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The Crissy Field Drainage Improvement Project was undertaken to alleviate flooding problems upstream in the Crissy Field and Mason Street areas of San Francisco. The work had the potential not only to disrupt marine wildlife but its habitat as well. Photos: Elastec.

Behind the curtain

Geosynthetics make an impact in a large marine construction project near the Golden Gate Bridge.

BY JAKE KULJU

Marine construction projects often come with a unique set of obstacles. In addition to the challenge of building stable structures in and under water, the environmental impact of construction must be limited. Creative and inventive methods for mitigating environmental contamination range from artificial habitat creation to coral relocation at construction sites. The use of geosynthetic materials has proven to be one of the most cost-effective and efficient methods for limiting environmental contamination during marine construction.

A high-profile marine construction project completed for the California Department of Transportation (Caltran) near San Francisco's fabled Golden Gate Bridge in the fall of 2015 required some unique environmental considerations of its own. The Crissy Field Drainage Improvement Project was undertaken to alleviate flooding problems upstream in the Crissy Field and Mason Street areas of San Francisco. The stormwater drainage outfall pipe near the Golden Gate Bridge needed to be extended and widened to prevent blockage from sand and other sediment buildup from stormwater drainage.

The buildup of sand from tidal activity and weather events regularly buried the pipe, necessitating frequent excavation. The project aimed to increase drainage capacity to accommodate stormwater runoff from the Presidio Parkway improvement, and was designed to take into account a 50-year projected sea level rise of 22 inches and beach accretion levels resulting from that rise.

A GEOSYNTHETIC SOLUTION

Home to several different species of fish, including green sturgeon, steelhead trout, salmon and smelt, the San Francisco Bay is a sensitive marine habitat that could have been negatively affected by construction activity. The Crissy Beach area habitat consists of natural northern foredunes—coastal dunes that host native beach vegetation, including sand-verbena, beach strawberry and beach primrose. This habitat is important for the snowy plover, which rests and forages in the foredune habitat from August through April.

The work had the potential not only to disrupt marine wildlife, but its habitat as well. To protect the underwater environment during the project, an ELASTEC Type III RuffWater Screen turbidity curtain was installed. The curtain minimized the impact of construction by reducing silt flow from dredging and construction activity.

Hanging curtains

Turbidity barriers, also known as turbidity curtains, are designed to restrict sediment-laden water from storm drains and runoff in construction sites by keeping sediment contained in a limited area, allowing it to settle before spreading to surrounding waters.

They can be designed to float in place or be staked. Floating turbidity curtains offer more options, especially for large construction areas in tidal waters. Floating curtains use a top flotation boom and a bottom steel chain. Top and bottom are sealed inside a fabric hem; curtain sections can be attached through grommets with ropes or nuts and bolts. Filter fabric is inserted between the top and bottom of the curtain, retaining silt and sediment while allowing water to pass through.

"Floating fabric turbidity curtains have a minimal effect on the environment," says Linda Henning, marketing director at Elastec, Carmi, Ill. "This was of concern due to National Parks Service jurisdiction of this project." Elastec's RuffWater Screen is specifically designed for use in demanding waters, including the tidal area of the Crissy Field drainage project. The screen is able to control the migration of silt and turbid water in the construction zone. By intercepting debris and slowing the movement of rough water, it helps keep marine wildlife and habitat safe and intact.

The Elastec RuffWater Screen consists of a yellow 22-ounce PVC curtain frame, with Mirafi FW404 filter fabric for the curtain itself. "The 22-ounce PVC provides strength, and the filter fabric creates a skirt," Henning says. The Mirafi® filter fabric, manufactured by TenCate Geosynthetics Americas, Pendergrass, Ga., is woven with high-tenacity monofilament polypropylene yarn. The geotextile is inert to biological degradation, resists naturally encountered chemicals, and is designed for stability to ensure the yarns retain their relative position.

Mirafi fabric is specifically designed for engineered filtration. It resists clogging while maintaining flow rates in tidal conditions and has a high survivability rating in aggressive installation and loading conditions. The durable 34-mil fabric has a tear strength of 150/165 pounds, a tensile strength of 3,000 pounds per foot, and is manufactured with highly UV-stabilized monofilament and multifilament fibers to provide uniform opening size while maintaining predictable long-term flow rates. TenCate's FW-series geotextiles, including Mirafi, are also used underneath rip rap or concrete revetment systems along inland waterways and coastal shorelines to protect spillways and cut-off drains. These design specifications made it an effective solution for the Caltran project. Five hundred feet of the eight-foot skirt curtain was configured in a U shape to encompass the work site.

The curtain is designed to both float and be anchored in position. A flotation tube is sewn into a sleeve at the top of the curtain, fastened in sections with marine-grade aluminum universal connectors. A cable runs below the flotation tube along the length of the curtain, connected every 50 feet with eyebolt anchors. The curtain sections are laced together through grommets on both ends of the seam. The bottom of the curtain is tensioned with a ballast chain sewn into the bottom sleeve of the curtain, which also adds weight and stability to the geotextile.

PROTECTING THE ENVIRONMENT

The Crissy Field Drainage Improvement Project took place in a National Park Service jurisdiction, making it a uniquely challenging undertaking. The potential environmental impact was of concern to the National Park Service, the local media and the local population. "If any plumes of sediment escaped the work area or any marine life would have been harmed, the project would have been shut down," says Henning. The turbidity barrier helped Power Engineering Construction Co., Alameda, Calif., perform its work with minimal environmental impact.

According to Henning, the use of a Type III curtain is required in tidal construction areas. "Our RuffWater Screen offers support cables on both sides of the curtain to support it in tidal flow," she says. "With the wind and waves in the San Francisco area, we needed to use a heavy-duty turbidity curtain that could withstand the possible conditions." In addition to reducing the movement of sediment in the bay, the turbidity curtain, working in tandem with an air bubble system, also helped to reduce noise pollution in the marine environment.

The turbidity curtain made environmental mitigation possible *before* the construction project rather than after. Mitigation performed after a project is often much more expensive than preventative techniques and produces a questionable return of ecosystem services. Elastec also sent employees from its Floating Barrier division in Cocoa, Fla., to ensure a successful installation of the curtain.

As environmental conditions become more fragile and demanding, geosynthetic solutions like the Elastec turbidity curtain play an increasingly important role in the way we interact with our surroundings. Best practices in underwater construction zones will likely continue to incorporate geosynthetics to minimize impacts to marine and tidal habitats.

Jake Kulju is a Minneapolis-based freelance writer.

By intercepting debris and slowing the movement of rough water, the Elastec RuffWater Screen helps keep marine wildlife and habitat safe.

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