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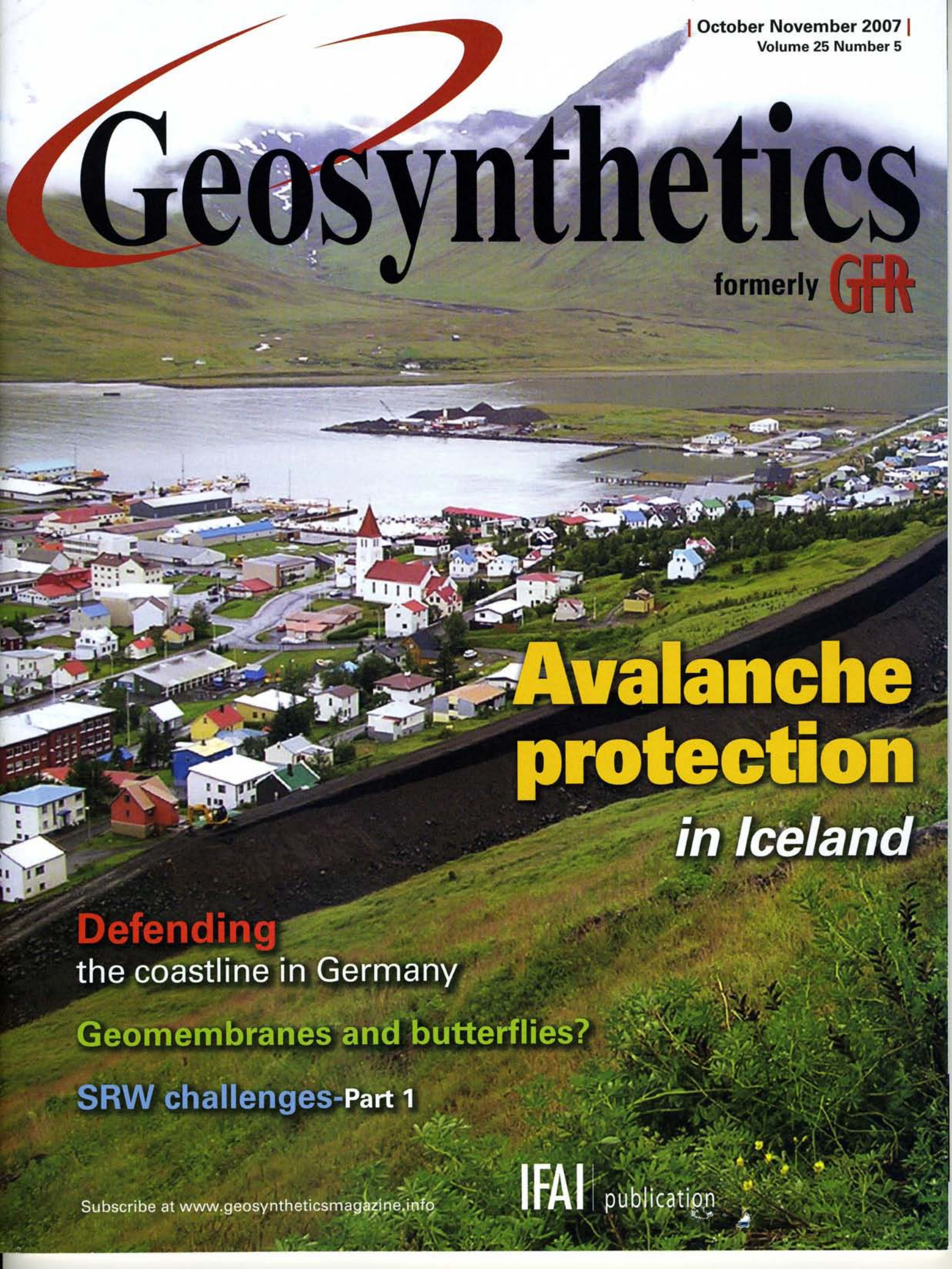

Avalanche protection *in Iceland*

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Photos courtesy of Presto Products Co.

Siglufjördur: The historic architecture, colorful rooftops of the upper town, the harbor, and the awe-inspiring panorama provide a photographic setting.

Using geosynthetics for avalanche protection in northern Iceland

One of the northernmost towns in Iceland, while picturesque, sits at the base of avalanche-prone mountainsides.

Tiny Siglufjördur—population about 1,400—has sought to have this situation addressed for years. But a final answer—a reinforced-soil avalanche-barrier system—was implemented only recently.

The beginnings of the latest earth-retention system was installed in 2005—a soil-stabilizing solution, and ideally, an avalanche protection barrier. It is the first time that this geocell product has been used for such an application.

Siglufjördur is on the northern coastline of Iceland, about 40km (25 miles) from the Arctic Circle on the Greenland Sea. The town is situated at the head of a fjord of the same name (Sigluffiord), surrounded by the 3,000-plus-ft. towering slopes of the Tröllaskagi mountain range.

Because of the location, Siglufjördur and the nearby mountains receive significant precipitation. Annual snowfalls totaling 40-60in. or more are common. And many years, residents have been evacuated for fear of damage from avalanches during winter months.

Ron Bygness, editor of *Geosynthetics*, contributed to this article.

| An earth-retention system is now in place as an avalanche protector near the municipality of Siglufjördur in northern Iceland. The town rests at the base of steep mountainsides that are covered with snow for much of the year. Five barrier systems, each more than 1 mile long and 15-20ft high, were used to create the avalanche protection barriers.

| Siglufjördur's dwindling population still depends on the sea for work, and the village enjoys a dramatic setting beside a small fjord at the northern tip of the Tröllaskagi mountain range.

Installation criteria included: soil conditions, availability of backfill, budget, and aesthetics.

Historically, avalanches have posed a threat to the people of Iceland. In 1995, 2 avalanches killed 34 people in Sudavik and Flateyri in the northwestern Iceland region called West Fjords. Both communities are west of Siglufjördur.

The last deadly avalanche in Siglufjördur occurred in 1919, when 18 people were killed. Since that time, frequent avalanches have caused extensive property damage to the town. In an effort to ensure the safety of the residents of the village, Icelandic authorities took measures to protect Siglufjördur against the possibility of another deadly natural disaster.

VSO Consulting, an Iceland-based engineering design firm, selected the geocell earth-retention system for the

The protection system's outer walls, when filled with soil provided an environment to support native vegetation.

avalanche barriers. "The plan was to use a concrete retaining wall, but then VSO decided to look for something more environmentally and aesthetically suited for the area, since the barrier would be located on the slopes facing houses in the village," said Gary Bach, business unit manager for Presto Products Geosystems. "VSO found the product while searching the Internet ... it met the criteria, plus it offers a long-term solution for deflecting snow away from the village."

Among the key criteria for selecting this type of installation were: soil conditions at selected sites, availability of suitable backfill materials, project economics, and the desired aesthetics of the completed site.

An initial portion of the avalanche-protection project was completed in December 2005. But additional barrier sets followed, including current construction that will continue through next year. All told, the project involves the installation of 5 barrier sets, each more than a mile long and 15-20ft high.

"The system provides a sustainable solution to soil-stabilization problems," said Dan Senf, an engineer and director of business development for Alcoa Geosystems.

"Manufactured from polyethylene, the system's outer cells, when filled with site topsoil, provided an ideal environment to support native vegetation. In addition, the material is much faster to install than comparable earth-retention systems, such as concrete," said Senf, who provided on-site construction start-up support.

The multi-layer design of the geocell material makes it adaptable and capable of meeting a wide range of applications. The system has proven quite versatile, providing solutions to other earth-retention problems ranging from stabilizing roadway embankments to the construction of retaining walls.

Project Highlights

Protection structures against snow avalanches in northern Iceland

Clients: Icelandic Ministry for the Environment and the town of Siglufjördur
Expected completion: 2008-2009
Location: Siglufjördur, Iceland
Objective: avalanche protection for the town
Construction manager: VSO Ltd. Consulting Engineers, Reykjavik
Construction company: Sudurverkl Ltd.
Landscape architects: Landslag (Reynir Vilhjalmsson), Reykjavik
Consultants: Thorsteinn Johannesson, Iceland Meteorological Office
Geosynthetic materials: Geoweb by Presto Products Co.