Cobble Beach, Berm, and Dune Enhancements: Pacific Coast, OR

Region: West Coast
Coastal Risks Addressed: Erosion, wave runup, flooding

Oregon DOT designed several nature-based solutions for the purpose of protecting the Oregon Coast Highway (U.S. 101) from the impacts of extreme events and coastal bluff erosion (ODOT 2017). The Oregon Coast Highway is an important 363-mile-long coastal transportation corridor connecting the States of California and Washington. The highway, in many places, runs along high cliffs and beaches, and through State Park lands. In many places, there is limited space between the shoreline and roadway, making many forms of roadway management and maintenance more difficult. The limited space and easement constraints favor a protection strategy; however, Oregon's coastal and land-use policies require completion of a complicated regulatory exceptions process when coastal armoring is necessary. Oregon DOT worked collaboratively with regulatory and resource agencies, as part of this process, to develop a suite of nature-based solutions that existing rules and regulations would allow.

Oregon DOT focused on three sites vulnerable to erosion, surge, and wave runup in Lincoln County (see location overview on Figure 5-24). These sites represent a small fraction of the more than 20 miles of coastal highway that Oregon DOT identified as highly vulnerable to coastal bluff erosion and wave attack. The conditions at the three subject sites are, however, representative of the many constraints and vulnerabilities found at other locations along U.S. 101. The three sites chosen for this study were Beverly Beach to the north of Newport, and Lost Creek and Ona Beach to the south of Newport. The diversity of sites allowed Oregon DOT to address unique constraints, as well as the timeliness of resilience enhancements. The Beverly Beach site required more immediate intervention, while the Lost Creek and Ona Beach sites were of concern over a longer timeframe.

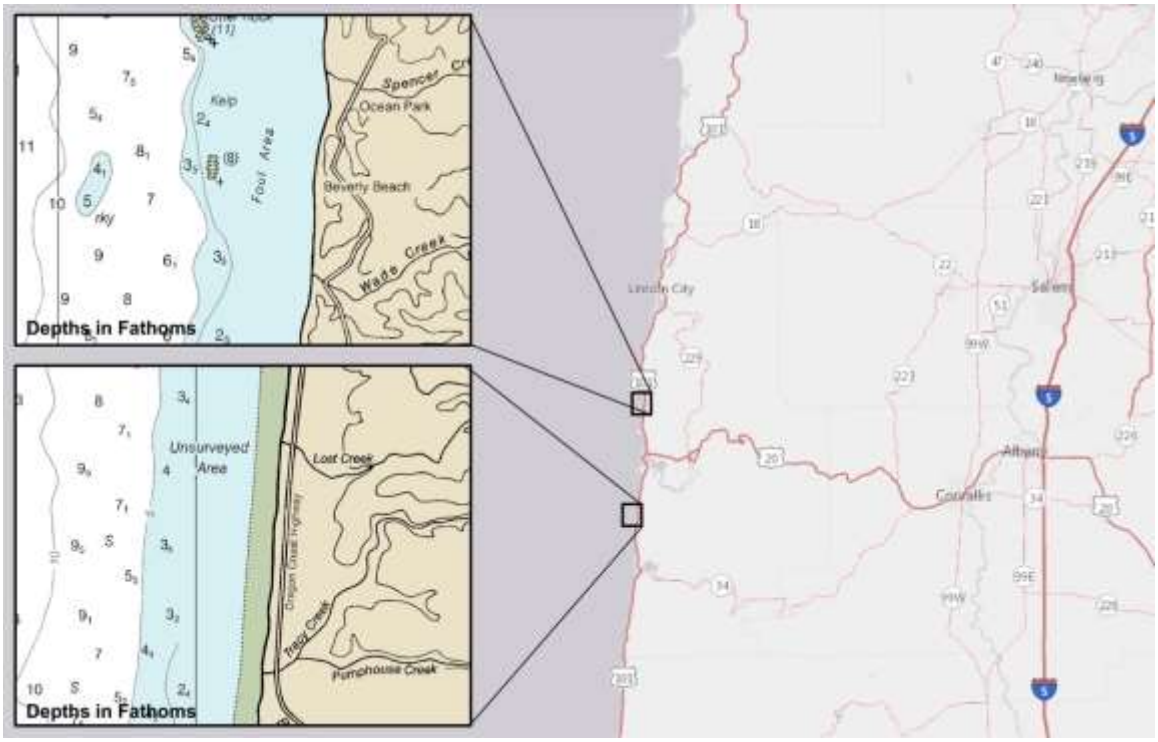

Figure 5-24. Oregon coast location overview (NOAA Nautical Chart 18561 inset, depths in fathoms).

Oregon DOT capitalized on their previous research on dynamic revetments to inform many of the nature-based designs for their study. The Oregon coast consists of natural cobble beaches in many locations. These cobble beaches provide a natural form of wave protection along the backshore and respond to extreme events in a dynamic manner that makes them resilient to ocean forcing. Given its exposure to Pacific Ocean swell and storm waves, and deep offshore depths, nature-based solutions along the Oregon coast are more constrained than they are along sheltered shorelines. Oregon DOT selected a high-range sea level rise scenario to 2050 along with a 100-year return period storm event as the basis for their design—an extreme set of requirements for nature-based solutions.

Oregon DOT designs focused on replicating the naturally occurring beach materials and morphologic features, while incorporating structural features to enhance the resilience of the natural system and their transportation infrastructure. Each design incorporates a restored cobble beach with some other protective or stabilizing feature to address the vulnerabilities and hazards unique to a specific site:

- **Beverly Beach** is currently very narrow, affected by high energy waves, and lacks substantial sand input from natural processes. The highway is threatened by coastal bluff erosion at this site. The hybrid design for this site includes a cobble beach covering large stone keyed in with piles at the toe of the coastal bluff (Figure 5-25). Bluff slope stabilization is achieved using a mechanically stabilized earth (MSE) wall with planted terraces. The total cost estimate is $41 million for the 2,100-foot-long project, resulting in a unit cost of approximately $19,500 per linear foot.
- **Lost Creek** is a low-lying portion of U.S. 101 vulnerable to flooding, storm surge, and sea level rise. The highway at this location has experienced overtopping during significant

storm events in the past. The nature-based design selected for this site includes a cobble beach seaward of an artificial dune (Figure 5-26). The total cost estimate for this 600-foot-long repair, including the cost of replacing a culvert on the opposite side of the road, is $2.8 million. The approximate unit cost is $4,700 per linear foot.

- **Ona Beach** is another low-lying portion of U.S. 101 just south of Lost Creek. The vulnerabilities and hazards at Ona Beach are like those at Lost Creek. The site-specific design here incorporates a cobble beach, MSE slopes, and a core of sand-filled geotextiles (i.e., geotubes) for added stability (Figure 5-27). The total cost estimate for this 1,150-foot-long repair is $5.9 million, resulting in a unit cost of approximately $5,000 per linear foot.

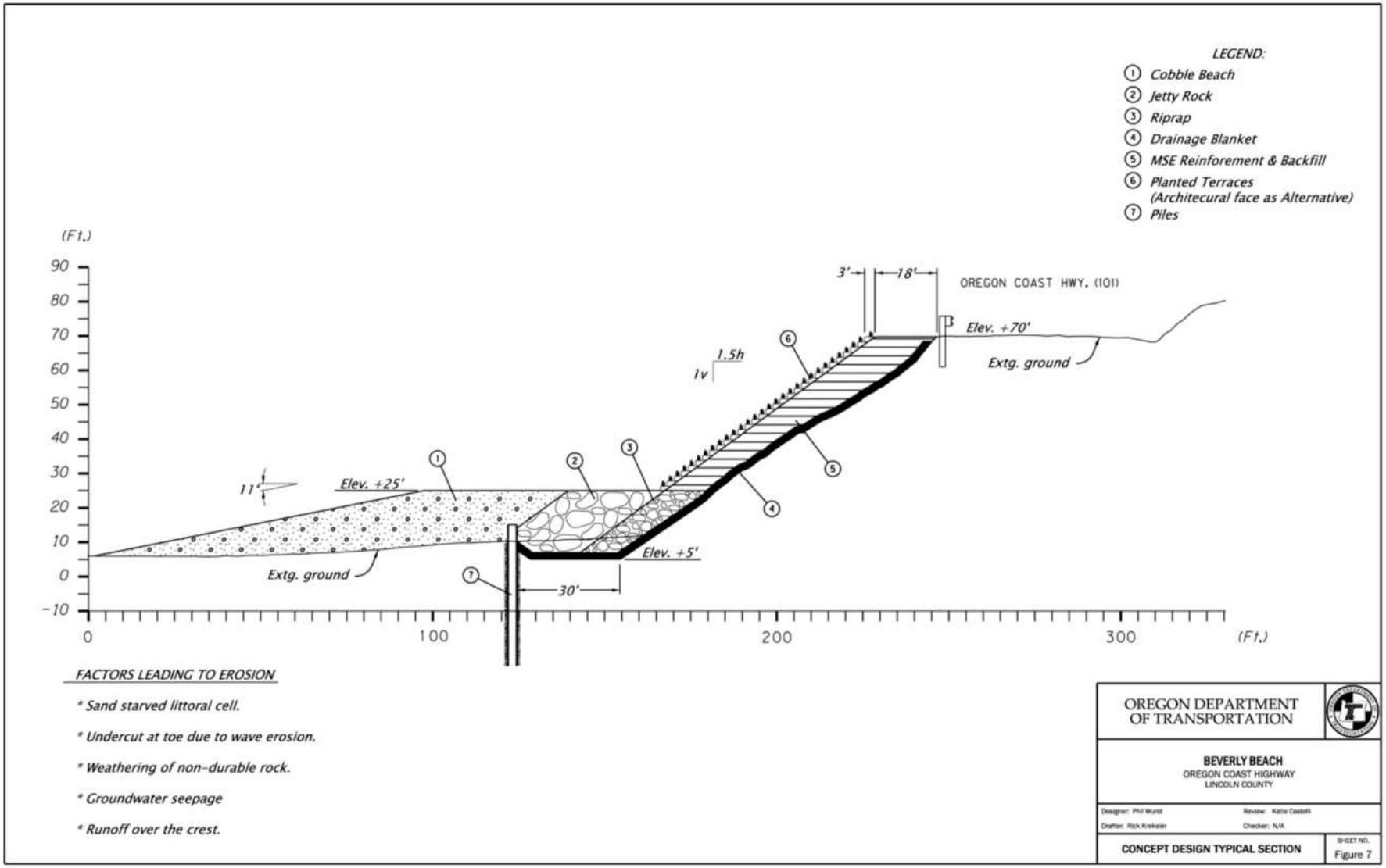

Figure 5-25. Cross-section diagram of the nature-based protection at Beverly Beach, OR (ODOT 2017).

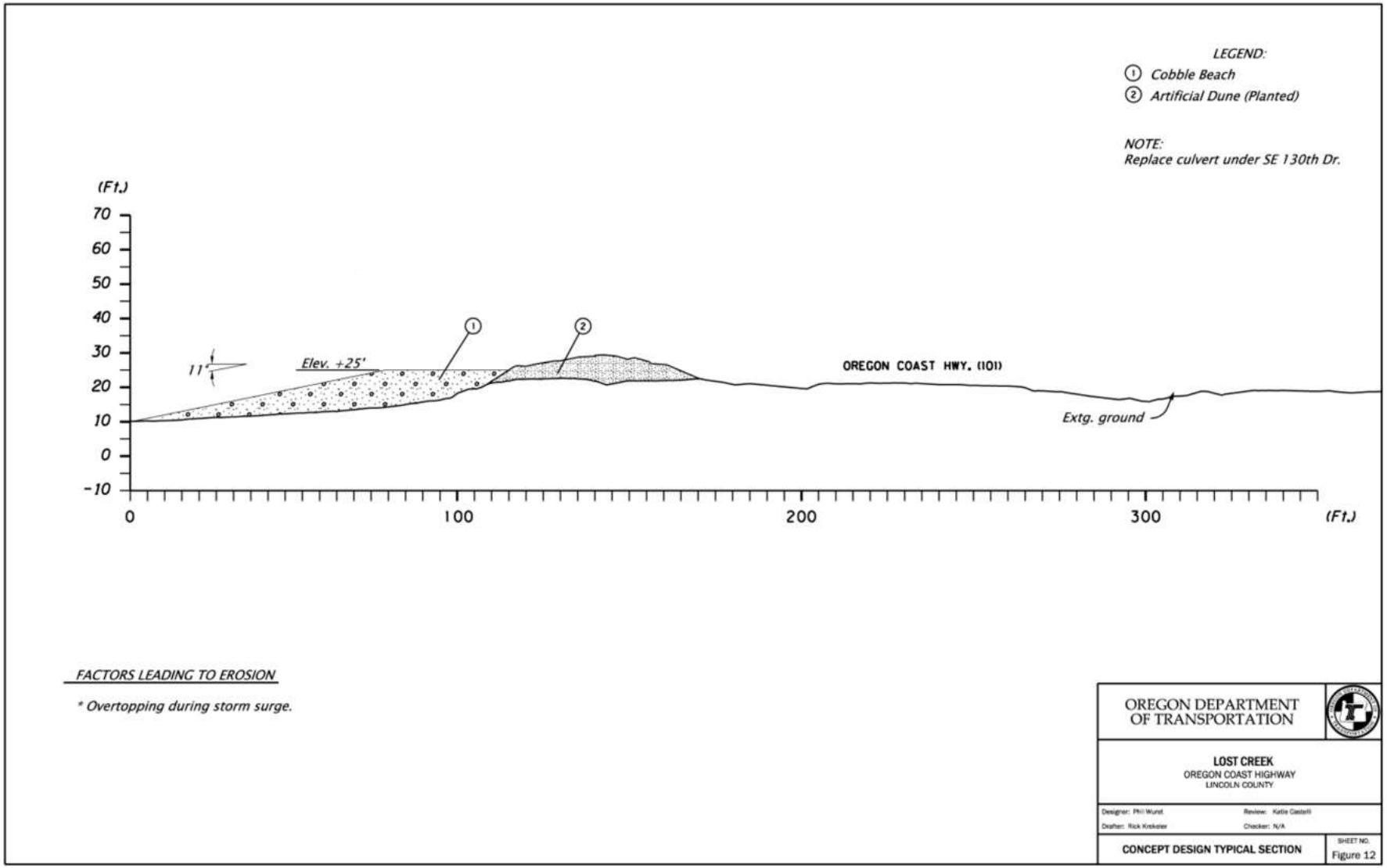

Figure 5-26. Cross-section diagram of the nature-based protection at Lost Creek, OR (ODOT 2017).

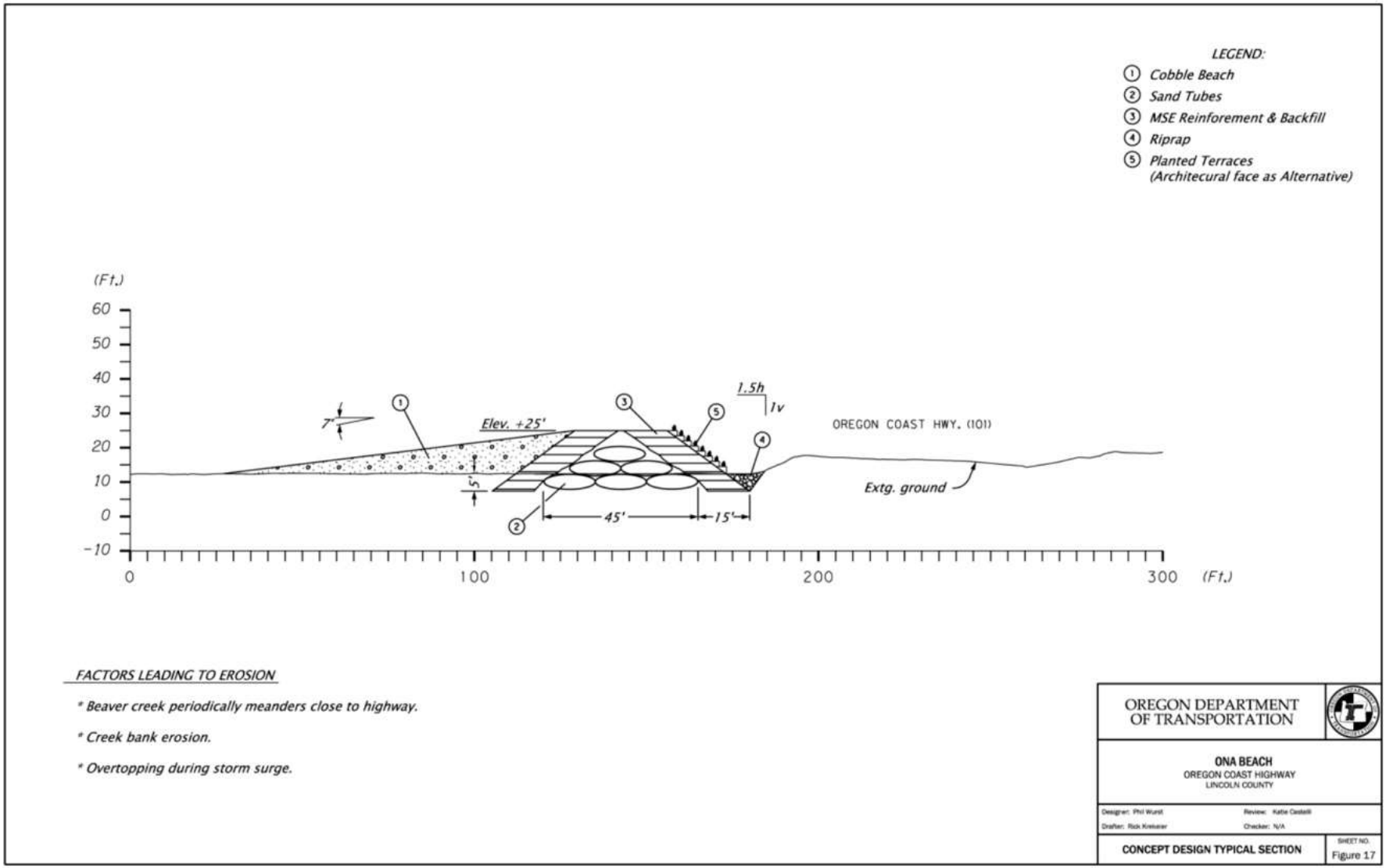

Figure 5-27. Cross-section diagram of the nature-based protection at Ona Beach, OR (ODOT 2017).