Water Sensitive Urban Design

CAR PARKS

Purpose of this fact sheet:

This fact sheet provides advice to the development industry on applying Water Sensitive Urban Design in the Coastal Dry Tropics Region to Car Parks.

Car Parks Characteristics

Car parks are large impervious areas generally located in commercial or industrial areas. Their location, function and typical design provide a number of issues for the surrounding natural environment:

- generate high run-off and pollutant loads due to number of cars and large impervious area
- high levels of anthropogenic litter is often associates with these locations
- large expanse of impervious area can also create 'heat islands'

Therefore car park design should aim to reduce impervious areas and treat stormwater to remove pollutants, such as engine oil. The area of paved surfaces can be limited by using landscaped areas, such as medians as well as utilising these areas for storm water runoff detention prior to disposal.

Bioretention in the streetscape

KEY POINTS OF THIS FACT SHEET

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

- An overview of the techniques and principles of WSUD in car parks
- Benefits and opportunities

City of Townsville

WSUD options in car parks

There are many opportunities to incorporate water sensitive design into car park areas ranging from stormwater harvesting to treatment.

Stormwater Harvesting

Harvesting stormwater on-site removes the infrastructure needed to convey it off-site. Retaining the water on-site also creates an option to be able to reuse this water.

Stormwater Treatment

A range of stormwater treatment measures are available and can be incorporated into the car park design. These measures include:

- Gross pollutant traps: These litter collection devices are intended to retain gross organic and anthropogenic litter that is washed from urban surfaces. They rely predominantly on physical screening rather than flow retardation to remove litter.
- Porous paving: These are constructed from modular or lattice paving and can be used in conjunction with a with a stormwater infiltration system through a sand-mix medium. A number of porous paving products are commercially available including special asphalts, concrete grid pavements and modular pavements. The paving blocks are used to provide structural support, while retaining a large proportion of the "paved-area" pervious for infiltration of rainfall and ponded stormwater. The pavers can reduce flow peak, increase groundwater recharge, improve water quality and reduce the area of land dedicated solely for storm water management.
- Oil and grease separators: There are currently a number of oil and grease separators being used in the stormwater industry, with varying success. The separation of oil and grease in such systems rely on near-quiescent flow conditions and are most appropriate when used in treating runoff from clearly isolated oil and grease source areas (i.e. limited stormwater peak flows).
- Swales: Vegetated swales provide a means of disconnecting impervious areas from downstream waterways, assisting in protecting waterways from damage by frequent storm events, by reducing flow velocity compared with piped systems. They provide removal of coarse and medium sediments and are commonly combined with buffer strips and bioretention systems to provide further treatment.
- Buffer strips: Buffer strips (or buffers) are areas of vegetation through which runoff passes while travelling to a discharge point. They reduce sediment loads by passing a shallow depth of flow through vegetation and rely upon well distributed sheet flow. With their requirement for uniformly distributed flow, buffer strips are suited to treatment of road runoff in situations where road runoff is discharged via flush kerbs or through regular kerb 'cut-outs'.
- Sand filters: Sand filters operate in a similar manner to bioretention systems, with the exception that stormwater passes through a filter media (typically sand) that has no vegetation growing on the surface,

Vegetated bioretention system in carpark

WSUD benefits

There are a number of benefits to including WSUD into car park designs:

- Protecting natural environment - through reduce peak flows and pollutant reduction
- Reducing construction costs - reduced paved areas and less infrastructure needed to convey stormwater
- Improve car park aesthetics - interrupting the paved surface with landscaped treatment options improves the look of car parks

Designing WSUD in Car Parks

reducing their treatment performance comparatively. The absence of vegetation is due to low moisture content in the sandy soils and low light due to systems often being installed underground. Sand filters should only be considered where site conditions, such as space or drainage grades, limit the use of bioretention systems.

- Bioretention systems: Bioretention systems operate by filtering stormwater runoff through densely planted surface vegetation and then percolating runoff through a prescribed filter media. During percolation, pollutants are retained through fine filtration, adsorption and some biological uptake.
- Infiltration systems: These systems do not treat stormwater, but capture runoff and encourage infiltration into surrounding in-situ soils and underlying groundwater. This has the benefit of reducing stormwater runoff peak flows and volumes, reducing downstream flooding, managing the hydrologic regime entering downstream aquatic ecosystems and improving groundwater recharge.

1. Define design objectives

- Reduce total impervious area
- Reduce road/parking construction costs
- Provide safe access and adequate parking
- Minimise disturbance to natural site hydrology
- Improve site appearance
- Create opportunities for stormwater treatment and infiltration.

2. Site interpretation

Car Park Location - If the car park is associated with a shopping precinct then gross pollutants traps maybe useful for capturing litter.

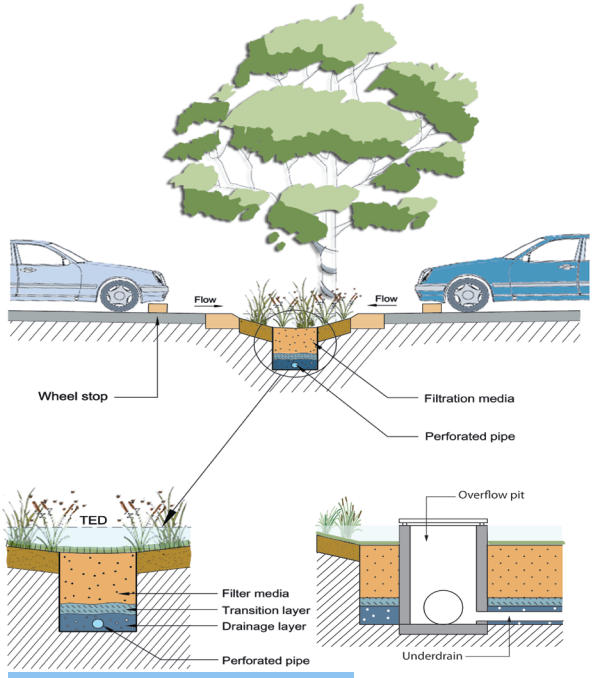
Traffic Volumes

- Low Traffic Volume:
  lower pollutant loads allow for the possibility of porous pavement to be used in open car parks and driveways as a source control measure used in conjunction with a stormwater infiltration system through a sand-mix medium.
- High Traffic Volume:
  pollutant loading rates are higher and oil and grease removal is a common requirement, needing appropriate selection of treatment measures. This could include oil and grease separators. Incidental export of oil and grease from urban catchments may be better treated by grass swales and wetlands while source areas of high pollution potential (e.g. petrol stations and garages, car wash areas etc) should ideally be isolated and dedicated oil, grease and grit traps installed.

Car Park Design - Expansive parking lots that drain to just a few locations create large volumes and high velocities that require the use of larger 'end-of-line' stormwater treatment techniques. The low impact design approach encourages designers to create smaller decentralised treatment areas such as bioretention trenches and conveyance swales. On hilly sites, the creation of multiple parking areas at different elevations can reduce the amount of grading necessary and preserve natural hydrology.

3. Develop WSUD strategy

Provide at-source treatment of stormwater within the carpark by directing stormwater to a series of small bioretention basins. The total treatment area must be sufficient to meet the Townsville City Council stormwater treatment objectives.



Vegetated bioretention carpark design


Bioretention within the streetscape

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