The challenge of managing sediment input, transport, and subsequent output dominates coastal concerns within the several units of Gateway National Recreation Area (NRA) (Fig. 1). Driven by a generally persistent direction of functional incident waves at the local level, evolution of the coastal geomorphology in the units of Gateway NRA is constrained by the factors affecting input sediment supply to the unit boundary, to the transport mechanisms within the units, and to the elements of sediment manipulation. Some portions of the units have a process-response relationship in a quasi-natural system without impediments to sediment transfers, whereas other portions have groins, jetties, and bulkheads that direct or limit dimensions of the geomorphological responses and resulting features.

Figure 1. Locations of sediment management issues within Gateway NRA, adapted from Psuty, et al. (2010a).

A program of standardized monitoring on 1-D, 2-D, and 3-D coastal features under the impetus of the NPS Inventory and Monitoring program (Psuty, et al. 2010b; Psuty et al. in press) is generating data sets on dimensions on the temporal and spatial vectors of changes within Gateway NRA. Analyses of the survey results reveal a recurring condition of sediment deficit near the updrift boundary of the Gateway unit.
transitioning to an area of sediment surplus toward the downdrift terminus. Effects of erosion at the updrift locations are exposing elements of the infrastructure to damage, whereas the effects of accumulation are altering habitats and producing shoals in navigation channels and marina basins.

Sediment budgets at the local levels establish the scale of impacts and offer a means to ameliorate the effects. At Sandy Hook, a negative sediment budget on the order of 20,000 – 40,000 m³/yr in the southern portion of the Hook grades northerly (downdrift) to a near equilibrium budget, and then (continuing downdrift) to a positive sediment budget of about 30,000 m³/yr. At Great Kills, sediment input to the park is totally eliminated by a series of groins, a very long outfall pipe that serves as a terminal groin, and a headland (Okulewicz and DiGuardia 1984). The result is a negative sediment budget of about 5,000-10,000 m³/yr at the updrift portion of this coastal zone, and a gradual decrease in sediment loss, transitioning to accumulation toward the downdrift terminus. The terminus is a jetty bounding a navigation channel. The jetty has accumulated sufficient sediment to completely fill the collection area and sediment is now spilling over the jetty, creating a beach on the downdrift side, and extending into the adjacent entrance to a major marina basin. At Plumb Beach, a dredged navigation channel has effectively cut off the ambient sediment supply and the present condition is a consistent displacement of about 2,500 m³/yr from the central portion of Plumb Beach predominately toward the east. Erosion at the central portion is damaging a multi-use path and endangering other infrastructure while downdrift deposition is extending over a very scarce wetland resource and diminishing associated habitats. Although Breezy Point is at the downdrift of a periodically-renourished beach (Kassner and Black 1984), very little of the sediment arrives at the Park because of a series of groins and a very high and long terminal groin at the public/private border. The eastern portion (updrift) of Breezy Point has a negative sediment budget that has removed all of the buffering dunes and high berm seaward of park infrastructure. The negative sediment budget extends downdrift for about 6 km before reaching the terminal jetty defining the end of the barrier island. The jetty is full and sediment overtops and extends around the jetty to accumulate in the navigation channel.

In each of these park units, issues accompanying negative sediment budget are succeeded downdrift by issues of positive sediment budget, each with their own suite of impacts. Sediment management in the form of treatment of the alongshore variations in sediment budget is being addressed at several levels. At Sandy Hook, a buried pipeline is currently in place and is in the testing stage for backpassing beach sand from areas of shoreline progradation updrift to areas of loss. At the other sites, smaller projects are being considered to balance the sediment budgets by moving sand via a number of means from areas of accumulation to areas of loss. Throughout the Park, the management program calls for a holistic approach to issues of sediment supply and the geotemporal variations in coastal sediment budgets.

References