

## Gas Proofing (Permaliner® FPP)

**.5 mm Polypropylene, Syntex® (GNP B1 Strength Class B) Nonwoven Geotextile**  
**Warehouse development, landfill site, Auckland, New Zealand**

**Client: Fletcher Properties Ltd**

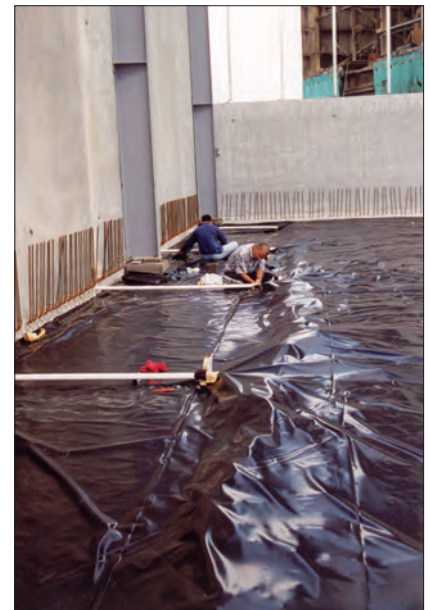
**T**he Circle International Warehouse site, located in Penrose, Auckland and adjacent to the Ericson Stadium, was constructed on an old landfill site. The monitoring indicated that some gas migration continues through the ground substrata in the adjacent areas. When the excavation was done for the site preparation, leakage of landfill gas was observed penetrating from the ground. It was decided by the Consultants to install a gas proof membrane to completely seal the building from the ground. A complete system was designed with a pipe system built below floor level.



Permaliner FPP (Flexible Polypropylene) .5 mm geomembrane was specified to be placed between the top of the subbase course and the concrete slab. Permaliner geomembrane offers excellent gas barrier characteristics and is resistant to most chemicals. In landfill applications, the principal gases generated are methane & carbon dioxide.

Permaliner is a coextruded flexible polypropylene with a low transmission rate for water and methane, which meets the barrier requirements for the municipal solid waste landfills in most countries. It is triple-layered, available from .3 mm to 2 mm thickness. It has excellent tensile strength and flexibility to withstand ground settlement and loading stresses.

As the liners are prone to damage from protrusions in the prepared subgrade onto which they are deployed, Syntex GNP B1 nonwoven geotextile was placed as a cushion to protect the liner from puncture. Syntex GNP B1 is a medium weight nonwoven (Strength Class B) geotextile with a high puncture and mullen burst strength, which increases its installation survivability. It is very resistant to aggressive chemicals and has been found acceptable in most solid and hazardous waste landfill sites. Prior to deployment of the steel framing and main panels all pads were covered with Permaliner, Syntex and neoprene gaskets over the bolts. These in turn were sealed with a flexible polyurethane sealant, designed to retain long-term flexibility during expansion and contraction.



Then total area of approximately 4300 m<sup>2</sup> was covered with 8 panels of Permaliner prefabricated in the factory under ideal quality control conditions. These panels were joined on-site with Vulcaneal (1 mm rayon reinforced isobutylene isoprene) moisture and vapour resistant double sided tape and installed by Permathene.

## Gas Proofing (Permaliner® FPP)

**.5 mm Polypropylene, Syntex® (GNP D1 Strength Class D) Nonwoven Geotextile  
Warehouse development, landfill site, Auckland, New Zealand**

**Client: Ampelite**

It was determined that a high risk of methane was possible due to construction over an old landfill site. Permaliner FPP (Flexible Polypropylene) .5 mm geomembrane was specified to be placed between the top of the subbase course and the concrete slab. Permaliner FPP offers excellent gas barrier characteristics and is resistant to most chemicals. In landfill applications, the principal gases generated are methane & carbon dioxide.

Permaliner has a low transmission rate for methane, which meets the barrier requirements for the municipal solid waste landfills in most countries. It is a triple-layered, coextruded polypropylene product available in .5 mm to 2 mm thickness. It has excellent tensile strength and flexibility to withstand ground settlement, loading stresses, high tear, puncture resistance, and is free from additives such as plasticisers, adhesives and lubricants. It is manufactured to food grade standards and is suitable for potable water so will not contaminate ground water.

Syntex GNP D1 (Strength Class D) nonwoven geotextile was placed over the finished liner as a cushion to protect the membrane from puncture during concreting. Syntex GNP D1 is a heavy weight nonwoven with a high puncture and mullen burst strength, which increases its installation survivability. It is very resistant to certain concentrations of aggressive chemicals and has been found acceptable in most solid and hazardous waste landfill sites. Syntex has been widely used for similar applications worldwide.

A total area of approximately 3000 m<sup>2</sup> was covered with 3 panels of .5 mm Permaliner FPP, prefabricated in the factory under ideal quality control conditions. The panels were deployed over the entire site and sealed to all protrusions and footings using a combination of special adhesives and sealants. The adhesives are designed to remain flexible. The panels were fusion welded on-site with no taped joints. This provides an impervious membrane.

The combination of Permaliner FPP prefabricated panels and Syntex geotextile cushioning proved to be the most cost effective and environmentally acceptable construction method for this type of project.



## Chemical Protection (Permaliner® FPP)

**1 mm Polypropylene, Syntex® (GNP C2) Nonwoven Geotextile**  
**Retaining wall construction, Auckland, New Zealand**

**Client: North Shore City Council**

**T**he Axis subdivision in Albany included construction of retaining walls with the placing of the Polyrock, an expanded polystyrene block product specially designed for geotechnical applications in the construction industry.

Permathene supplied and installed the protection membrane and a Syntex GNP C2 (280 gsm) nonwoven geotextile fabric to cover the Polyrock in order to protect the blocks from any chemical spillage. This method was chosen over conventional fill materials because it offers great benefits, i.e. easy to install, impressive load bearing capacity, very light weight (only 1% to 2 % density that of soil). This reduces load to a great extent.

The combination of the Polyrock and protection membrane has been successfully used in civil applications worldwide for many years.

Permathene provided lining and installation. This protection membrane is resistant to most chemicals and has the advantage of providing flexibility during settlement. Permaliner FPP has excellent tear and puncture resistance.



## Pond Liner Golf Course (Permaliner®)

**Flexible Polypropylene**  
**Auckland, New Zealand**

**Client: Akarana Golf Club**

**T**he Akarana Golf Club in Auckland built a series of three ponds. The design included a small pond in the foreground with a waterfall, made using large boulders. The total pond area is approximately 6,000 m<sup>2</sup> which we mostly welded on-site using a 1 mm Permaliner FPP polypropylene pond lining membrane.

For the middle pond the liner was factory made due to this pond being an old swamp. The knee deep in mud conditions making onsite welding impossible. As this middle liner was 1800 m<sup>2</sup> (over 1.5 tonnes of material) deploying it over the extremely boggy site conditions proved to be quite a challenge. However, the Permathene installation crew still completed the job ahead of schedule.

Permaliner FPP is a triple-layered, coextruded polypropylene product available from .5 mm to 2 mm thickness. It has excellent tensile strength and flexibility to withstand ground settlement, loading stresses, high tear, puncture resistance, and is free from additives such as plasticisers, adhesives and lubricants. It is manufactured to food grade standards and is suitable for potable water so will not contaminate ground water.

All welds were double fusion welds with testing channel to ensure seam integrity.

Each pond from the smallest to largest is built to allow water to flow from smallest to largest. This provides an attractive water feature for this city golf course.

The area around the completed ponds was then landscaped with pathways built to provide access for golf carts.



## Liquid Containment (Permaliner® FPP)

**1 mm Polypropylene, Syntex® (GNP B1 & GNP E1) Nonwoven Geotextile  
Timber treatment plant, Marsden Point, New Zealand**

**Client: CHH Ltd**

**C**arter Holt Harvey LVL facility in Marsden Point wanted to line a storm water pond to hold approximately 2.5 million gallons of storm water. Tonkin and Taylor designed the pond and selected Permaliner FPP (Flexible Polypropylene) 1 mm liner. By virtue of its chemical composition, molecular structure and thermodynamic properties, polypropylene is one of the most resistant materials available.

A proper drainage system was designed which comprised of rows of 150 mm diameter perforated PVC pipes on sandy subgrade, covered with 200 mm of loose 40/16 aggregate and Syntex GNP B1 (Strength Class B) nonwoven geotextile to cushion the lining from aggregate.

Rolls of Permaliner 6 m x 100 m x 1 mm were shipped to site and was fabricated to fit the existing pond profile. Proper panel placement was facilitated by cross referencing each numerically identified panel with a layout plan approved by the consultant and client. All the site tests were conducted to comply with the QA/QC requirements.

The correct installation and welding of the Permaliner liner is of paramount importance since the integrity and long term performance is dependent upon it. The welding of the liner was executed by using various methods including dual track fusion welding and extrusion fillet welding methods. Polypropylene fusion welding is an exact process which requires a high degree of supervision. Done in accordance with good Code of Practice, FPP polypropylene provides an extremely effective lining system.

The entire area of 7000 m<sup>2</sup> was covered in approximately 7 days including welding of 7 pipe boots of 300 mm diameter OD on site. On the finished liner surface, 200 mm of coarse sand was evenly placed using rubber track excavators and spreaders.

The side slopes were covered with Syntex GNP E1 (Strength Class E), heavy weight geotextile cushion before covering the area with 75 mm thick reinforced concrete. The heavy weight nonwoven geotextile was selected because it provides a higher angle of friction and greater puncture resistance to protect the liner from any damage. Syntex GNP E1 is specially manufactured for geomembrane protection.

