# THE SMART WAY TO CONTROL OPEN CHANNEL FLOW – COUNCIL CASE STUDIES

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## ABSTRACT

Engineers often turn to rock lined or concrete channel systems to line open channels and regulate water flow to prevent flooding and property damage.

Geofabrics Australasia's SmartDitch® Channel Lining System provides another alternative to Engineers for lining of open channel drains. SmartDitch® is a leak-free channel lining system engineered to control and direct the flow of water or critical fluids. Made from proven UV resistant HDPE, SmartDitch®'s unique corrugated design helps regulate the flow of water from flat to steep grades so that the drainage and flow patterns designed are maintained.

MegaDitch® is the infinitely expandable equivalent of SmartDitch for larger channels. SmartDitch® comes in sizes for nearly any application and its light-weight construction makes it ideal for difficult to access or uneven terrain. The SmartDitch® Channel system is lightweight, flexible and easy to handle. Once installed, the deep-ribbed design provides exceptional strength and flow control. The SmartDitch® Channel System provides a cost-effective alternative to concrete lined channels and rock lined channels, whilst maintaining the ability to manage flow velocity without increasing channel width.

This paper will highlight the Engineering advantages and versatility of the SmartDitch® system and will explain how the larger MegaDitch® version solved a perennial problem for a NSW Council in a highly exposed area.

## 1.0 INTRODUCTION

Water management is always at the forefront of drainage Engineers, Councils and for that matter any developer or Government Authority. Rainwater, whether local isolated showers or torrential rain will invariably lead to erosion, scouring, flooding and costly maintenance rectification works. Councils often turn to rock lined or concrete channel systems to line open channels and regulate flow to prevent flooding and property damage.

**Figure 1:** ***Examples of Eroded Open Channels***

The steepness of the drainage channel can also make scouring and erosion issues more severe and hence, repetitive maintenance cycles are a natural progression. Often, Councils and other Authorities experience problems with existing concrete lined channels when they crack due to long life or from subgrades which continually go through expansion and contraction cycles e.g. Black soil subgrades, Landfill caps etc.

## 2.0 DISCUSSION

This paper will introduce the development of a "Smart" method of lining open channels, namely SmartDitch®, to alleviate the problems that many Engineers experience when designing, constructing and maintaining these assets. Outlining how the SmartDitch® system was developed, its first commercial installation, the features and benefits of the system, advancements after initial development and how some Councils designed and installed the SmartDitch® system to solve their problem.

### 2.1 Development

In 2003, an Engineer from New Mexico in the USA approached an automotive industry manufacturer called Penda Corporation, to help refine a liner concept to repair a severely corroded and cracked concrete irrigation channel. Penda Corporation founded in 1975 in Portage, Wisconsin, originated with a focus in the automotive industry and by 1983, Penda began manufacturing pickup truck bed liners establishing itself as an innovative, high quality supplier to both the aftermarket and original equipment markets. Penda grew rapidly and fostered partnerships with the world's leading automotive companies, including Ford, General Motors, Chrysler, Nissan & Toyota.

The brief from a group of farmers, represented by the New Mexico engineer, was to repair 12 km of concrete channel which was losing 60% of its available water. It needed to be affordable (ie. less expensive than excavating and replacing the existing concrete channel), it needed to withstand a harsh environment, be leak proof, easy to install and above all, it needed to be easy to maintain.

SmartDitch®, a leak-free, trapezoidal, corrugated channel lining system made from proven UV resistant HDPE was born. A complete system invented and designed out of a necessity.

**Figure 2:** ***Before, During and After Photos of the First SmartDitch® Installation***

Eight years after the initial approach, Penda had manufactured all 12 km of SmartDitch® which was retrofitted into the existing concrete lined channel. It now supplies 90% of the available water as compared to 60% previously.

## 2.2 Features and Benefits

### Features

SmartDitch® comes in two standard trapezoidal sizes, 300mm and 600mm depths and also a 600mm deep semi-circular configuration. The ribbed or corrugated design provides strength and exceptional flow control whilst mitigating the effects of erosive forces and velocities. The ribbed pattern offers the added advantage of a self-cleansing capability at minimal grades. With its flexible, lightweight design it is ideal for use on difficult to access, uneven terrain and steep slopes.

### Benefits

SmartDitch® eliminates sidewall erosion and the subsequent sediment that can end up in the channel whilst maintaining excellent flow properties. It does not erode, crack or corrode when exposed to weather, erosion, ground movement or freeze/thaw cycles. It is engineered with a self-scouring ability that helps keep channels clear and reduces maintenance. It also comes with a wide range of fittings to tie into existing systems such as bulkheads, multidirectional sections, gate valves, transitions and flared inlets/outlets. The HDPE construction is safe for use in irrigation and landfill applications, withstanding chemical and corrosion attacks that may otherwise affect the design life of a channel.
The SmartDitch® semi-circular shape can also be used for temporary flow diversions for above ground applications. It provides the added benefit of relocation and reuse.

## 2.3 Advancements after Initial Development

In every drainage application there are needs for both small and large-scale water control solutions. The SmartDitch® *Mega*Ditch was developed in response to the demand for a large scale version of the successful SmartDitch® System. *Mega*Ditch is the first expandable HDPE channel lining system and is the ideal solution for large water flow applications. The SmartDitch® *Mega*Ditch is an expandable channel lining system specifically designed for the rehabilitation of very large, concrete-lined and earthen ditches and canals. *Mega*Ditch is a dependable solution for new construction, stormwater drainage, erosion control, irrigation, industrial site containment systems and mining site water run off applications. *Mega*Ditch is engineered with adjustable sidewalls to conform to the variety of slopes and grades that are typically found in these unconventional large water flow applications. The base and wall sections are connected for maximum expandability and fit both flat-bottom and V-bottom channel profiles. Multiple bases and sidewall sections can be connected to any desired length or width.

# 3.0 CASE STUDIES

## 3.1 A Council Landfill Case Study

Landfills are constructed in the surface soils of the earth for the purpose of solid waste disposal. Currently landfills are the most economical and environmentally acceptable method for solid waste disposal. However, controlling stormwater runoff at landfill sites is critical due to the production of leachate, a liquid created after water from rain is mixed with the chemicals in the waste, that percolates and drains from the landfill. Today's landfills are designed to prevent environmental contamination of all kinds. If water from rain is not managed, and the leachate is not directed or collected, toxins can leak into the environment polluting creeks, stream beds and the local groundwater system.

One of the features that makes SmartDitch® ideal for landfill projects is its weight and ease of installation. SmartDitch® is easily transported to the jobsite and can be handled with minimal equipment. Each SmartDitch® section can be moved into place with one or two people, allowing for manoeuvrability in rugged or steep terrain. It is designed to utilize the surrounding soil for support and is easily installed with supplied anchoring system and assembly hardware. SmartDitch® offers the added benefit in Landfills, especially capped Landfills, of flexibility of the system. The flexibility of SmartDitch® can easily accommodate the settlements which occur in Landfill caps where more rigid, concrete or rock lined, channels cannot.

The 300mm deep SmartDitch® system was chosen by a North Queensland Council to provide surface drainage and runoff from such a Landfill cap. There were two runs installed at variable grades approaching 1 in 3 maximum and traversed from near the top of the crested landfill down to an outlet near the natural surface.
The decision to use SmartDitch® was based on the system's flexibility, its inherent environmental qualities to withstand the rigors of a harsh environment, its ability to withstand erosive forces in a clay material that is easily eroded and ease of installation.

**Figure 3:** ***Trench Excavation and* SmartDitch® *Installation***

Because of the hard and compact nature of the clay capping the Smartditch was installed utilising a hand held impact driver to secure the anchorage system.

**Figure 4:** ***SmartDitch® Installation***

## 3.2 Shoalhaven Council, Raglan Street Case Study

Following severe localised flooding, Shoalhaven Council was approached by a property owner to find an effective stormwater management solution for a flooding and erosion problem in Raglan St. Culburra Beach.

**Figure 5:** ***The Existing Drainage Problem***

The Megaditch system was chosen as a cost effective alternative to a concrete box culvert design. The expandable channel-lining system has an adjustable sidewall design which allows it to conform to a variety of slope gradients.

The Raglan St project was specifically designed and proposed using site-specific criteria and Council requested the entire channel length of 128m be divided into three sections which incorporated two separate box culverts which acted as residential property accesses. Using Mannings formula and the relevant Mannings Coefficient of 0.022 for Megaditch, calculations were performed and a base width of 1.83m and wall height of 600mm was selected. The engineered adjustable sidewalls were specific to this application and enabled a variable wall height over the length of this channel.

**Figure 6:** ***Construction of the Megaditch Channel***

**Figure 7:** ***Box Culvert Residential Property Accesses***

The Megaditch standard colour is black but can be produced in a range of other colours and Shoalhaven Council selected a green colour for this project. The ultimate decision by Shoalhaven Council to select Megaditch was based on its ease of installation and it's lightweight deep ribbed profile which provided strength and flow control to minimise further channel erosion.

## 4.0 CONCLUSION

The versatility of SmartDitch®, makes it the best solution for many applications. The multiple sizes and fittings make designing for even the most complex situation cost effective and easy. In addition to traditional channel design, the SmartDitch®, system is often specified to form defined channels to control erosion and catch loose sediment. SmartDitch®, is also used for both permanent and temporary applications, and in-ground, as well as above-ground, temporary flow diversions.

## 5.0 ACKNOWLEDGEMENTS

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## 5.0 REFERENCES

*Some sample references for books and websites and the layout is provided below.*

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http://www.smartditch.com/about-us.html

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