Setting Buffer Sizes for Wetlands

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The lands surrounding a wetland are critical to its survival. These buffer areas protect a wetland's water quality and serve as habitat for wetland-dependent species. Local governments are often in the best position to protect these valuable resources. This article looks at the different approaches local governments take in defining a wetland buffer.

The upland area adjacent to a wetland is essential to its survival and functionality. Buffers protect and maintain wetland function by removing sediments and associated pollutants from surface water runoff; removing, detaining, or detoxifying nutrients and contaminants from upland sources; influencing the temperature and microclimate of a water body; and providing organic matter to the wetland. Buffers also maintain habitat for aquatic, semiaquatic, and terrestrial wildlife, and can serve as corridors among local habitat patches, facilitating movement of wildlife through the landscape.

Local governments that have wetlands within their boundaries have the opportunity to conserve these resource lands and to control or compensate for activities and development that might impair their ability to provide benefits to the community and the environment. As many as 5,000 local governments have taken some actions to protect at least some wetlands within their borders (Kusler 2003). In many important ways, local governments are better situated than state and federal environmental authorities to control activities on the lands that surround wetland resource areas because they are not just concerned with wetland functions, but also with surrounding land uses and the benefits wetlands provide for their communities.

We reviewed approximately 50 enacted wetland buffer ordinances and nine model ordinances, as well as several hundred scientific studies and analyses of buffer performance to identify both the state-of-the-art and the range of current practice in defining the protection of wetland buffers by local governments.

The Science of Buffers for Wetlands

In adopting a buffer and defining its dimensions, a local government must rely on good science, both to achieve effective results and to meet any legal challenges to its regulation of activities within this area. A large scientific literature examines effective buffer sizes for water quality and wildlife habitat. In general, the science shows that wide and densely vegetated buffers are better than narrow and sparsely vegetated buffers. However, the buffer size necessary to provide a particular level of function depends on the functions of the wetland, the wetland's relative sensitivity (as influenced by water retention time and other factors), the characteristics of the buffer, the intensity of adjacent land use, and watershed characteristics.

A multi-function buffer should be sized to meet all of the functions identified as being locally important.

Water Quality & Buffers

Wetland buffers protect the water quality of wetlands by preventing the buffer area itself from serving as a source of pollution, as well as by processing pollutants that flow from upland areas. Water quality benefits vary not just with the size of the buffer, but also with the flow pattern, vegetation type, percent slope, soil type, surrounding land use, pollutant type and dose, and precipitation patterns (Adamus 2007, Wenger 1999, Sheldon et al. 2005). Both the type and intensity of surrounding land uses are key factors determining the effectiveness of wetland buffers in protecting water quality. Variations in water quality have been correlated over extended distances with quantity of intense urban land use in the contributing area, forest cover, and proximity of road crossings (Houlahan and Findlay 2004, Wilson and Dorcas 2003). Intense urbanization, agriculture, and concentrated timber harvests can increase the amount of sediments and contaminants in surface runoff, cause changes in hydrology, and increase the severity of water fluctuations in a wetland during storm events. Vegetation and deep permeable soils in the buffer slow down surface flow, allow for infiltration before runoff reaches valuable wetlands, and inhibit the formation of channelized flow, improving removal of sediments and nutrients. Buffers that include both forested and grassy vegetation may be most effective at removing both sediments and nutrients, especially in agricultural areas. Buffer effectiveness, however, can be reduced over the long term by activities that destroy vegetation or compact or erode soils, causing rills and gullies. Effectiveness in the short term may diminish if sediment and nutrients are added too quickly or in chronically high concentrations.

Depending on site conditions, much of the sediment and nutrient removal may occur within the first 15-30 feet of the buffer, but buffers of 30-100 feet or more will remove pollutants more consistently. Buffer distances should be greater in areas of steep slope and high intensity land use. Larger buffers will be more effective over the long run because buffers can become saturated

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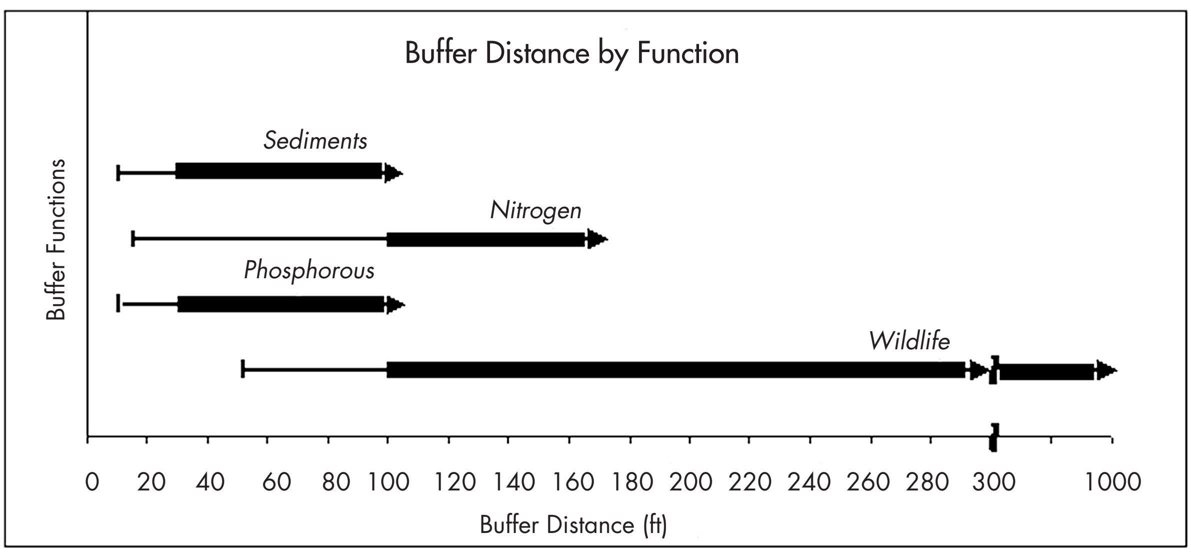
with sediments and nutrients, gradually reducing their effectiveness, and because it is much harder to maintain the long term integrity of small buffers. In an assessment of 21 established buffers in two Washington counties, Cooke (1992) found that 76% of the buffers were negatively altered over time. Buffers of less than 50 feet were more susceptible to degradation by human disturbance. In fact, no buffers of 25 feet or less were functioning to reduce disturbance to the adjacent wetland. The buffers greater than 50 feet showed fewer signs of human disturbance. Cooke concluded that the effectiveness of buffers to protect adjacent wetlands is increased when fewer lots are present, buffers are larger and vegetated, and buffers are owned by landowners who understand the purpose of the buffer. Tougher monitoring and enforcement of buffer requirements should also help.

Wildlife Habitat & Buffers

Wetland buffers maintain or serve directly as habitat for aquatic and wetland-dependent species that rely on complementary upland habitat for critical stages of their life-history (Chase et al. 1997). Buffers also screen adjacent human disturbance and serve as habitat corridors through the landscape. The appropriate buffer size for habitat functions will depend on the resident species, the life-history characteristics of the species, the condition of the wetland and the wetland buffer, the intensity of the surrounding land use, and the function the buffer is to provide. Adamus (2007) suggests that the buffer size determination consider all of the buffer functions relevant to habitat including removing pollutants, limiting disturbance by humans, limiting the spread of non-native species into wetlands, helping maintain microclimatic conditions, and providing habitat for native wetland-dependent species that require both wetland and upland habitats. The Environmental Law Institute's (2003) review of the science found that effective buffer sizes for wildlife protection may range from 33 to more than 5000 feet, depending on the species. The State Wildlife Action Plans (www.teaming.com), developed by fish and wildlife agencies in all 50 states and six territories, are good sources of relevant information on native species, species of conservation concern, and their habitat requirements. These data can be supplemented by consulting local biologists to tailor buffer sizes to specific habitat types, species, and landscapes.

Approaches to Setting Buffer Distances

There are a number of alternative approaches to setting the buffer distance—usually defined in feet measured horizontally from the edge of the defined wetland. Many ordinances simply prescribe a fixed buffer distance for all wetlands subject to the ordinance (*e.g.*, 75 feet or 100 feet). Others vary the prescribed distance depending upon the type of wetland or the quality of wetland from which the buffer is extended (*e.g.*, 75 feet from least vulnerable wetland type; 100 feet from most vulnerable). Others further vary the buffer distance to account for slope toward the wetland—requiring wider buffers where slopes are steeper because negative impacts from land-disturbing activities, including concentrated water flows, are likely to increase with increasing slope. Some or-



Effective buffer distance for water quality and wildlife protection functions. The thin arrow represents the range of potentially effective buffer distances for each function as suggested in the science literature. The thick bar represents the buffer distances that may ***most*** *effectively accomplish each function (30 - > 100 feet for sediment and phosphorous removal; 100 - > 160 feet for nitrogen removal; and 100 - >300 feet for wildife protection. Depending on the species and the habitat characteristics, effective buffer distances for wildlife protection may be either small or large.*

dinances vary the buffer distances based on the type or intensity of land use—requiring larger buffers for more intensive land uses potentially affecting the wetland area. In contrast, some ordinances require or allow the zoning administrator to establish or vary buffers on a case-by-case basis. These ordinances usually prescribe the factors that must be taken into account and the information to be supplied by an applicant, but then rely on performance standards in the ordinance to drive the buffer distance decision. In another approach, Strommen et al. (2007) suggest an ordinance that regulates the entire drainage area contributing surface or subsurface flow to sensitive wetlands, with defined buffer protections within this area.

Enacted local government buffer ordinances show a wide range of wetland buffer dimensions. The lowest we found was 15 feet measured horizontally from the border of the wetland, with the highest approximately 350 feet. Several ordinances set 500 feet as a distance for greater regulatory review of proposed activities, but do not require nondisturbance at this distance. Often the ordinances provide a range of protections, with nondisturbance requirements nearest the wetland and various prohibitions and limitations as the distance from the wetland increases. Among the ordinances we examined, the largest number of ordinances clustered around nondisturbance or minimal disturbance buffers of 50 feet or 100 feet, with variations (usually upward variations) beyond these based on particular wetland characteristics, species of concern, and to account for areas with steeper slopes. The largest ordinance-prescribed buffer distances (350 feet or more) tended to be for tidal wetlands and vernal pool wetlands.

Local governments, in general, use five approaches in defining buffer distances.

*(1) Fixed Nondisturbance Buffer***.** Some local ordinances provide for a fixed buffer distance within which disturbance activities are prohibited (or strictly limited). For example, Casselberry, Florida, requires wetland buffers of 50 feet. (§3-11) Virginia cities and counties subject to the state's Chesapeake Bay Preservation Act establish "resource protection areas" of a 100-foot vegetated buffer landward of tidal and certain nontidal wetlands, as in Petersburg, Virginia (§122-76) and Henrico County, Virginia (§24-106.3). Some local buffer ordinances are "setback" ordinances. For example, Bay County, Florida, prohibits construction of any building or structure within 30 feet of any wetland. (§1909) The Northeastern Ohio Model Ordinance provides for a 120-foot or 75-foot "setback" from Ohio EPA Category 3 and 2 wetlands, respectively. Summit County, Colorado, and LaPorte, Indiana, each provide that soil disturbances and structures are prohibited within 25 feet of a wetland. (§7105.1(A); §82-561)

(2) Nondisturbance Buffer plus Additional Setback. Some ordinances prescribe a fixed nondisturbance wetland buffer, and then prescribe an *additional* setback distance for structures from the edge of the wetland buffer. The idea is that the prescribed nondisturbance buffer protects the wetland, and that buildings should not be constructed on the buffer's edge if a functional buffer is to be maintained. Baltimore County, Maryland provides for a nondisturbance buffer of 25 feet from nontidal wetlands in accordance with the state nontidal wetlands law (75-100 foot buffers apply if associated with a stream, and 100-300 feet if a tidal wetland), but then further provides that residential buildings must be set back an *additional* 35 feet and commercial buildings an additional 25 feet *from the edge of the buffer*. (§§33-2-303, 33-2-401, 33-2-204(c), 33-3-111(d)) Charleston, South Carolina, defines "critical line" wetland buffers of a minimum of 25 to 40 feet based on zoning districts, but then further provides that all buildings must be set back a minimum of ten feet from the edge of the required buffer. (§54-347.1a3)

(3) Regulated Buffer Area with Minimum Nondisturbance Area. Another approach defines the buffer in terms of the area within which *regulatory scrutiny* will be applied to limit uses by permit or other review. Monroe County, New York, regulates a 100-foot "adjacent area" to freshwater wetlands. (§377-1 *et seq*.) Permits are required for activities within this area. Many jurisdictions supplement this regulated area with a prescribed minimum nondisturbance zone immediately adjacent to the wetland. Polk County, Wisconsin, provides for regulation of shorelands within 1000 feet of the ordinary high water mark of any navigable lake or pond or flowage, and within 300 feet of any navigable river or stream or floodplain including wetlands. It then provides *within* these fairly substantial regulated areas for a 75-foot minimum setback with a 35-foot vegetated protective area immediately adjacent to the wetlands or waters. (Art.7, 11(C)) New Lenox, Illinois, provides for the regulation of all lots lying wholly or in part within 100 feet of the edge of a wetland, while requiring a minimum nondisturbance set-back of 75 feet from the edge of the wetland (with only very minimal activities allowed by permit) and a minimum natural vegetation strip of 25 feet from the edge of the wetland. (§§38-131 to -133) Lewiston, Maine, regulates all areas within 250 feet of the upland edge of all ten-acre or larger wetlands, and requires that all structures must be set back at least 75 feet from the wetland edge with no variances, and that a "natural vegetative state" must be maintained for the first 50 feet. (§34.2) Croton-on-Hudson, New York, does this in reverse by first specifying a mandatory nondisturbance area of 20 feet adjacent to the wetland, and then the regulatory "minimum activity setback" extending an additional 100 feet from the edge of the nondisturbance buffer. (§227-3)

Massachusetts' state wetlands protection act, which is locally administered by municipal conservation commissions, provides for a 100-foot regulated buffer area, and a permit process that applies to both the buffer and the wetland. (110 Mass. Gen. L. 131 §40) Many municipalities have adopted variations on this regulatory approach. Barnstable, Massachusetts, using home rule authority as well as the state wetlands law, has added a provision that requires an undisturbed area of 50 feet adjacent to the wetland, and further provides that any structures permitted within the 100 foot regulated buffer must be located within the 20 feet of the landward margin of the buffer (viz. 80 feet from the wetland). (§704-1) Sturbridge, Massachusetts specifies various regulatory buffer areas greater than the state-required 100 feet (e.g. 200 feet for freshwater wetlands), and prescribes minimum nondisturbance areas ranging from 25 feet to 200 feet, depending upon the wetland resource. (§1.4)

Wetland Category		Standard Buffer Width (ft)
Category I:	Natural Heritage or bog wetlands	215
	Habitat score 29-36	200
	Habitat score 20-28	150
	Not meeting above criteria	125
Category II:	Habitat score 29-36	150
	Habitat score 20-28	100
	Not meeting above criteria	75
Category III:	Habitat score 20-28	75
	Not meeting above criteria	50
Category IV:		50

Sammamish, Washington, ordinance: Wetlands rated according to the Washington State Wetland Rating System for Western Washington (Washington Department of Ecology, 2004, or as revised).

(4) Matrix Based on Listed Factors. Some ordinances include a matrix of wetland types, slopes, habitats, and land use intensities, which are then used to define the extent of the buffer. For example, Sammamish, Washington, prescribes a set of buffers based on four distinct categories of wetlands initially defined by their wetland functions, and further modified by the habitat scores for each of these wetlands (see Table).

Under the ordinance, Sammamish's development department may further increase the required buffer distance by the greater of 50 feet or a distance necessary to protect the functions and values of the wetland as well as to provide connectivity whenever a Category I or II wetland with a habitat score of 20 or greater is located within 300 feet of another Category I or II wetland, a fish and wildlife conservation area, or a stream supporting anadromous fish. Required buffers may be reduced if the impacts are mitigated and result in equal or better protection of wetland functions. (§21A.50.290)

Since 1984, Island County, Washington, has had an ordinance that takes into account wetland type, wetland size, and land use zones. The County has recently revised the ordinance for new development proposals to base buffer distance which can range from 15 to 300 feet in width, primarily on intensity of surrounding land uses, habitat structure within and around a wetland (as scored with a simple checklist that landowners may use), and wetland sensitivity. The ordinance considers depressional "isolated" wetlands that lack outlets to be more sensitive to degradation due to accumulating sediment and bioaccumulation of contaminants and requires these wetlands to have wider buffers. Some wetlands surrounded by steep slopes or highly erodible soils are also required to have wider buffers. Island County also requires wider buffers for several carefully defined wetland types, due to their high ecological value or sensitivity: (A) bogs, coastal lagoon wetlands, delta estuary wetlands, mature forested wetlands, (B) large non-estuarine ponded wetlands, anadromous fish stream wetlands, wetlands associated with a bog, coastal lagoon or delta estuary, (C) other estuarine wetlands, resident salmonid stream wetlands, mosaic wetlands, and (D) native plant wetlands and small ponded wetlands. The County prepared a series of tables that show buffer widths required for various combinations of these factors (e.g., intensity of surrounding land use, wetland structure, and slope). (§17.02B.090)

Another example is Bensalem, Pennsylvania, which prescribes varying wetland buffer distances within natural resource protection overlay districts based on the underlying land use zoning. The buffer distance ranges from 20 feet in agricultural zones, to 100 feet in general industrial zones. (§ 232-57) The ordinance's standards require the buffer to be maintained in 80 percent natural vegetative cover.

(5) Case by Case Buffer Determinations. A number of wetland buffer ordinances do not specify a numerical distance, but require the applicant to submit information sufficient to allow the local government to specify the buffer distance based on performance standards. For example, Commerce City, Colorado requires that the buffer must be sized to ensure that the natural area is "preserved" and expressly provides that the director of community development may increase or decrease the buffer to meet the goals of the ordinance; however, it further provides that the buffer for wetlands will in no case be less than 25 feet. Woodbury, Minnesota, provides for a minimum native vegetated buffer of 15 feet, but further provides that the city reserves the right to require up to a 75-foot undisturbed buffer where "in the opinion of the city" the area contains "significant natural vegetation in good condition," or up to a 25-foot buffer where "useful for water quality improvement, wildlife habitat, a greenway connection, or any other wetland function or value."(§27-4(b))

Alachua County, Florida, provides for a case-by-case performance standard buffer, but also provides for a numerical default value when sufficient information is not available to support a case-by-case determination. The buffer:

shall be determined on a case-by-case basis after site inspection by the county, depending upon what is demonstrated to be scientifically necessary to protect natural ecosystems from significant adverse impact. (§406.43)

The county requires the following factors to be considered in making the case-by-case determination: 1) Type of activity and associated potential for adverse site-specific impacts; 2) Type of activity and associated potential for adverse offsite or downstream impacts; 3) Surface water or wetland type and associated hydrological requirements; 4) Buffer area characteristics, such as vegetation, soils, and topography; 5) Required buffer area function (*e.g.,* water quality protection, wildlife habitat requirements, flood control); 6) Presence or absence of listed species of plants and animals; and 7) Natural community type and associated management requirements of the buffer. (§406.43). Where sufficient scientific information is not available, the ordinance prescribes default values with an average buffer distance of 50 feet, and minimum of 35 feet for wetlands less than or equal to a half acre; 75/50 feet for wetlands greater than half acre; 150/75 feet where listed species are documented; and 150/100 feet where the wetland is an outstanding resource water. (§406.43(c)).

Crestview, Florida's ordinance provides:

The size of the buffer shall be the minimum necessary to prevent significant adverse effects on the protected environmentally sensitive area. §102-202(e)(1).

Fife, Washington's ordinance specifies buffer distances, but further provides that:

The community development director shall require increased standard buffer zone widths on a case by case basis when a larger buffer is necessary to protect wetlands functions and values based on local conditions. This determination shall be supported by appropriate documentation showing that it is reasonably related to protection of the functions and values of the regulated wetland. Such determination shall be attached as a permit condition and shall demonstrate that:
A. A larger buffer is necessary to maintain viable populations of existing species; or B. The wetland is used by species proposed or listed by the federal government or the state as endangered, threatened, rare, sensitive or monitor, critical or outstanding potential habitat for those species or has unusual nesting or resting sites such as heron rookeries or raptor nesting trees; or C. The adjacent land is susceptible to severe erosion and erosion control measures will not effectively prevent adverse wetland impacts; or D. The adjacent land has minimal vegetative cover or slopes greater than 15 percent. §17.17.260.

This approach requires more information at the application stage and also requires the administrator to have sufficient technical capacity to make a legally sufficient and sustainable choice.

Buffer Averaging and Minimum Distances

Some buffer ordinances that set specific and minimum buffer dimensions allow the local government to accept buffer averaging in order to accommodate variability in terrain or to accommodate development plans. For example, a wetland normally entitled by ordinance to a 75-foot minimum buffer may be able to tolerate a 50-foot buffer over part of its margin if a wider buffer is provided along another part. This may depend upon such issues as water flow, topography, habitat and species needs, and other factors that can best be assessed on a case-by-case basis. Port Townsend, Washington allows buffer averaging if the applicant demonstrates that the averaging will not adversely affect wetland functions and values, that the aggregate area within the buffer is not reduced, and that the buffer is not reduced in any location by more than 50 percent or to less than 25 feet. Woodbury, Minnesota allows buffer averaging where averaging will provide additional protection to the wetland resource or to environmentally valuable adjacent uplands, provided that the total amount of buffer remains the same.

Conclusion

Local buffer ordinances serve a critical role in maintaining community quality of life, management of stormwater and flooding, protection of water quality and quantity, habitat conservation, and resilience to the future effects of global climate change on local communities. In addition to determining appropriate buffer dimensions, local governments should clearly address what the ordinance is intended to do, what wetlands are to be protected, allowable activities, review procedures, affirmative obligations, and enforcement provisions when drafting a wetland buffer ordinance or bylaw.

Science should serve as the foundation for defining the dimensions of wetland buffers. But this does not mean that each community will need to commission an elaborate scientific study. A great deal of information is available from state environmental protection agencies, state natural heritage programs, and from other communities that have adopted wetland ordinances. The science summarized in this article should provide a good starting point. ■

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Congress

Chamber Action

H.R. 2419, Farm Bill Extension Act, which would provide for the continuation of agricultural programs through fiscal year 2012, was passed by the Senate on December 14.

Committee Action

H.R. 236, North Bay Water Reuse Program Act of 2007, which would authorize the Secretary of the Interior to create a Bureau of Reclamation partnership with the North Bay Water Reuse Authority and other regional partners to achieve objectives relating to water supply, water quality, and environmental restoration, was reported by the Committee on Natural Resources on December 4.

H.R. 664, Dana Point Desalination Project Authorization Act, which would amend the Water Desalination Act of 1996 to authorize the Secretary of the Interior to assist in research and development, environmental and feasibility studies, and preliminary engineering for the Dana Point Desalination Project in Orange County, California, was reported by the Committee on Natural Resources on January 17.

H.R. 2537, Beach Protection Act of 2007, which would amend the Clean Water Act as it relates beach monitoring, was reported by the Committee on Transportation and Infrastructure on December 12.

H. Res. 845, a resolution that would recognize the 60th anniversary of Everglades National Park, was reported by the Committee on Transportation and Infrastructure on January 28.

Bills

S. 2384, a bill to authorize the Chief of the U.S. Army Corps of Engineers to conduct a feasibility study relating to the construction of a multipurpose project in the Fountain Creek watershed in Colorado, was introduced by Senator Salazar (D-Colo.) on November 16. The bill was referred to the Committee on Environment and Public Works.

S. 2494, a bill to provide for equitable compensation to the Spokane Tribe of Indians of the Spokane Reservation for the use of tribal land for the production of hydropower by the Grand Coulee Dam, was introduced by Senator Cantwell (D-Wash.) on December 17. The bill was referred to the Committee on Indian Affairs.

S. 2512, a bill to establish the Mississippi Delta National Heritage Area in the state of Mississippi, was introduced by Senator Cochran (R-Miss.) on December 18. The bill was referred to the Committee on Energy and Natural Resources.

H.R. 4928, a bill to authorize the Chief of the U.S. Army Corps of Engineers to conduct a feasibility study relating to the construction of a multipurpose project in the Fountain Creek watershed in Colorado, was introduced by Representative Udall (D-Colo.) on December 19. The bill was referred to the Committee on Transportation and Infrastructure.

H.R. 5106, a bill to authorize the Marine Mammal Commission to establish a national research program to fund basic and applied research on marine mammals, was introduced by Representative Abercrombie (D-Haw.) on January 23. The bill was referred to the Committee on Natural Resources.

H.R. 5451, a bill to reauthorize the Coastal Zone Management Act, was introduced by Representative Bordallo (D-Guam) on February 14. The bill was referred to the Committee on Natural Resources.

H.R. 5452, a bill to authorize Coastal Zone Management Act grants to coastal states to initiate and complete surveys of coastal state waters and adjacent federal waters to identify potential areas suitable or unsuitable for the exploration, development, and production of renewable energy, was introduced by Representative Capps (D-Cal.) on February 14. The bill was referred to the Committee on Natural Resources.

H.R. 5453, a bill to authorize assistance under the Coastal Zone Management Act to coastal states to develop coastal climate change adaptation plans pursuant to approved §306 management programs and to minimize contributions to climate change, was introduced by Representative Capps (D-Cal.) on February 14. The bill was referred to the Committee on Natural Resources.