Appendix C.1. Water Bodies

This section contains information about the recommended subdivision design standards for water bodies.

Water bodies and their associated habitats are important to protect from new development. These areas are a limited element on the landscape (less than 4 percent of the state), yet they support the greatest concentration of wildlife species in Montana (Montana's Comprehensive Fish and Wildlife Conservation Strategy (MCFWCS) 2005), including:

- Over *one third* (196 species) of our state's terrestrial wildlife species—mammals, birds, reptiles, and amphibians—are considered "riparian/wetland obligates," which means they depend upon these areas for some part of their life cycle (MCFWCS 2005);
- Almost *half* (265 species) of Montana's terrestrial wildlife species are known to use or frequent wetland or riparian habitats (MCFWCS 2005); and
- *All* of Montana's 85 fish species depend on water bodies, especially rivers, streams, and lakes (Holton and Johnson 2003).

Montana's water bodies are also critical to the state's economy, public health and welfare, and the quality of life of citizens and communities.

Habitat Description

Montana's water bodies include rivers, streams, lakes, ponds, reservoirs, and wetlands. Their associated habitats serve as unique transition zones between aquatic and terrestrial environments. In an arid state like Montana, this combination supports more plant and animals than anywhere else in the state (MCFWCS 2005).

There are generally two main habitats associated with water bodies: riparian areas and wetlands. Although Montana's riparian and wetland communities vary widely depending on the area of the state and elevation where they are located, they generally represent the green zones along rivers, streams, lakes, ponds, and reservoirs and include potholes, wet meadows, marshes, and fens. These two habitat types are described below:

Riparian areas are plant communities contiguous to rivers, streams, lakes, ponds, reservoirs, or drainage ways. They have one or both of the following characteristics: (1) vegetative species distinctively different from adjacent areas; and/or (2) species similar to adjacent areas but exhibiting more vigorous or robust growth forms (U.S. Fish and Wildlife Service 1997). Riparian areas are commonly associated with a valley. The width of the valley often determines the extent of the riparian area: some are narrow strips, while others can be quite broad. Water flows associated with riparian areas can be perennial (all seasons of the year), intermittent (for several weeks or months per year), or ephemeral (only in response to precipitation events) (Wenger 1999). This community type includes cottonwood forests, riparian shrublands (e.g.,

alder, willow, birch, or red-osier dogwood), and riparian coniferous forests (floodplain and streamside forests dominated by coniferous tree species) (Casey 2000).

Wetlands are areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support—and that under normal circumstances do support—a prevalence of vegetation typically adapted for life in saturated soil conditions (Federal Register 1982). Wetlands are generally characterized by one or more of the following features:

- Water at or near the land surface all or part of the year;
- Soils that are poorly drained and develop certain soil characteristics (e.g., blue-green or gray color, or rotten egg smell) due to the presence of water and absence of oxygen; and
- The presence, at least occasionally, of water-loving plants (hydrophytes).

The term wetland is a catchall that includes swamps, marshes, bogs, fens, and lowlands covered with shallow and sometimes intermittent or ephemeral water. The term also includes wet meadows, potholes, sloughs, and some stream overflow areas. In addition, shallow lakes and ponds, usually with emergent vegetation, are included in the definition. Although permanent waters deeper than 6½ feet are not technically considered wetlands, the term does include the shallow edges of these deeper water bodies (Windell et al. 1986; Hansen et al. 1995).

Typical Locations in Montana

Wetlands and riparian areas are found throughout Montana in association with water bodies. The Wetland and Riparian Mapping Center located at the Montana Natural Heritage Program is currently mapping these areas (see **http://mtnhp.org/nwi/**).

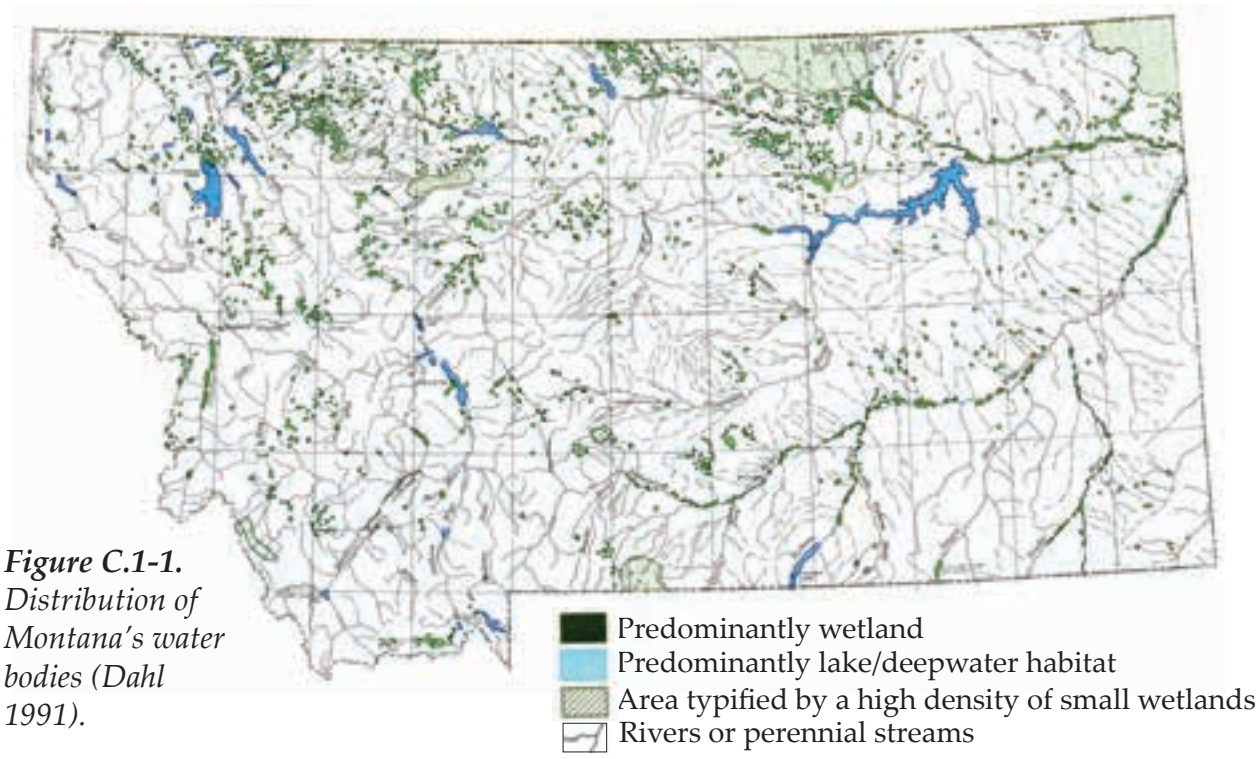


Figure C.1-1. *Distribution of Montana's water bodies (Dahl 1991).*

Objectives of Recommended Design Standards

- Protect water quality, stream stability, natural stream processes, aquatic habitat, and fish and wildlife habitat by conserving water bodies, their associated riparian areas and, in some situations, associated uplands.
- Retain existing wetlands and riparian areas by avoiding or minimizing human disturbances associated with developments such as buildings, roads, docks, and other structures.
- Maintain the natural hydrological and ecological functions of wetlands and riparian areas by minimizing fragmentation and degradation of these sites.
- Maximize the ability for wetlands, riparian areas, and, in some situations, associated uplands, to function as wildlife habitat.

Conservation Status

Riparian and wetland habitats associated with water bodies are considered a Montana Tier 1 ecosystem (ecosystem in greatest need of conservation) in Montana's Comprehensive Fish and Wildlife Conservation Strategy (MCFWCS 2005). Although these habitats occupy an estimated 3.94 percent of the state, almost half of Montana's terrestrial vertebrate species (mammals, birds, reptiles, or amphibians) use riparian and wetland habitat community types (265 species out of the total 551 terrestrial vertebrate species found in Montana), with 196 of these species being essentially associated (i.e., 196 species of wildlife, 36 percent of the state's total, depend on riparian and wetland communities for their existence).

Impacts from Development

Wetlands and riparian areas are easily degraded by land use changes from subdivision activities and associated development. New development near water can involve degradation and/or removal of native vegetation, including replacement of wetland/riparian vegetation with buildings, pavement, roads, and manicured plantings. This loss of natural vegetation and impact to wetlands and riparian areas is usually permanent. The effects of urban and commercial developments can result in:

- loss and/or degradation of wetland and riparian habitat;
- loss of woody debris and other structures important to the function of streams;
- degradation of stream channels and natural stream processes;
- reduction of water quality;
- habitat fragmentation; and
- introduction and spread of nonnative species.

As more and more people choose to build homes, live and recreate, or otherwise utilize the land next to Montana's streams, rivers, lakes, and ponds, these areas are impacted—often to the detriment of the very qualities that attracted buyers in the first place. Many of the impacts to wetlands and riparian areas could be avoided by land use planning decisions made at the local level (e.g., Knutson and Naef 1997; Ellis and Richard 2008).

Recommended Standards

The following design standards are recommended for water bodies and their associated habitats:

(1) These standards pertain to any subdivision development proposed on property that contains or adjoins a water body and/or its associated riparian area.[1]

(2) Apply the following vegetated buffers and building setbacks (see Figure C.1-2):

- **Rivers:** A minimum of 250 feet of vegetated buffer plus 50 additional feet of building setback. Total building setback equals at least 300 feet from each side of a river.
- **Perennial Streams:** A minimum of 150 feet of vegetated buffer plus 50 additional feet of building setback. Total building setback equals at least 200 feet from each side of a perennial stream.
- **Other Water Bodies:** A minimum of 100 feet of vegetated buffer plus 30 additional feet of building setback. Total building setback equals at least 130 feet from the boundary of a wetland or pond, or the ordinary high-water mark of an intermittent stream, lake, or reservoir.

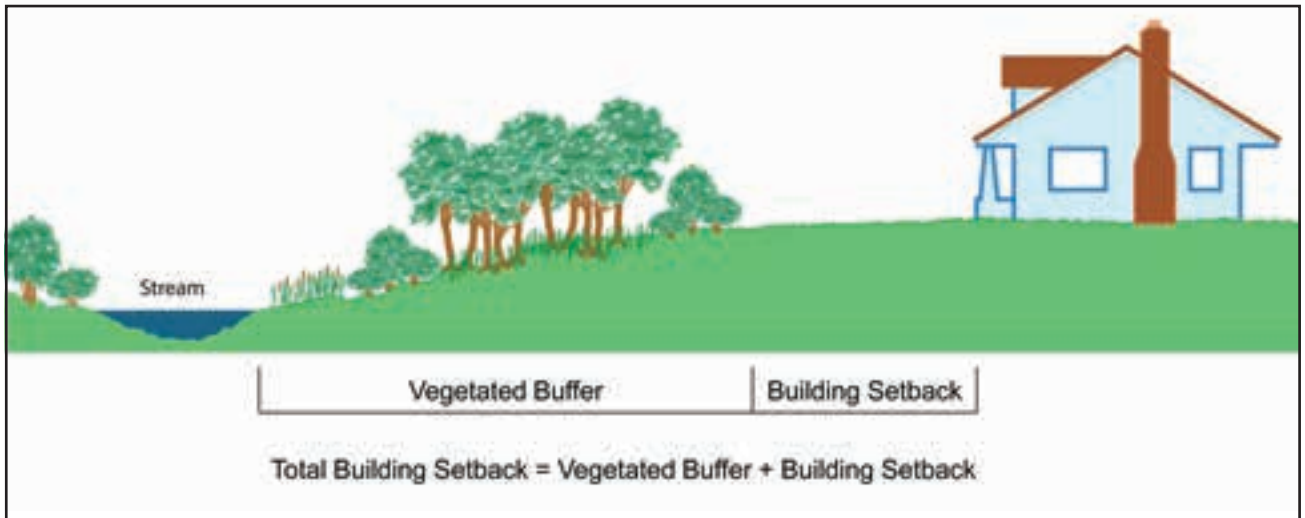


Figure C.1-2. *Illustration of total building setback*

[1] These water body standards offer guidance beyond that provided by other types of water-related standards often implemented by local governments (e.g., water quality, lakeshore protection, floodplain protection, and stormwater drainage standards). These other standards can also help maintain healthy fish and wildlife habitat (e.g., if, as a result, development does not occur in the 100-year floodplain, or stormwater drainage facilities are designed and installed to minimize impacts on water quality and maintain, as much as possible, pre-development runoff conditions and hydrology).

(3) Measure vegetated buffer and building setback distances from all water bodies on a horizontal plane, as follows:

- Rivers, streams, reservoirs, and lakes: Measure from the ordinary high-water mark. For braided rivers, measure from the ordinary high-water mark of the outermost braid that is nearest to the proposed structure.
- Wetlands (including ponds): Measure from the wetland's defined boundary. The outer edge of a wetland marks the boundary between the wetland and adjacent upland areas.

(4) If the riparian area associated with a water body extends beyond the pertinent vegetated buffer outlined above, extend the vegetated buffer to encompass all of the riparian area.

(5) If a channel migration zone (CMZ) study is completed for a river or stream for a time frame of 100 years or longer, use the CMZ maps as a guide for recommending that the total building setback be extended in order to locate development outside of the CMZ. Where the CMZ is wide and encompasses cropland, the vegetated buffer may be reduced below the minimum, but the building setback may need to increase in order to maintain an effective total building setback.

(6) For wetlands, the subdivider is advised to follow one of two alternative design approaches, depending on the distance between wetlands and subdivision design features:

- Recommended Wetland Approach #1. If any proposed subdivision design features are located 150 feet or less from a wetland, the subdivider retains a qualified wetland professional to determine the wetland's boundary in accordance with the 1987 U.S. Army Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987), or the most current wetlands delineation manual sanctioned by the Army Corps of Engineers–Omaha District. Although the total building setback is 130 feet for wetlands, this slightly larger area (150 feet) warrants professional evaluation to ensure that wetlands are not impacted by misidentified boundaries. Because wetland boundaries can be difficult to determine accurately, this standard helps ensure that the total building setback for wetlands is not encroached upon. The subdivider then includes the wetland delineation information in the subdivision application.
- Recommended Wetland Approach #2. If all proposed subdivision design features are located 150 feet or more from any wetlands, the subdivider demonstrates in the subdivision application that the subdivision design features will not encroach on the total building setback recommended for wetlands.

(7) For wetlands and wetland complexes that are important for migratory game birds and/or shorebirds, biologists may recommend that the total building setback be extended to encompass specific cropland areas adjacent to the wetlands that are consistently and seasonally used by large numbers or a high diversity of these species.

(8) Within the total building setback:

- Avoid the placement of homesites and other subdivision improvements (except roads and bridge abutments at river or stream crossings, designed and constructed

in accordance with Natural Streambed and Land Preservation Act (310) or Stream Protection Act (124) permit requirements).

- Where disturbance does occur, incorporate effective measures to limit erosion and sedimentation.

(9) Within the vegetated buffer: Avoid disturbing native vegetation, except as needed to control noxious weeds (with herbicides approved for use in riparian environments), reduce accumulated fuels related to fire protection, erect fencing, remove individual trees that pose a threat to public safety, or provide the types of access described in #11 and #12 below.

(10) Within the building setback: Lawns can be planted, and native vegetation can be removed or otherwise disturbed.

(11) Water-dependent uses may occur within the total building setback, as long as the impacts of design features are minimized to the greatest extent possible. Specifically this applies to:

- Water-dependent agricultural facilities (e.g., pumps, diversion structures); and
- Water-dependent recreational facilities (e.g., nonmotorized trails, docks, boat ramps) that do not impact vegetated buffers for sensitive species (see Selected Species of Concern, Appendix C.6 below).

This provision does not exempt a subdivider from needing to comply with other pertinent local regulations, such as lakeshore protection regulations or floodplain management regulations.

(12) Minimize the extent of subdivision roads needed to provide access to all areas proposed for development.

Substantial Evidence for Water Body Recommendations

In order to more easily describe the rationale and scientific evidence for the water body recommended standards, the standards have been divided into twelve provisions. Each provision is stated below, followed by the substantial evidence supporting that provision, including pertinent scientific studies and professional opinions.

Provision 1. "Vegetated Buffer." Specific distances are designated for vegetated buffers from rivers, streams, lakes, ponds, reservoirs, and wetlands. For rivers, a minimum of 250 feet of vegetated buffer should be maintained; for perennial streams, a minimum of 150 feet of vegetated buffer should be maintained; and for other water bodies, a minimum of 100 feet of vegetated buffer should be maintained.

Substantial Evidence for Provision 1

There is much scientific literature on the need for vegetated buffers to protect wildlife and wildlife habitat along rivers, perennial streams, and other bodies of water. Riparian and wetland buffers have gained wide acceptance, including in Montana, as tools for maintaining wildlife habitat and providing other benefits to people and the environment (e.g., Environmental Law Institute 2008; Knutson and Naef 1997; Wenger 1999; Ellis and Richard 2008).

The following studies and professional opinions justify the vegetated buffer distances recommended under this design standard:

- The mean width of all wildlife studies reviewed indicates that 88 meters (287 feet) is required to protect wildlife habitat (Knutson and Naef 1997).

- "Scientific studies recommend that, in order to protect wildlife and wildlife habitat, 300-foot (100-meter) stream vegetated buffers be maintained. Certain wildlife species need a larger vegetated buffer" (Ellis 2008, Part 3, p. 7).

- "While narrow buffers offer considerable habitat benefits to many species, protecting diverse terrestrial riparian wildlife communities requires some buffers of at least 100 meters (300 feet)" (Wenger 1999, p. 3).

- "The most common recommendation in the literature on wildlife (most of which focuses on birds) is for a 100 m (300 ft) riparian buffer" (Wenger 1999, p. 47).

- Subdivision development can cause significant, permanent loss and degradation to wetlands, water bodies, and their associated riparian areas. One of the most effective tools available to local governments interested in minimizing loss and degradation to these areas is to set back structures and protect buffers with native vegetation (Ellis 2008, Parts 1, 2 & 3).

- "In order to balance development with effective natural resource protection, a rational strategy for protecting aquatic resources must be developed. It appears that the use of buffers will continue to be an important element of this strategy. To accomplish this, scientifically based criteria for establishing buffer requirements must be utilized by resource agencies" (Castelle et al. 1994, p. 878).

Provision 2. Use a "building setback" as part of the "total building setback." This provision recommends specific distances (50 feet or 30 feet) for building setbacks. The building setback is located between the vegetated buffer and any houses or other buildings.

Substantial Evidence for Provision 2

- "The building setback is designed to protect the vegetated buffer from human disturbance that could diminish the effectiveness of the buffer. Examples of human disturbance include dumping refuse or yard waste; cutting, mowing, or burning vegetation; filling areas; trampling vegetation; and recreational vehicle use. Direct human disturbance affects both the habitat provided by the vegetated buffer and the wildlife species that are dependent on the buffer" (Clancy et al. 2012, p. 2).

- "A 50-foot backyard is a reasonable distance to conduct most activities associated with a residential or commercial subdivision. As an example, most families use the area between their home and the vegetated buffer for lawns, play areas, swing sets, picnic tables, vegetable gardens, landscaping, etc." (Clancy et al. 2012, p. 3).

- Human disturbance can decrease the size of the vegetated buffer over time (Cooke 1992, p. 6):
  - o "More than 90% of the buffers examined for this study did not remain in a pristine state after the surrounding land use change was initiated. Of those buffers altered, 76% were altered in a negative manner."
  - o "Buffers less than 50 feet in width showed a 95% increase in alteration of the buffer," but "where the buffer was greater than 50 feet, only 35% showed alteration."
  - o "Of the 21 sites examined, 18 were shown to have reduced buffer zones between one and eight years later."

- "Lawns should not be considered part of the vegetated buffer. With their shallow roots, lawns are not particularly effective at absorbing and retaining water, especially during heavy rains" (Ellis 2008, Parts 1, 2 & 3, p. 2).

- "The building setback should be wide enough to prevent degradation of the vegetated buffer…As a result, the building setback should extend at least 25–50 feet beyond the vegetated buffer" (Ellis 2008, Part 1, p. 2).

Provision 3. The vegetated buffer and building setback are measured from (1) the ordinary high-water mark for rivers, streams, lakes, and reservoirs; and (2) the defined boundary of a wetland (including ponds).

Substantial Evidence for Provision 3

- The ordinary high-water mark is a well-known standard described in the Montana Code Annotated (23-2-301, MCA).

- "Riparian buffers are most commonly established by measuring the setback from the ordinary high water mark of a watercourse . . . When no ordinary high water mark is discernible, [vegetative buffers and building] setbacks are usually measured from the top of the stream bank . . . Wetland buffers are typically determined by measuring from the edge of a wetland's boundary" (Ellis and Richard 2008, p. 4–10).

- "There are a number of alternative approaches to setting the buffer distance [for a wetland]—usually defined in feet measured horizontally from the edge of the defined wetland" (Environmental Law Institute 2008, p. 10).

Provision 4. If the riparian area associated with a water body extends beyond the pertinent vegetated buffer, extend the vegetated buffer to encompass all of the riparian area.

Substantial Evidence for Provision 4

- Wildlife dependent on riparian habitat need "habitat connectivity; vegetation diversity in terms of age, plant species composition, and vegetation layers; vegetation vigor; abundance of snags and woody debris; unimpeded occurrences of natural disturbances and minimization of human-induced disturbances; an irregular shape; and a width that is adequate to retain riparian habitat functions" (Knutson and Naef 1997, p. xii).

- "Because riparian habitat supports the greatest number of species compared to other habitats, its protection can provide a significant benefit to fish and wildlife in developed landscapes" (Knutson and Naef 1997, p. 69).

- "When riparian habitat is lost or severely altered without mitigation, the downward trend of fish and wildlife populations continues. Only by retaining existing habitat and restoring degraded areas will the trend of reduced habitat quality for fish and wildlife be slowed or reversed" (Knutson and Naef 1997, p. 94).

- "For wildlife, [riparian] buffers must provide enough room for animals to take shelter, find food, successfully raise young, and hide from predators. While narrow buffers offer habitat benefits to many species, most wildlife—especially birds and larger mammals—depend upon riparian areas that are a minimum of 300 feet wide (Wenger, 1999) . . . As desirable as they may be, 300- or 600-foot-wide buffers are not practical on all streams in most areas. One recommendation to accommodate this issue involves including at least a few wide (300–1,000 foot) riparian sections and large blocks of upland habitat along narrower protected corridors" (Ellis and Richard 2008, p. 4–9).

Provision 5: If a channel migration zone (CMZ) study is completed for a river or stream for a time frame of 100 years or longer, use the CMZ maps as a guide for recommending that the total building setback be extended in order to locate development outside of the CMZ.

Substantial Evidence for Provision 5

When available, CMZ maps should be used when evaluating subdivisions:

CMZ maps help landowners and river and stream managers avoid or reduce adverse impacts to buildings, roads, and infrastructure, as well as fish and wildlife habitat. The following studies and professional opinions justify using CMZ maps as recommended under this design standard:

- "CMZ delineations help reduce risks to human communities by guiding development in and along river systems away from such areas. Limiting development within CMZs also reduces the costs of repairing or replacing infrastructure and major civil works that might otherwise be threatened or damaged by channel migration. Additionally, CMZ delineations can provide guidance in reducing degradation and loss of critical aquatic and riparian habitats, helping assure that fluvial process[es] are accommodated and that the river landscape is not permanently degraded or disconnected from the river by development" (Rapp and Abbe, 2003, p. 1).

- "It is important to fish and wildlife that natural disturbances (e.g., flooding, channel meandering) occur unimpeded and that human-induced disturbances are minimized. Fish and wildlife that use riparian and associated aquatic systems have evolved with continual yet generally low-level natural disturbances. Natural frequencies and magnitudes of disturbances enhance habitat diversity and provide key resources to riparian and aquatic areas (e.g., woody debris, nutrients). Disturbances caused by human activities often occur more frequently and are of greater magnitude than natural disturbances" (Knutson and Naef 1997, p. 80).

- "Stream meander is crucial to the maintenance of aquatic habitat because as a stream cuts through its valley, it builds instream complexity by developing floodplains and cutbanks. This natural process of erosion and deposition increases exposure of overhanging woody material and coarse sediments imbedded in the banks, both of which, in turn, increase instream habitat complexity" (Robins 2002, p. 7).

What is a Channel Migration Zone Map?

Rivers and streams found in Montana's valleys and plains meander—or migrate—laterally across the landscape. Channel migration can occur gradually, as a river erodes one bank and deposits sediment along another. It can also occur as an abrupt shift of the channel to a new location, called an avulsion, which may happen during a single flood event (Rapp and Abbe, 2003). A channel migration zone (CMZ) is the area where it is reasonably foreseeable that an active channel of a river or stream could migrate during a time period—usually 100 years—because of erosion or avulsion. These maps are developed using a variety of previously developed data, including historic aerial photography and digital elevation data. The goal is to interpret past and current channel conditions in order to predict future channel behavior and identify areas at risk of rapid channel movement and/or flooding due to natural stream processes.

As of January 2012, 100-year channel migration zone maps have been completed on the following streams and rivers in Montana:

- Big Hole River, from its headwaters on the Montana/Idaho border to its mouth near Twin Bridges (Thatcher and Boyd 2005);
- Clark Fork River, from the confluence of the Bitterroot River to Huson (Applied Geomorphology and DTM Consulting 2009);
- Flathead River, from the Old Steel Bridge downstream to Flathead Lake (Boyd et al. 2010a);
- Prickly Pear Creek (Lewis & Clark County), from Lake Helena upstream to the Lewis & Clark County line (Thatcher et al. 2011);
- Tenmile Creek (Lewis & Clark County), from its confluence with Prickly Pear Creek, upstream to Interstate 15 (Thatcher et al. 2011);
- Ruby River, from Ruby Reservoir downstream to the Beaverhead River (Boyd et al. 2010b); and
- Yellowstone River, from Gardiner near Yellowstone National Park to its confluence with the Missouri River in McKenzie County, North Dakota (Thatcher et al. 2009).

Reports completed on the above CMZ projects are excellent sources of information on the methods, science, and uses of CMZ studies and mapping.

Channel migration zone maps should be developed for a 100-year time frame or longer:

- "[A] 100-year time frame was selected for the life of the CMZ. This criteria for projected channel movement was adopted because of the ecological implications of a 100-year time frame, as well as the fact that a 100-year CMZ has been most commonly adopted by other mapping efforts . . . As the oldest cottonwood trees in the riparian zone are

on the order of 100 years old, this time frame is considered likely to provide conditions necessary to develop diverse riparian age classes and locally support mature riparian forest" (Thatcher et al. 2009, p. 4).

- CMZ maps need to be science-based tools that look at long-term migration patterns for rivers and streams. "The principal goal of delineating the Channel Migration Zone (CMZ)—the area where a stream or river is susceptible to channel erosion—is to predict areas at risk for future channel erosion due to fluvial processes" (Rapp and Abbe 2003, p. 1).

- FEMA's regional guidance for mapping CMZs recommends a 100-year design life as described by Rapp and Abbe 2003 (FEMA 2010).

- Regarding the use of longer time frames for CMZ studies, the Federal Emergency Management Agency (FEMA 1999, p. 134) noted, ". . . uncertainty is greater for long time frames. On the other hand, a very short time frame for which uncertainty is much reduced may be useless for floodplain management because of the minimal erosion expected to occur."

Figures C.1-3 through C.1-6 provide three examples of how to apply the CMZ and riparian area standards (Provisions 4–6).

Figure C.1-3. *CMZ map showing three cross sections.*

This figure shows a map of a river (blue) with native riparian vegetation (green) and cropland (brown). The CMZ boundary is marked by a broken line. Three cross sections are also marked: #1, #2, and #3. Each cross section represents a different example, illustrated on p. C-17. In all cases, a landowner proposes to subdivide a parcel along the south side of a river where a 400-foot CMZ has been mapped.

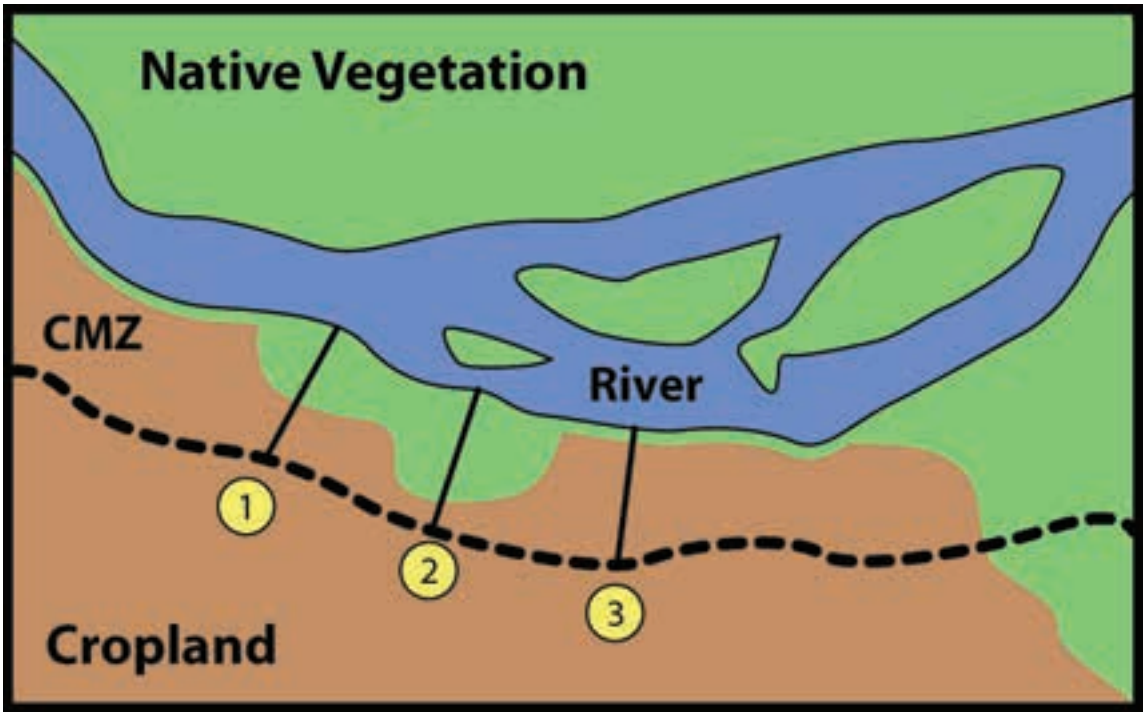


Figure C.1-4. *Illustration of CMZ/riparian example—cross section #1.*

In the 400-foot CMZ illustrated below, 250 feet is a native riparian area and the remainder is cropland. The recommended standard is that all buildings be placed outside the CMZ *and* outside of the riparian area. In this example, the vegetated buffer is 250 feet and the building setback is 150 feet, for a total building setback of 400 feet.

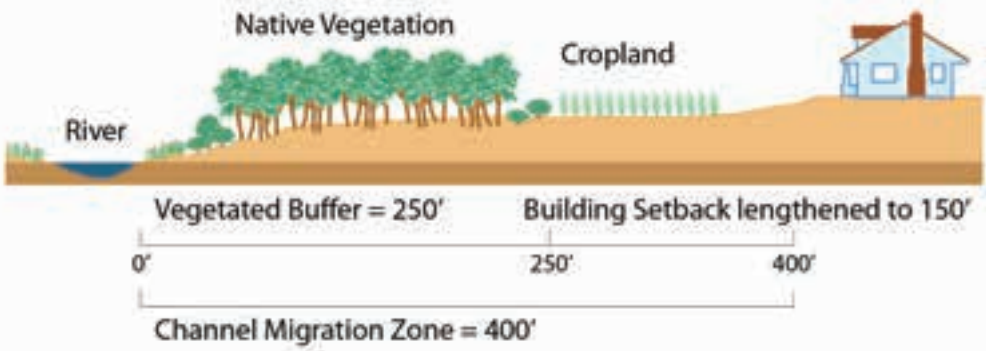


Figure C.1-5. *Illustration of CMZ/riparian example—cross section #2.*

In the 400-foot CMZ illustrated below, all 400 feet is a native riparian area. The recommended standard is that all buildings be placed outside the CMZ *and* outside of riparian area. In this example, the vegetated buffer is 400 feet and the building setback is 50 feet, for a total building setback of 450 feet.

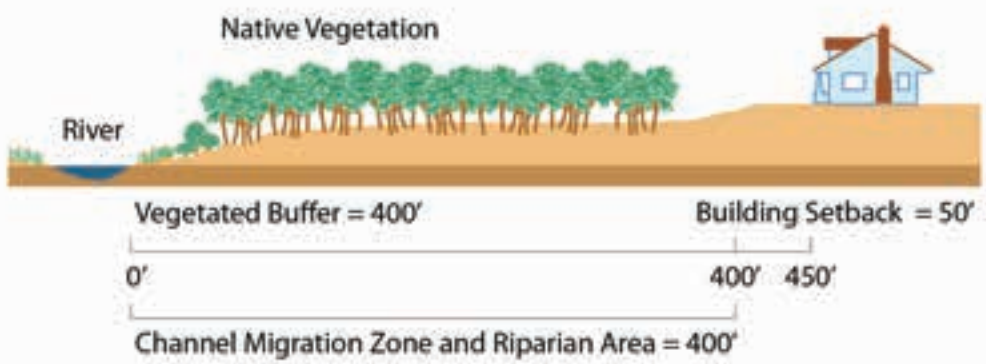
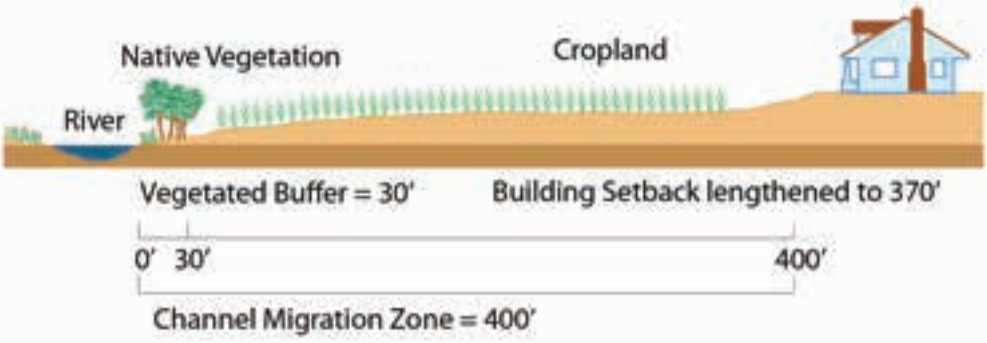


Figure C.1-6. *Illustration of CMZ/riparian example—cross section #3.*

In the 400-foot CMZ illustrated below, only 30 feet is a native riparian area; cropland makes up the rest of the CMZ. The recommended standard is that all buildings be placed outside the CMZ. In this example, the vegetated buffer is reduced to 30 feet and the building setback is increased to 370 feet, for a total building setback of 400 feet.



Provision 6. Where the CMZ is wide and encompasses cropland, the vegetated buffer may be reduced below the minimum, but the building setback may need to increase in order to maintain an effective total building setback.

Substantial Evidence for Provision 6

An important purpose in using CMZ maps and locating development out of the CMZ is to maintain natural stream processes, which sustain significant riparian and aquatic habitats. For this reason, it is recommended that development be located outside the CMZ even where cropland—and not native vegetation—occupies the CMZ.

The following studies and professional opinions justify the recommendation to maintain natural stream processes by locating development out of the CMZ:

- "Sediment recruitment, transport, and deposition resulting from channel migration and erosion is the primary mechanism of aquatic and terrestrial habitat formation along Montana's large prairie rivers. Retention of natural, unrestricted channel migration will allow continued formation of important habitats on these rivers. The endangered pallid sturgeon and other native fish and wildlife species will benefit from retaining these natural dynamics and habitat-formation processes" (MT FWP 2010, p. 1).

- "[T]he long-term health of streams, fish, and aquatic habitat requires maintaining natural stream processes—which includes natural erosion processes. In a healthy valley stream or river, banks erode naturally and the material is deposited elsewhere, which in turn builds banks and their associated floodplain. As a result of this natural process, the location of the stream channel changes over time. If given space, meandering streams create a pattern where outside bends of the stream are dominated by cut banks (caused by natural erosion), and inside bends are dominated by sand or gravel bars (where sediment is deposited)" (Ellis 2008, p. 7).

- "Habitat complexity is a result of stream meander and floodplain processes caused by periodic flooding. This results in a mosaic of habitat types within riparian buffers. These naturally complex systems offer an array of niches for wetland and terrestrial species, and thus lead to high levels of species diversity. Therefore, maintenance of the basic natural disturbance regime—flooding—is essential to the protection/enhancement of a riparian buffer for wildlife habitat. The literature is filled with research on the requirements of riparian buffers for various species" (Robins 2002, p. 8).

Provision 7. In order to ensure that wetlands are protected, two alternative design approaches are offered, depending on how close the wetland and the subdivision design features are located to each other. Recommended Wetland Approach #1: If any proposed subdivision design features are located within 150 feet of a wetland, the subdivider retains a qualified wetland professional to determine the wetland's boundary. Or, Recommended Wetland Approach #2: If the wetland is more than 150 feet from all subdivision design features, the subdivider demonstrates that the wetland's total building setback will not be encroached upon.

Substantial Evidence for Provision 7

This provision is designed to ensure that the total building setback for wetlands is not encroached upon by subdivision design features. Although the total building setback is a minimum of 130 feet for wetlands, a slightly larger area (e.g., 150 feet) should be evaluated to ensure that wetlands are not impacted by misidentified boundaries. Wetland boundaries are often challenging to delineate.

The following studies and professional opinions justify the recommended approaches for determining wetland boundaries established under this design standard:

- "There are a number of alternative approaches to setting the buffer distance [for a wetland]—usually defined in feet measured horizontally from the edge of the defined wetland" (Environmental Law Institute 2008, p. 10).

- For wetlands, "[b]uffer widths toward the upper end of this range [30 m or 98 feet] appear to be the minimum necessary for maintenance of the biological components of many wetlands. . . ." (Castelle et al. 1994, p. 881).

- "The upland area surrounding the wetland is essential to its survival and functionality. If a wetland area cannot absorb the stormwater it normally absorbs, the chances of flooding will increase further downstream; if the wetland cannot serve as home for wetland species and vegetation, community values and quality of life will be impaired. 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 benefits to the community and the environment . . . 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" (Environmental Law Institute 2008, p. 2).

- "Where wildlife needs are factored into the design, VFS [Vegetated Filter Strips] or buffers in urban areas can add to the species diversity of the urban environment by providing wildlife nesting and feeding sites, in addition to serving as a pollution control measure" (Environmental Protection Agency 2005, p. 15).

Provision 8. For wetlands and wetland complexes that are important for migratory game birds and/or shorebirds, biologists may recommend that the total building setback be extended to encompass specific cropland areas adjacent to the wetlands that are consistently and seasonally used by large numbers or a high diversity of these species.

Substantial Evidence for Provision 8

Croplands located on uplands adjacent to wetlands and wetland complexes are important for migratory game birds and some shorebirds:

- "During fall and winter, dabbling ducks such as mallard, pintail, and green-winged teal depend greatly on agricultural grains for high energy food. Mallards consume

about 100 grams of waste grain per day during this period, and average-sized geese need twice this amount. Most grains are consumed after crops are harvested, when waste corn and small grains become available. . . . Corn, wheat, barley, rye, oats, grain sorghum, millet, soybeans, field peas, and buckwheat are used as waterfowl food crops . . ." (Ringelman 1991, p. 24).

- ". . . Geese from the Hi-line breeding populations, which nest in eastern Wyoming, eastern Montana, southeastern Alberta, and southwestern Saskatchewan, begin migrating into north-central Colorado in late October . . . Cereal grains become an increasingly important component in their diet during fall . . ." (Ringelman 1991, p. 6).

- "During migrations, cultivated grains are major food items (Lewis 1977; Kauffeld 1982; Tacha et al. 1994). Cranes often feed in grain fields in the spring before nest sites thaw and again in late summer after the young fledge (Armbruster 1987). Important grains include barley in Idaho and Wyoming (Drewien 1973; Lockman et al. 1987) and wheat in Colorado (Bieniasz 1979). Cultivated grains provide the necessary fat stores required during migrations and are accessible with minimum energy expenditures (Tacha et al. 1987)." (Subcommittee on Rocky Mountain Greater Sandhill Cranes 2007, p. 3)

- Shorebird use of cropland is documented in management plans. For example: "Agricultural Field Habitat. Hay fields are used by shorebird species, for foraging sites (e.g., Long-billed Curlew and Killdeer) and for nesting (e.g., Killdeer, Wilson's Phalarope, and Long-billed Curlew). Killdeer nest in association with agriculture wherever freshwater is available" (Oring et al. 2000, p. 5).

- "Long-billed curlews migrating through the interior of North America use fallow, plowed, wheat, and alfalfa fields, sparsely vegetated areas such as prairie dog colonies, low grassland fields, shallow wetlands, and lake and reservoir edges for foraging and roosting (Paulson 1993; Shane 2005; D.S. Stolley, pers. comm.; E.A. Young, pers. comm.). Many agricultural sites used by curlews have center pivot irrigation systems (Shane 2005)." (Fellows and Jones 2009, p. 9)

- "They [Long-billed Curlew] commonly nest in hayland, cropland, fallow or stubble fields (D. Casey, pers. comm.). During migration, birds use agricultural fields, grazed pastures, wetlands, and mudflats (Putnam and Kennedy 2005)." (Montana State Summary in Fellows and Jones 2009, p. 33)

- Killdeer during the breeding season frequent "open areas, especially sandbars, mudflats, heavily grazed pastures, and such human-modified habitats as cultivated fields, athletic fields, airports, golf courses, graveled or broken-asphalt parking lots, and graveled rooftops." During spring and fall migration, "Mudflats left by receding floodwaters and human-made wetlands such as sewage lagoons and reservoirs are favored stopover and feeding areas, as are gravel bars in rivers, fallow agricultural fields, and broad expanses of open, closely mowed grassy areas such as sod farms and golf courses, particularly when wet" (Jackson and Jackson 2000).

Migratory game birds and shorebirds are impacted by human disturbance. Keeping areas free from human disturbance may require buffers that shield wetlands and wetland complexes:

- "Prolonged and extensive disturbances may cause large numbers of waterfowl to leave disturbed wetlands and migrate elsewhere. These movements can be local in areas of plentiful habitat or more distant and permanent in areas of sparse habitat, and may result in shifts in flyway migration patterns. Extensive disturbances on migration and wintering areas may limit use by waterfowl below the carrying capacity of wetlands" (Youmans 1999, p. 3.5).

- "Make shorebird-migration-staging areas 'disturbance-free' during periods of use (Morrison and Harrington 1979)" (Youmans 1999, p. 3.11).

- "Disturbance of shorebirds on nesting, feeding, and roosting areas may significantly reduce survival and reproductive success" (Brown et al. 2001, p. 31).

- "Overall Management Guidelines for Montana Waterfowl:
  Fortunately, numbers of breeding waterfowl usually increase in response to reduction or elimination of human disturbances. For the benefit of waterfowl, human disturbances must be minimized or eliminated. Management techniques that reduce human disturbances of waterfowl include:

  1. Increasing the quantity, quality, and distribution of foods to compensate for energetic costs from disturbances.
  2. Establishing screened buffer zones around important waterfowl breeding, roosting, and feeding areas.
  3. Reducing the number of roads and access points to limit accessibility to important waterfowl habitats.
  4. Reducing the sources of loud noises and rapid movements of vehicles and machines" (Youmans 1999, p. 3.8).

- "Human activity causes wintering waterfowl to expend energy to avoid humans at a time in their annual cycle when energy conservation is important to survival, migration, and breeding reserves. Understanding the effects of recreational activities on waterfowl is important to managing natural resource areas where migratory birds depend on wetland habitat for resting and feeding"(Pease et al. 2005, p. 103).

- "Increases in home development and subdivisions are negatively impacting some pre-migration staging habitats in portions of eastern ID, western WY, and southwestern MT" (Subcommittee on Rocky Mountain Greater Sandhill Cranes 2007, p. 29).

Provision 9. Within the total building setback, (1) avoid the placement of homesites and other subdivision improvements (except roads and bridge abutments at river or stream crossings); and (2) where disturbance does occur, incorporate effective measures to limit erosion and sedimentation.

Substantial Evidence for Provision 9

Avoid the placement of homesites and other subdivision improvements within the total building setback:

- Subdivision development can cause significant, permanent loss and degradation to wetlands, water bodies, and their associated riparian areas. One of the most effective tools available to local governments interested in minimizing loss and degradation to these areas is to set back structures and protect buffers with native vegetation (Ellis 2008, Parts 1, 2 & 3).

- "The building setback is designed to protect the vegetated buffer from human disturbance that could diminish the effectiveness of the buffer. Examples of human disturbance include dumping refuse or yard waste; cutting, mowing, or burning vegetation; filling areas; trampling vegetation; and recreational vehicle use. Direct human disturbance affects both the habitat provided by the vegetated buffer and the wildlife species that are dependent on the buffer" (Clancy et al. 2012, p. 2).

- "When riparian habitat is lost or severely altered without mitigation, the downward trend of fish and wildlife populations continues. Only by retaining existing habitat and restoring degraded areas will the trend of reduced habitat quality for fish and wildlife be slowed or reversed" (Knutson and Naef 1997, p. 94).

Additional justification for this provision can be found above under Provisions 1, 2, 4, and 5.

Where disturbance occurs in the total building setback, incorporate effective measures to limit erosion and sedimentation:

- "Excess amounts of sediment can have numerous deleterious effects on water quality and stream biota. For a full discussion of this topic, refer to Waters 1995 and Wood and Armitage 1997. The following brief list summarizes the major sediment effects:
    - Sediment in municipal water is harmful to humans and to industrial processes.
    - Sediment deposited on stream beds reduces habitat for fish and for the invertebrates that many fish consume.
    - Suspended sediment reduces light transmittance, decreasing algal production.
    - High concentrations of fine suspended sediments cause direct mortality for many fish.
    - Suspended sediments reduce the abundance of filter-feeding organisms, including mollusks and some arthropods.
    - Sedimentation reduces the capacity and the useful life of reservoirs" (Wenger 1999, p. 11).

- "The loss of riparian vegetation due to urbanization: 1) degrades stream conditions through increased erosion of banks that are no longer armored with roots and debris from natural vegetation, 2) removes a source of logs and organic debris that stabilize streams and provide a source of food and nutrients, 3) increases stream temperatures through shade removal, and 4) reduces the capacity of the riparian area to filter incoming sediments and pollutants" (Klein 1979). (Knutson and Naef 1997, p. 69)

- "Natural vegetated buffers are important to water quality, because the longer runoff is detained in a buffer, the fewer pollutants will enter the stream. Physically, plants act as a barrier, slowing down water flow, giving sediments and other contaminants time to settle out of runoff, and allowing more water to move into the soil. Plant roots trap sediments and other contaminants in shallow groundwater, take up nutrients, hold banks in place, and prevent erosion" (Ellis 2008, Part 1, p. 4).

- "In addition to being sensitive to water pollutants, fish can be extremely intolerant of sediment in the stream. Sediments come from a variety of sources, including natural and human-driven stream bank erosion, agricultural fields, exposed earth at construction sites and on dirt roads, and other activities that remove vegetation and expose soil" (Ellis 2008, Part 2, p. 8).

Provision 10. Avoid disturbing the vegetated buffer except as needed to "control noxious weeds (with herbicides approved for use in riparian environments), reduce accumulated fuels related to fire protection, erect fencing, remove individual trees that pose a threat to public safety, or provide access . . ."

Substantial Evidence for Provision 10

- Wildlife dependent on riparian habitat characteristics need "habitat connectivity; vegetation diversity in terms of age, plant species composition, and vegetation layers; vegetation vigor; abundance of snags and woody debris; unimpeded occurrences of natural disturbances and minimization of human-induced disturbances; an irregular shape; and a width that is adequate to retain riparian habitat functions" (Knutson and Naef 1997, p. xii).

- "As a general rule, all sources of contamination should be excluded from the buffer. These include: land disturbing activities, impervious surfaces . . . septic tank drain fields, waste disposal sites, [and] application of pesticides and fertilizer (except as necessary for buffer restoration)" (Wenger 1999, p. 48).

- ". . . [S]treamside buffers must provide enough room for wildlife to take shelter, find food, successfully raise young, and hide from and avoid predators" (Ellis 2008, Part 3, p. 5).

- It is equally important to protect rivers and small tributary streams with adequate vegetated buffers because small tributaries provide essential habitat for many terrestrial wildlife species; "contribute steady amounts of clean, cooler water to mainstem rivers; filter sediments and pollutants; play a key role in the retention and absorption of flood and storm water in a watershed; are an important water source, especially during low

flow periods of the year; are a major source of woody debris and other organic matter necessary for aquatic organisms; and provide critical spawning sites for many fish species" (Ellis 2008, Part 2, p. 6).

- Vegetated buffers are known to protect water quality, as specified in the following review studies:
  - To protect water quality overall, "a 100 ft [30 meter] fixed-width riparian buffer is recommended for local governments that find it impractical to administer a variable-width buffer" (Wenger 1999, p. 47).
  - Scientific studies indicated that to protect water quality, vegetated buffers should be between 24 and 42 meters (78 and 138 feet) (Knutson and Naef 1997).
  - "[W]ider buffers (> 50 m) [> 167 feet] more consistently removed significant portions of nitrogen entering a riparian zone" (Mayer et al. 2005, p. iv).

Provision 11. The following water-dependent uses may occur within the total building setback, as long as the impacts of design features are minimized to the greatest extent possible: water-dependent agricultural facilities (e.g., pumps, diversion structures); and water-dependent recreational facilities (e.g., nonmotorized trails, docks, boat ramps) that do not impact vegetated buffers for sensitive species (see Selected Species of Concern recommended design standards or Appendix C.6).

Substantial Evidence for Provision 11

Water-dependent agricultural and recreational facilities must be located adjacent to a body of water or they cannot be used for their specific purpose (i.e., it makes no sense to build a boat ramp 130 feet or more from the water).

The concept of "water-dependent" use has been adopted by the U.S. Army Corps of Engineers, which regulates the filling of wetlands, streams, and other water bodies under Section 404 of the Clean Water Act (Clean Water Act, 40 CFR 230.10[a][3]). The Corps conducts a "water dependency test" for projects it reviews:

- Structures such as boat docks, irrigation intake structures, bank stabilization structures, etc. are considered water-dependent activities. These structures cannot function if they are built on uplands away from a water body; their ability to function is tied to their proximity to a water body. Other water-dependent structures include boat ramps, fishing access sites, fishing piers, marinas, facilities needed to service boats (e.g., marinas, fuel sales for boats, boat repair), facilities that generate electricity from water, and agricultural facilities directly related to removing (e.g., diverting, pumping) water out of a water body (e.g., pumps, diversion structures) (Ankersen and Ruppert 2006).

- Projects such as houses, garages, golf courses, most roads, etc. are *not* considered water-dependent because these structures can be built on uplands away from a water body to accomplish the same result. They function independently of water bodies. The category also includes all housing (e.g., apartment buildings, condominiums, etc.), hotels, motels, restaurants, warehouses, manufacturing facilities, dry boat storage for boats that can be transported by trailer, long-term parking, parking for persons not participating

in a water-dependent activity, boat sale facilities, and agricultural facilities that are not directly related to removing water from a water body (e.g., barns, outbuildings) (Ankersen and Ruppert 2006).

The Corps uses the "water-dependent activity" test to prevent the filling of water bodies unnecessarily. Projects that are water-dependent are allowed to proceed as long as impacts are minimized and/or mitigated; projects that are not water- dependent that would impact water bodies are scrutinized at a much higher standard than those that are water-dependent. Likewise, in this provision of the recommended water body design standards, water-dependent activities may occur within the total building setback as long as the impacts of design features are minimized as much as possible. Many state and local governments use the term "water-dependent use" as a tool for managing land use activities along waterfronts (Ankersen and Ruppert 2006).

Provision 12. Minimize the extent of subdivision roads needed to provide access to all areas proposed for development.

Substantial Evidence for Provision 12

- "Road crossings and other breaks in the riparian buffer effectively reduce buffer width to zero and allow sediment and other contaminants to pass directly into the stream (Swift 1986). Buffer crossings, or even just narrow points in the buffer, may be the locations of the majority of contaminant transport to the stream (Weller et al. 1998). All buffer crossings should be minimized, but when they are necessary, Schueler (1995) suggests the following guidelines:
  - Crossing width should be minimized
  - Direct (90 degree) crossing angles are preferable to oblique crossing angles
  - Construction should be capable of surviving 100-year floods
  - Free-span bridges are preferable to culvertizing or piping the stream" (Wenger 1999, p. 51).
- "The number of stream crossings should be minimized. Stream crossings should be perpendicular to the stream and they should minimize actual contact with the stream (e.g., use long-span bridges). Crossings or stream contact points should be designed to minimize disturbance to stream banks, streambeds, and other sediment-producing situations (Sachet 1988)" (Knutson and Naef 1997, p. 110).

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