollutants in urban stormwater may be overloaded by industrial pollutants.

Alternative stormwater management strategies, based on treating known pollution from a particular industrial activity, may be ineffective in the longer term because of unforeseen pollution from a current or future tenant. Businesses change premises regularly and so do the key pollutants and the likelihood of their release. Devices tailored to the needs of one business are unlikely to suit subsequent businesses. Devices aimed at treating a wide range of pollutants may have limited ability to accommodate storm events or require combinations of devices and specialised management.

As an alternative to roofing work areas, structural separation may also be achieved by containing runoff from work areas and disposing of this water in an acceptable manner (such as reusing the water in industrial processes or treating the water and then infiltrating it to groundwater). However the large size of storages which can be required to contain the runoff from high intensity summer rainfall in the coastal dry tropics region reduces the feasibility of this option for most sites.

Raising awareness for tenants

Education programs to promote good environmental practice by businesses in industrial and commercial precincts are also important in helping sites to meet water quality objectives. Such programs should promote operational practices that minimise opportunities for industrial pollutants to enter the stormwater system, as well as raising the environmental awareness of individuals working in industrial precincts.

Designing WSUD in industrial and commercial developments

The following water sensitive design process is focused on individual commercial or industrial lots. This same process also applies to precincts although designers of precincts have the opportunity to consider solutions that extend beyond individual lot boundaries.

1. Define design objectives

- Treating stormwater to ensure compliance with design objectives
  - >80% reduction in TSS
  - >65% reduction in TP
  - >40% reduction in TN
  - >90% reduction in gross pollutants
- Isolating industrial pollutants from stormwater catchments.
- Reuse of stormwater or wastewater.
- Attenuation of peak discharges during heavy rainfall events.
- Minimise use of potable water or minimal discharge of sewage.

2. Site appraisal

Assess the proposed development site for opportunities and constraints, including:

- Identification of natural drainage lines and possible pathways and discharge locations for runoff from minor and major storm events.
- Identification of any external catchments draining through the site and assessment of flood conveyance requirement.
- Assessment of site topography to determine feasible WSUD strategies.

Once the opportunities and constraints of the site have been assessed, a preliminary drainage strategy and/or lot layout can be developed.

3. Achieve structural separation of work areas

This includes designing the layout of buildings within lots to:

- Ensure all potential work areas are covered with a roof, or that runoff from work areas can be contained and reused.
- Avoid small spaces behind or beside buildings that could potentially be used for informal storage or disposal of materials.

Achieving structural separation has the benefit of enabling the site to support a range of future industrial activities without significant site redesign. Where the risk associated with a particular work activity is compatible with simple and generic means of treating stormwater to best practice pollution targets, structural separation may not be necessary. This exemption from structural separation would need to be reassessed if the nature of the work activity changed.

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Topography considerations

Only steep sites will have sufficient relief to enable end-of-pipe stormwater treatment, whereby underground pipes can be 'daylighted' to deliver water to a vegetated treatment system. Most other sites will require stormwater to be treated before it enters the underground drainage system. This will typically require an iterative approach to drainage and site design. Table 1 provides a guide to the feasibility of various stormwater treatment approaches for various degrees of steepness.

Table 1.

Elevation difference between lowest point of site and legal point of discharge	Likely feasible treatment measure	Area required (as % of contributing catchment area)
2m (steep)	End-of-pipe bioretention	2%
1m (relatively flat)	At-surface bioretention	2%
Less than 1m (flat)	Wetland	7%

Where the elevation difference between the lowest impermeable surface of the site and the legal point of discharge is less than 1m it will be difficult to drain bioretention systems. To meet treatment requirements, combinations of the following options may be required:

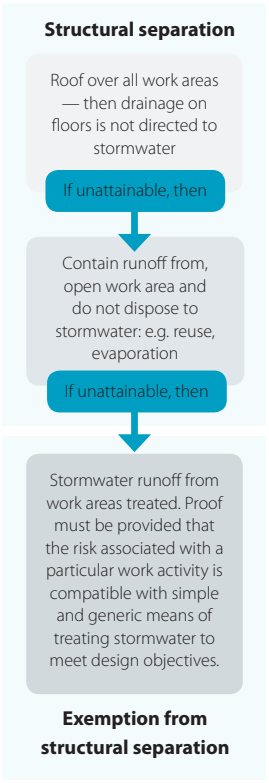
- Filling the site.
- Using stormwater treatment wetlands.
- Where available, contributing to a local offset scheme.

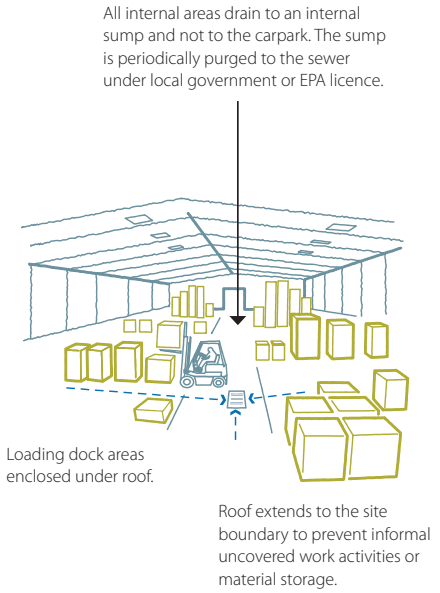
4. Develop a WSUD strategy

Design objectives for stormwater treatment can generally be achieved using a combination of rainwater tanks and bioretention systems. Other technologies available include wetlands and gross pollutant traps. Site design will need to ensure that site runoff can be delivered to these systems.

Consideration must be also given to water cycle objectives such as the harvesting and reuse of roofwater for end uses such as toilet flushing, landscape irrigation, vehicle wash down and process water.

Many industrial and commercial areas have minimum landscape requirements and with a considered approach to site design, WSUD systems can generally be accommodated within these designated landscape areas without impacting on developable site area.





EXAMPLE OF STRUCTURAL SEPARATION

Source: SEQ HWP, 2007

Site vs Precinct

Scale considerations

The transport of materials within industrial and commercial estates presents an inherent risk of industrial pollutants entering WSUD systems, potentially resulting in significant and costly damage. For this reason, distributed stormwater treatment systems are more robust than centralised treatment systems where a chemical spill could disable the precinct's entire stormwater treatment system.

For industrial and commercial precincts, developers have the flexibility of assessing the relative life-cycle costs of providing treatment for stormwater runoff from allotments in public realm areas (by enlarging the size of treatment systems that would otherwise be required to treat road reserve runoff) compared with treating all allotment runoff within allotment boundaries.

Factors to consider in assessing the balance between allotment-based treatment and precinct-based treatment include:

- Site topography
- Proposed future ownership structures and maintenance responsibilities.
- Construction staging – where WSUD assets in public realm areas are intended to be handed over to Council it is a common requirement that all construction within the catchment be completed prior to the asset going off-maintenance. This minimises the risk of overloading WSUD systems with high sediment loads from construction activities.
- Potential impacts of on-site WSUD
- Requirements on future tenants.
- The risks to centralised WSUD systems discussed above.

This factsheet has been adapted from the SEQ Healthy Waterways Partnership's *Factsheet No.3 : Water Sensitive Urban Design in Industrial Areas* (from: http://www.healthywaterways.org/FileLibrary/wbd_3_wsud_industrialareas.pdf)

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