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Comment #	Comment
0034929-018	Wetlands are defined as areas of land with poorly to very poorly drained soils; they remain wet for part or all of the year. Wetlands can occur almost anywhere, from coastal and tidal areas, to riparian areas, and even at high elevations. Because the hydrologic system is a continuum, impacts to one part also impact the contiguous parts. Roads built through wetland ecosystems often have severe impacts (Adamus and Stockwell 1983, McCleese and Whiteside 1977, Winter 1988). In addition to direct hydrologic impacts, roads cause significant indirect effects by altering vegetation, changing available habitat for wildlife, especially migratory birds. Wetland function is driven by forces such as solar energy, wind and hydrologic forces (including tides, gradient currents, run-off and groundwater). Roads interrupt these forces, altering wetland hydrology (Adamus and Stockwell 1983). Basic research on roads and wetlands has found the following road-related wetland impacts: -- concentrating and accelerating sediment runoff (particularly from construction); (Adamus and Stockwell 1983; Zeedyk 1996); -- fill including alteration of circulation and movements of fish and wildlife; (Adamus and Stockwell 1983); -- channel straightening, deepening and widening; (Adamus and Stockwell 1983; Zeedyk 1996); -- water level increases or decreases, (most result from inadequate culverting, water table disturbance, or accelerated runoff); (Adamus and Stockwell 1983; Zeedyk 1996); -- constraining and diverting surface and subsurface flows and intercepting groundwater flow; (Zeedyk 1996); -- increasing sediment loading; (Zeedyk 1996); -- clearing vegetation and conversion to barren road surfaces and facilities; (Adamus and Stockwell 1983; Zeedyk 1996); -- reducing habitat or displacing wildlife; (Adamus and Stockwell 1983; Zeedyk 1996); -- introducing toxic runoff; (Adamus and Stockwell 1983; Zeedyk 1996). Even when culverts are properly installed, roads act as dams, altering water flow from one side to the other (Winter 1988). This can result in flooding on one side of the road and drying out on the other, altering vegetation and associated species. Roads also can cause subtle changes to hydrologic flow that appear only in extreme conditions. For example, roads can reduce nutrient transport during infrequent (25 year) storm events. Such storms may indirectly be critical to the productivity of downstream fishery food chains (Adamus and Stockwell 1983). Though roads can cause inadequate drainage, they also can cause excessive drainage (by constructing drains and channels too deeply, for example), leading to a drying out of the wetland. This can lead to fire hazards on organic soils, or altered vegetation composition (McCleese

and Whiteside 1977). Drier conditions favor upland plants over wetland plants, which once established, often take over, even if normal flooding regimes return (McCleese and Whiteside 1977, Thibodeau and Nickerson 1985, Zeedyk 1996). This is significant because short-term alterations of flood cycles can have substantial and long-lasting effects on wetland vegetation (Thibodeau and Nickerson 1985).

Roads affect groundwater and 'recharge wetlands' (wetlands that help recharge local groundwater systems) by decreasing water availability through storm sewering (Winter 1988) and reducing groundwater recharge (Zeedyk 1996). Water quality also is impaired by roads and run-off. Nutrients, chlorides, heavy metals and organic chemicals enter groundwater from road run-off (Ehrenfield and Schneider 1991). According to one study on development in the Jersey pine barrens, 'engineering features located within or near the study sites, including dams, drainage ditches and channelized streams, had a greater impact on the hydrology of the wetlands than did the presence of roads, septic systems or storm sewers' (Ehrenfield and Schneider 1991). Clearly, a dam will have a stronger impact than a road, but road impacts are significant, nonetheless.