

## 'Treatment-Train' solution for Sylvia Park town centre complex

The 24-hectare Sylvia Park town centre complex is situated 10km south of the Auckland CBD at the junction of the Southern Motorway, Mount Wellington Highway and South Eastern Arterial Highway – the geographic and demographic heart of Auckland.

The site has a colourful history, dating back to the establishment of successful 'Sylvia Park Stud Farm' in 1882, with its associated Melbourne Cup successes. It was purchased by the New Zealand Government in 1927 and had stores erected on it by the US Armed forces (1943) before taking control again and selling it to the private sector in 1992. Current site owners Kiwi Income Property Trust acquired the land 1995-1998 and started site works for the new retail centre in 2004.

### The master plan and the vision

The vision for Sylvia Park is to meet the emotional and physical aspirations of residents and visitors to New Zealand through offering an exceptional and innovative retail, entertainment and working environment in the heart of Auckland.

- Flagship major stores - The Warehouse, PAK'nSAVE and Foodtown
- Over 180 specialty retail stores
- The largest regional shopping centre in New Zealand



An aerial view of the Sylvia Park complex

- State of the art Hoyts Cinema complex - including La Premiere seating
- Over 3,000 carparks - the largest number of carparks in any shopping centre in New Zealand
- Carparks to be linked by an internal ring road
- Proposed business centre

### Guiding Principles

- Inspiring design
- Partnership
- Environmental considerations

In response to environmental considerations stated in the Sylvia Park development guiding principles, the retail precinct includes many environmental features such as:

- rain water harvesting for non drinking water uses;
- water efficient fittings employed throughout;
- high quality filtering of storm water prior to discharging from the site;
- numerous energy efficiency measures including, efficient air conditioning systems, optimised levels of insulation, high levels of day lighting in the mall and lighting configured to be turned off when there is sufficient daylight;
- recycling facilities;
- substantial recycling of former building and site materials; and
- utilisation of timber from sustainable sources.

Kiwi Income Property Trust engaged Sinclair Knight Merz (SKM) engineers to design the stormwater reticulation for the site and gain the required ARC approvals for Stormwater discharge. Ingal Environmental Services' solution was chosen as the Stormwater treatment system most suitable to exceed the ARC requirements for Stormwater Discharge. The following solution was conceived:

### Application

Retail complex stormwater runoff

- Site Owner – Kiwi Income Property Trust
- Project / Design Manager & Engineer to the Contract - Carson Group
- Civil Engineer – Sinclair Knight Merz (SKM)
- Principle Contractor – MULTIPLEX
- Drainage Contractors – Ross Reid Contractors
- Stormwater Treatment – INGAL Environmental Services



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### Pollutants of concern

- Particulate and Dissolved metals including zinc, lead and copper
- Total Suspended Solids
- Polycyclic Aromatic Hydrocarbons

### Solution

- 5 Box Culvert vault StormFilters (331cartridges)
- 4 pre-cast vault StormFilters (71cartridges)
- 16 Gullypit StormFilters (32cartridges)
- 5 Manhole vault StormFilters (22cartridges)
- 158 EnviroPod Catchpit inserts (200 micron filter)
- Zeolite/Perlite/Granular activated carbon (ZPG) cartridge media

### The Challenge

The Auckland Regional Council (ARC) consent required that the treatment system removed 75% of Total Suspended Solids (TSS). Because of the high traffic loading associated with the site, the ARC required a treatment technology that could remove dissolved metals (zinc, copper, and lead) as well as particulates. Kiwi property trust desired to have a stormwater solution that exceeded existing environmental guidelines

Due to the large impervious car park and road areas (12.1 hectare) requiring treatment and fixed outlet pipe depths of the existing watercourse, the low pipe gradients meant device outlet depths of as shallow as 1.3m.

### The Solution

SKM Consulting Engineers in conjunction with Ingal Environmental Services developed a 'treatment-train' approach that exceeds ARC guidelines; using EnviroPod Catchpit inserts and StormFilter vaults which incorporated media filled symphonic radial cartridges.

SKM believes that one of the key advantages of the 'treatment train' design was that the site could be constructed, treated and released in stages to be co-ordinated with relevant retail opening dates required by the client. The site was subdivided into a number of stormwater catchments to coincide with the staged release requirement and as a catchment was completed ARC provided confirmation that with each part of the site all of the consent conditions had been met. As the site has been developed the stormwater treatment has been completed providing a better runoff to the receiving environment. The combination of proven devices, technical design, and professional consultants and suppliers allowed for an easy consent process.

158 EnviroPod catchpit insert filters were installed into catchpit sumps upstream of the StormFilter treatment devices. The EnviroPod is a catchpit insert with a micron rated screening bag. It is designed to fit within the Catchpit and screen out over 50% of the contaminant load before it reaches the StormFilter.

A total of 30 StormFilter devices (456cartridges) were installed on the site. The StormFilter comprises a vault holding numerous StormFilter cartridges. The StormFilter cartridge is a siphonic radial filter cartridge filled with various types of filter media specifically chosen to treat targeted contaminants.

At Sylvia Park, Zeolite, Perlite and Granular activated carbon (ZPG) media was used as the filter media in Storm filter cartridge. ZPG filter media was chosen because of its ability to absorb dissolved heavy metals and PAH, which are likely to occur on the site because of the high traffic loading.

The 'treatment train' has been modelled in a design package called MUSIC (the Model for Urban Stormwater Improvement

Conceptualisation). This estimates a 91% removal of Total Suspended Solids. It is estimated that this media combination treatment train will remove over 40 - 60% of copper, lead and zinc, the principle heavy metals of concern.

"The treatment train approach is a great solution for Sylvia Park" comments Mike Hannah Technical Director of Ingal Environmental Services.

"Stormwater pollution has a range of contaminants in different forms and sizes. The treatment train targets the larger pollutants with the EnviroPod with the finer and dissolved pollutants being removed by the Stormfilter. These two treatment devices work in sequence prolonging maintenance frequencies and increasing efficiency by passing the polluted water through two treatment devices."

### Technologies

#### StormFilter - Siphon-actuated filtration

Designed to meet stringent regulatory requirements, the StormFilter targets the full range of pollutants in urban runoff. Total suspended solids (TSS), soluble heavy metals, oil and grease, and total nutrients are effectively removed using a variety of sustainable media.

The patented siphon-actuated surface cleaning system prevents surface blinding and extends the cartridge life cycle and maintenance intervals. The field-proven performance of the StormFilter has led to hundreds of regulatory agency approvals worldwide as a stand-alone stormwater treatment system. This cost-effective, passive filtration system is highly reliable and easy to install.

From small, pre-fabricated gullypits to large box culvert and panel vaults, StormFilter systems maximise land use. The compact design also reduces construction and installation costs by limiting excavation.

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### Flexible design

Due to the nature of the catchments at Sylvia Park, the ability for flexible design of the vaults was essential. The three configurations used were:

#### Gullypit StormFilters

To save on piping and installation costs, Gullypit vaults were employed on roadway areas. The gullypit configuration incorporates a grated inlet and forebay sump which eliminating the need for upstream catchpits. The 2 cartridge gullypit StormFilters utilised allow the outlet pipe invert to be layed at around 1m below finished ground level. Gullypit StormFilters have no confined space requirements for maintenance.

#### Manhole StormFilters

1800diameter 6 cartridge StormFilter vaults were used for medium size catchments. The Manhole StormFilter is a cost effective vault utilising standard manhole riser sections and can be placed directly from the delivery truck by Hi-ab lifter, eliminating the requirement for a crane during installation

#### Pre-cast vault StormFilters

Pre-cast vaults are assembled off site, and can simply be placed in the excavated hole and the inlet and outlet pipes connected, then backfilled.

#### Box-culvert vault StormFilters

The catchpits collecting the large catchments were able to be piped directly to large box-culvert vaults. The box culvert vaults were designed proportionately to the quantity of cartridges required for each catchment. Flexibility in depth and width of the culvert sections meant the head height could be maximised for the individual units to ensure design outlet pipe inverts were achieved.

### EnviroPod

The EnviroPod® is a proven product that removes a significant portion of trash, debris and other pollutants from water entering the storm drain. It can be installed in either curb inlet or flat-grate catch basins. Using low-cost passive screening and optional oil-adsorbent media, the EnviroPod can be customised to meet site-specific requirements with several available mesh screens. The EnviroPod is an effective pre-treatment device for use in a treatment train with hydrodynamic separators, filtration, ponds, swales and wetlands. In many cases, it's often the most practical solution for retrofits.

At Sylvia Park EnviroPod filters have been used as pre-treatment for the StormFilter filtration system. 200micron Polyester mesh screening bags have been installed. This mesh gives a moderate/high level of treatment with moderate maintenance requirements.

### Maintenance

With on-going maintenance responsibilities lying with site owners Kivi Income Property Trust, maintenance cost and cleaning frequency were key design factors. The treatment-train approach greatly reduced the maintenance frequency of system. The treatment-train targets different contaminants with alternate devices. The EnviroPod targets gross pollutants and sediment, the StormFilter targets fine sediment and dissolved metals. The EnviroPod removes over 50% of the sediment before it reaches the StormFilter, preventing the ZPG media from clogging with sediment, prolonging the cation exchange properties of the media.

Extensive research has been undertaken on the load capacity of each StormFilter cartridge, this allows Ingal to accurately estimate maintenance Frequencies. Maintenance frequency is largely

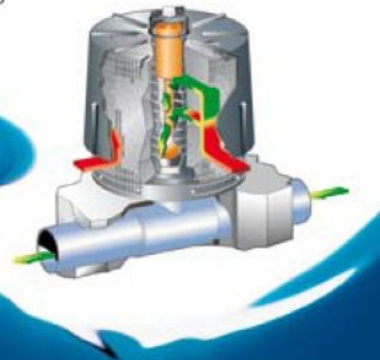
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## StormFilter

\*New ARC approved flow based designs

- Siphonic action radial filter cartridge
- 2,400+ cartridges installed in NZ
- Self-cleaning filter cartridge
- Proven maintenance frequencies
- ARC approval -TSS & High traffic loading
- Hundreds of Government agency approvals worldwide



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Installation of box-culvert StormFilter vaults

influenced by surface area. The cartridge configuration of the StormFilter gives a very large surface area for filtration. The Sylvia Park StormFilter design had similar surface area than a conventional sand filter while having a quarter of the overall plan foot print.

#### StormFilter

Due to the site usage as a retail centre, it was a requirement that maintenance disruptions were kept to a minimum. The high surface area stormfilter cartridge and effective EnviroPod pre-treatment is estimated to prolong maintenance frequencies to in excess of 2 years. Large access covers were incorporated into the vaults to ensure good ventilation and access to the cartridges. At the required maintenance period, the hoods are removed from the filter cartridges and the media removed by vacuum truck. Once sediment on the vault floor has been removed, re-juvenated cartridges are placed back on the threaded inserts on the floor, and maintenance is complete.

Maintenance frequencies for the StormFilters are in excess of 2 years

#### EnviroPod

The EnviroPod Catchpit inserts were chosen for the treatment-train approach as pre-treatment for the StormFilter vaults. The EnviroPod has ARC approval as pre-treatment with 50%TSS removal. Using the EnviroPod filters allowed the StormFilter vaults to be reduced in size. EnviroPod inserts remove litter, sediment, bark, leaves and other floatables upstream of the StormFilters. The EnviroPod filter can be easily maintained from ground level minimising confined space entry to servicing of the StormFilter vaults.

EnviroPod inserts are maintained by vacuum truck. The catchpit grate is lifted up and the contents of the bag are removed before the bag and support ring is lifted out and replaced with a rejuvenated set. The 200micron filterbags are waterblasted or washed at a controlled site for use in the next maintenance clean.

Story supplied by *INGAL Environmental Services*, [www.ingalenviro.com](http://www.ingalenviro.com), 0800 STORMWATER. ■

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