

Geosynthetics: How it all began...

In **1957**, after a tropical storm had caused severe beach erosion at the Florida home of the president of **Carthage Mills**, he joined forces with engineers from the *Coastal Engineering Lab* at the *University of Florida* to protect his property against future storms. They eventually developed a tough woven synthetic filter fabric with design properties that permitted water to pass through while holding back sand and particles. In the spring of **1958**, a revetment of interlocking concrete blocks was constructed using this innovative plastic material in place of a much more costly and ineffective graded granular filter. This marked the *first time ever* that a filter fabric had been used in a waterfront structure.

Carthage Mills then persuaded the late **Robert J. Barrett** to head up a commercial venture to perfect and market this new concept. Barrett set out to educate the many districts of the *US Army Corps of Engineers (USACOE)* and consulting engineers around the world on the benefits of using these new materials. At that time, the standard practice for shoreline erosion protection was limited to articulated concrete blocks, the deployment of large sand bags, concrete and sand filled mattresses, concrete block mattresses, membranes, gabions, and all – sometimes with and sometimes without – the *graded granular filter*.

The early years were very discouraging. By **1960**, Carthage Mills had sold only nine projects, but momentum was beginning to build and their use more widespread. In **1962**, the *USACOE* finally agrees to begin construction on a series of experimental projects to determine the overall effectiveness of Carthage Mills' fabrics and innovative methods of construction. The first sites on the Mississippi and St. Francis Rivers were carefully selected by the Corps “...in order to test the filter materials under the most extreme conditions possible”. After three years, the “*Results*” and “*Conclusions*” in the Corps' official technical reports were unanimous in recognizing Carthage Mills' fabrics and their recommended construction techniques as “*superior*” to every other method currently being employed by the Corps. As a result, the program was extended, additional sites were selected and evaluations would continue for an additional seven years.

As Barrett continued his work with the Corps, his **1966** presentation at the *International Conference on Coastal Engineering* in Tokyo, Japan of a paper titled “*Use of Plastic Filters in Coastal Structures*” was a significant turning point in designer's and owner's attitudes. At this time, Carthage Mills was still alone in its endeavors, and until **1967**, had the *only* plastic filter cloths available on the market. By this time, Carthage Mills had printed their 3rd and final version of the world's *first* “*Filter Handbook*” which was long referred to as the “*bible*” or “*the Book*” by engineers and contractors worldwide for the design and construction of erosion control systems such as revetments, seawalls, jetties, channel linings, breakwaters and more.

In **1972**, after extensive urging and teaching by Carthage Mills, and *ten years* of the experimental projects completed, the *USACOE Waterways Experiment Station (WES)* in Vicksburg, Mississippi issued their *first* comprehensive specification for filter fabrics including test methods still used today in essentially their original form for *percent open area*, *permeability*, *apparent opening size* and *gradient ratio* to measure a fabric's resistance to clogging. This work added considerable credibility to designs incorporating woven plastic filter cloths.

By **1976**, Carthage Mills' fabrics had been used in over 3500 projects in 49 states and 26 foreign countries, and Barrett was recognized as the “*father of filter fabrics*”. During this period, Barrett had also pioneered the use of filter fabrics in other areas – e.g. French drains, scour protection around bridge piers, fabric wrapped perforated pipe, and the fabric encapsulated sandcore breakwater.

A major breakthrough for the use of “*geotechnical fabrics*” in other applications occurred in **1978-1979**. Carthage Mills, working with the *USACOE*, participated in the construction of a full-scale embankment test section at Pinto Pass, Mobile, AL. Data obtained from this study were used to develop the *first* effective design criteria and construction techniques for “*fabric-reinforced embankments on extremely soft soils*”. This opened new frontiers for design engineers in the potential future uses of these fabrics.

Those first woven filter fabrics, many of which are still in service today, were the forerunners of a modern industry known as “*geosynthetics*”, and their innovative uses continue to spawn new ideas in both products and design in civil engineering. Today, the many benefits of geosynthetics and their applications are endorsed by contractors, engineers, universities, and governments the world over. And it all started with **Carthage Mills** – the company that truly *pioneered* an industry!

