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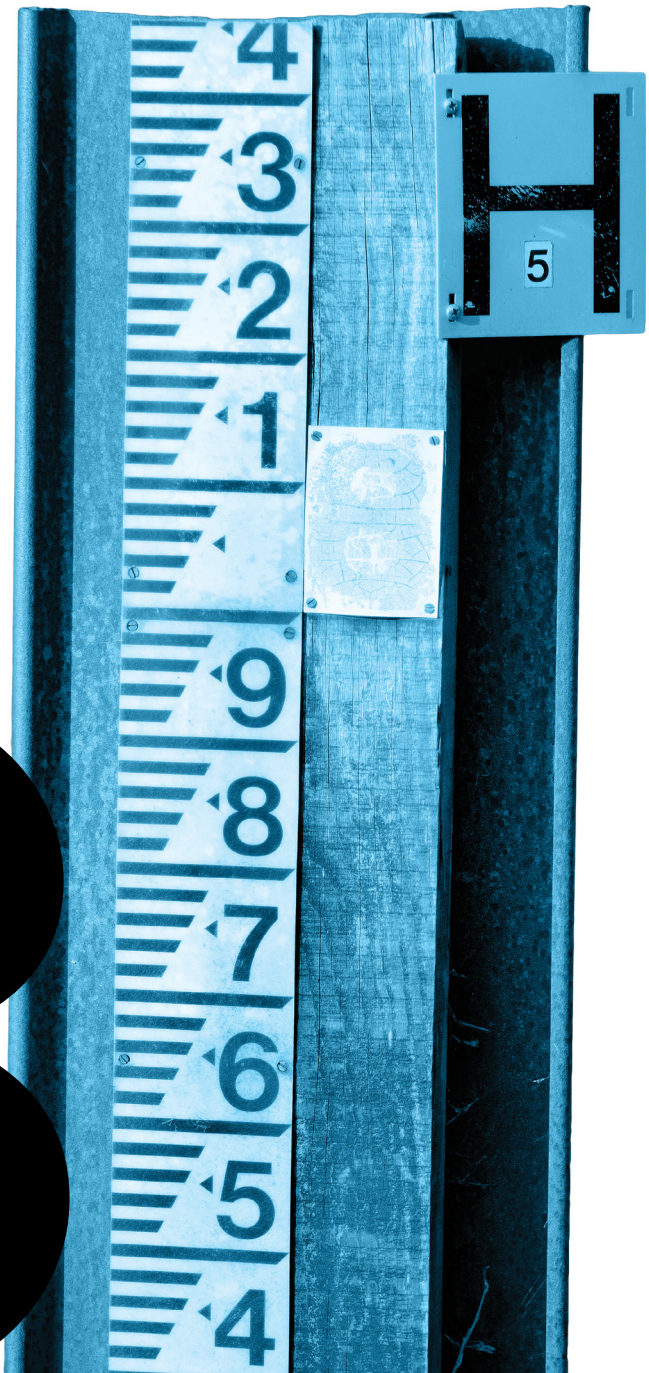

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Accounting for Flood Hazards in the Subdivision Approval Process

By Chad Berginnis and James C. Schwab, AICP

Along with zoning, the subdivision ordinance is a cornerstone of land-use controls for local governments in the U.S. In fact, many smaller jurisdictions that have never enacted zoning ordinances nonetheless have subdivision ordinances of necessity.

Carving up smaller residential parcels out of large blocks of land has long been the path to growth at the local level.

Later this year, the American Planning Association will publish a new Planning Advisory Service (PAS) report, *Subdivision Design and Flood Hazard Areas*, the result of a project funded by the Federal Emergency Management Agency (FEMA) and led by APA's Hazards Planning Center, in cooperation with the Association of State Floodplain Managers. The report examines how, and how well, communities incorporate consideration of flood hazard areas into their subdivision approval process, and recommends best practices. The project extends the work of a 1997 PAS report by Marya Morris, *Subdivision Design in Flood Hazard Areas* (PAS 473), which pursued similar questions and identified both problems and recommended solutions.

But why focus on floodplain management as a subdivision issue? Isn't flooding a larger community problem? The answer to the latter question is obviously *yes*, but that does not negate the value of specifically scrutinizing how subdivision design may contribute to the problem—or the solution. There are aspects of the subdivision approval process that are important factors in the creation of overall flood risk in a community. This issue of *Zoning Practice* draws on the forthcoming PAS report to highlight those questions and suggest answers. Our research during the project revealed that the following issues in subdivision design are of particular concern to justify this attention:

- It is not at all the case that flood hazard areas have all been appropriately identified, thus making it feasible to decide where subdivisions should or should not be located.
- Floodplains are not static features of the landscape, but rather are dynamically affected by new development, which can potentially increase flood risks by reducing impervious surface.
- There is also a need to protect the natural and beneficial functions of floodplains that is often not recognized adequately during the process of reviewing and approving subdivision plans.

With that in mind, the purposes of the new report, and of this article, are to: 1) update the recommended standards for subdivisions with respect to flood hazard areas; 2) examine applicable new knowledge in the field of floodplain management, including data related to climate change; and 3) place this information in the larger context of overall land-use planning in the community.

This article does not attempt to summarize all aspects of the PAS report. It focuses instead on specific areas of concern for updating subdivision standards to improve the management of flood risk. The report includes a wider discussion of the overall issue and a number of case studies highlighting valuable lessons from states and communities.

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Note the stack of wood pallets and woody debris for campfires in one of this subdivision's stormwater retention areas. If the retention area was flooded, the woody debris could clog the outlet, threatening the integrity of the retention area berm and causing more significant flooding.

FUNCTION	RANGE OF RIPARIAN BUFFER WIDTHS		
	Environmental Law Institute (2003)	Fischer and Fischneich (2000)	Hawes and Smith (2005)
Stream Stabilization	30–170 ft.	30–65 ft.	30–98 ft.
Water Quality Protection	15–300 ft. (remove nutrients) 10–400 ft. (remove sediment)	15–100 ft.	49–164 ft. (remove nutrients) 49–328 ft. (remove pesticides)
Flood Attenuation	65–500 ft.	65–500 ft.	--
Riparian/Wildlife Habitat	10 ft.–1 mile	100 ft.–0.3 mile	150–330 ft.
Protection of Cold Water Fisheries	›100 ft. (5 studies) 50–200 ft. (1 study)	--	30–230 ft.

Adapted from *Rhode Island Low Impact Development Site Planning and Design Guidance Manual*, 2011 and "A Scientific Foundation for Shaping Riparian Buffer Protection Regulations," Pennsylvania Land Trust Association, 2014

GEOGRAPHIC FEATURES

One critical issue of floodplain management is that much new development has typically occurred on the fringes of metropolitan areas, where the local planning capacity is often weakest. Small towns and rural areas often acquire planning staff only after significant development has already occurred and growth makes this necessary. By then, flooding issues arising because of new development may already be embedded in the natural and man-made landscape that results. Many water bodies lack identified floodplains because, prior to development, they posed no problem and thus received no attention.

Only one-third of rivers, streams, shorelines, and coastlines in the U.S. have flood hazards identified along them, and only half of those have detailed flood data. While the FEMA flood maps are the world's most comprehensive inventory of flood hazard areas, they are not complete. Further, because funding for mapping is limited and focused on existing areas of high flood risk (as defined by development), the lands most likely to be subdivided have been traditionally areas of low priority for flood mapping. Over 20 percent of flood insurance claims and one-third of federal disaster assistance payments are for damages outside the FEMA-mapped 100-year floodplains.

Communities can remedy this by requiring mapping of the 100-year floodplain and floodway for any area that could hold or convey water where a floodplain has not already been mapped. The basis for identifying these features can include (but is not limited to) U.S. Geological Survey blue line streams or identified water bodies, and historical flooding areas (good for depressional areas, karst topography, or other high-water areas). They can also use lower thresholds than National Flood Insurance Program minimum standards (50 lots or five acres) for triggering the need to undertake a detailed flood study. For example, the threshold could be reduced to five lots and two acres, which would be much more effective in most major subdivisions. Finally, they can require the use of future conditions, with regard to both land use and hydrology, when undertaking new flood mapping. The example of Charlotte-Mecklenburg County, North Carolina, in this regard is well documented, including a 2006 article in *Zoning Practice* by David Godschalk regarding build-out analysis, and a very thorough case study in PAS Report No. 560 (*Hazard Mitigation: Integrating Best Practices into Planning*, 2010).

Over 20 percent of flood insurance claims and one-third of federal disaster assistance payments are for damages outside the FEMA-mapped 100-year floodplains.

The most important landscape features with regard to managing flood risk are riparian areas, the corridors along the edges of rivers and streams that perform numerous ecological, hydrological, and geomorphological functions. These areas are effectively the buffers that protect upland development from the raw energy of water flows during periods of high precipitation. Protection should be the goal for riparian areas in the best ecological condition, while restoration is needed for degraded riparian areas. However, while many riparian areas can be restored and managed to provide many of their natural functions, they are not immune to the effects of poor management in adjacent uplands. Upslope management can significantly alter the magnitude and timing of overland flow, the production of sediment, and the quality of water arriving at a downslope riparian area, thereby influencing the capability of riparian areas to fully function. Therefore, upslope practices contributing to riparian degradation must be addressed if riparian areas are to be improved.

Communities can accomplish this in at least four ways:

- Prohibit development immediately adjacent to streams, rivers, lakes, wetlands, and other water bodies. Avoid land disturbance, pavement, and other impervious cover. Require restoration of any disturbances.
- Require and maximize the width of riparian

buffers. While the minimum width needed depends to some extent on what benefits or ecosystem services are deemed important by the community, virtually all sources recognize that the wider the buffer the better the ecosystem services performance.
- Inventory riparian areas as part of the subdivision process and preserve unimpaired riparian areas in natural conditions.
- Require restoration of impaired riparian zones as a condition of subdivision approval.

LAYOUT AND DESIGN

Cluster subdivisions are one of the most well-known techniques planners use to address many of the needs for better preserving the natural landscape and its functions. A cluster subdivision allows for the modification of dimensional requirements of the zoning law to group or "cluster" structures or lots at a higher density on the most suitable portion of land, leaving other areas open to preserve the natural and scenic quality of open lands. A conservation subdivision is a type of cluster subdivision that focuses on protecting large portions of a site with important environmental value. Usually, half or more of the site is preserved as open space. From a flood risk perspective, there is no other approach that has as much ability to reduce flood damages while simultaneously protecting the integrity of the floodplain ecosystem. PAS Report No. 473 recommends conservation subdivisions with no lots in the floodplain as the best policy for communities. Nothing has changed since 1997 to alter that view. However, some communities may have more difficulty implementing such an approach due to their geography or the fact that any remaining developable land is at higher risk from flooding.

Here are the basic principles of conservation subdivision design that also apply in reducing flood risk and enhancing natural floodplain functions:

- Ensure that floodplain areas are nonbuildable, either laid out as areas that are nonbuildable on lots, or set aside as reserve areas entirely (not contained within lots).
- Preserve riparian areas in perpetuity by making them reserve areas protected through permanent easements. This, in turn, protects or enhances the conservation of wildlife and aquatic resources.
- Use smaller lots.
- Allow for increasing density in developable areas to ensure a roughly equivalent lot yield that would otherwise be allowed if a more conventional subdivision design was applied to the site.
- Be flexible in reducing setbacks from roads and increasing setbacks from floodplains or water bodies.

Communities can accomplish this by prohibiting creation of new lots in the floodplain and requiring that any flood-prone land not be included in any lot. They can also require that floodplain land be set aside as designated open space on the subdivision plat and preserved in perpetuity through permanent easements. If floodplain development is unavoidable, they can require that all lots created have adequate buildable area on natural high ground above the 100-year base flood elevation. They can also require a flood protection elevation of at least two feet above the 100-year flood elevation for any buildings or improvements on a lot, a standard used by Portland, Oregon. Finally, they can ensure that conservation subdivision submittals are meeting the following three goals at a minimum:

- Protecting natural streams, water supplies, and watershed areas
- Maintaining and enhancing the conservation of wildlife, natural, or scenic resources
- Promoting conservation of soils, wetlands, and other significant natural features

Other considerations in layout and design include restrictions on problematic uses (e.g., storage or production of hazardous materials), dedication of land areas for public facilities and services, and providing adequate access, particularly where evacuation may be necessary or for the use of emergency vehicles. While not addressed here, these issues do receive attention in the forthcoming report.

INFRASTRUCTURE

In most subdivisions, roads and utilities are the two areas of concern with regard to development of infrastructure. The important questions relate to establishing standards that will protect such infrastructure from damage from natural hazards, including floods. For roads and bridges, this primarily means sizing culverts and bridges to handle the 100-year storm, and requiring the elevation of road surfaces above the base flood elevation—or allowing only a minimal flow of water over the road in such an event.

Utilities typically include electric, natural gas, and water and wastewater installations, all of which must be protected from damage in the event of flooding, for example, by mounting transformers and similar facilities above flood

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A nonelevated pad mounted transformer in the floodplain, very close to the flooding source.

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The small creek in the photo on the left drains 200 acres upstream of the stormwater detention pond in the photo on the right, which is partially owned by a home owners association (the other half of the pond is owned by another by the original developer). When the Hopewell Heights development was constructed about 10 years ago, the pond was eight to 20 feet deep. After 10 years, sedimentation reduced the depth from between zero and four feet, nearly eliminating the pond's stormwater storage function. The association decided to dredge its half of the pond and perform needed improvements to the outlet at a cost of nearly $20,000. Unfortunately, the original developer has refused to dredge the other half, imperiling the ongoing functionality of the pond for stormwater management.

levels. Ideally, utility easements should simply be located outside flood hazard areas entirely. Major utility equipment should be included in the community's definition of critical facilities, which should then be required to be located outside the 500-year floodplain to ensure a minimum of damage.

One area of concern identified in the new report is the proliferation of owners associations. According to the Community Associations Institute, 20.7 percent of the U.S. population, or 66.7 million Americans, live in 333,600 common-interest communities. Approximately 55 percent of these common-interest communities are home owners associations. Indeed, subdivision standards across the country generally allow for the creation of owners associations—usually either condo or home owners. These owners associations may manage roads, parklands and other open space, stormwater, and flood control infrastructure. If the association is managing these facilities, they are usually considered privately owned. The increasing use of the owners association may be seen as beneficial by tax-starved local governments who see them as a way to promote development and raise new tax dollars while avoiding liability for these new facilities. The question is whether such associations will be able over the long term to maintain the necessary assessments to support responsibility for managing highly engineered systems such as levees and floodwalls. The report offers some recommended standards for handling these problems.

PLATTING

One major step for the future involves the use of flood hazard information on plat maps. Significant improvements in FEMA flood maps have resulted in new flood maps that are overlaid on an aerial mapping layer, but the next step is to transfer that information to subdivision plans and plats. Having such data on preliminary plans can help community staff and planning boards make informed decisions as they consider approving new subdivisions. Having this information on final plats is very helpful in informing potential new residents and buyers of parcels of flood risk on the lots being developed.

Communities can address this by showing the 100-year elevation level on all subdivision plats. They can also require that those final plats include the building pad or proposed lowest finished floor elevations. Finally, a floodplain note on the plat or survey can identify the parcel as being flood prone (with references to flood zones and FIRM [Flood Insurance Rate Map] panel information), state that improvements are subject to additional floodplain management regulations, and inform of the need to submit an elevation certificate, or the need to purchase flood insurance.

Communities can also use conservation easements to permanently protect flood-prone areas or floodplains. Most planners are already familiar with the use of conservation easements in various contexts, so the real issue is how to apply them in this particular context. Planners can create incentives for the use of such easements for floodplains by allowing density bonuses on lots or dwelling units and by requiring a permanent conservation or drainage easement when the community has areas of lots in the floodplain that are not allowed to be developed. For example, Lake County, Illinois, requires a stormwater/drainage restrictive covenant for each lot platted for areas that are designated as stormwater and drainage ways, floodplains, wetlands, and buffer areas. This permanent deed restriction limits uses, requires maintenance of the area by the lot owner or home owners association, and importantly allows any property owner in the subdivision, property owners downstream or upstream adversely affected by any violation, or the municipality to have standing to bring an enforcement action.

WATERSHED MANAGEMENT

Stormwater management over the past few decades has relied on highly engineered practices that channel stormwater quickly and efficiently

away from the development site and into storm sewers, detention ponds, or nearby water bodies. However, new concepts are shifting the momentum in a new direction. Low-impact development (LID) is a set of techniques with the goal to restore or maintain predevelopment hydrological conditions, usually focused on retaining more stormwater where it falls. LID is generally focused on the site scale and uses natural systems and engineered systems. Similarly, green infrastructure is a set of techniques utilizing natural resources to manage stormwater and help preserve the ecological function of watersheds. Green infrastructure can occur at both the site and larger scale (neighborhood, municipal, regional, or watershed). For example, while using porous pavement in a parking lot for a commercial subdivision is definitely a LID technique, some may not consider it a green infrastructure technique.

Both techniques are decentralized stormwater management strategies that provide on-site water quantity and quality treatment, which is their main difference from traditional gray-infrastructure-based stormwater management. See the Resource Box for more information. It is also important to keep in mind that green and gray are not entirely mutually exclusive choices. Both have a role to play in addressing stormwater management problems, but they work in very different ways.

Communities can require the use of green infrastructure and LID techniques in both stormwater management and roadway design sections of subdivision regulations. These design elements can include bioswales, enhanced infiltration ditches along roadsides, and the general reduction of impervious surface area through the use of LID roadway and parking design standards. They can also require that postdevelopment peak storm flows and runoff be no higher than it was prior to development. Finally, they can require, prior to any site alterations, the development and submittal of a stormwater control plan, stormwater operations maintenance manual, and budget. A good example of using LID comes from Rhode Island's *LID Site Planning and Design Manual,* which recommends requiring, for parking lots of 10 or more spaces, that 10 percent of the parking lot area be dedicated to landscaped areas that can include LID stormwater practices.

Finally, communities can also focus more on habitat protection through a number of measures in subdivision approval, including identifying conservation land priorities such as protecting wetlands, undisturbed riparian areas, and the protection of rare or endangered species. Habitat assessments can be prepared to demonstrate that any subdivision activities will not adversely impact the habitat and species supported by the site and describe appropriate mitigation measures.

CONCLUSION

This article has focused specifically on a range of subdivision approval standards that can be adopted to enhance the management of flood risks connected with subdivision development. There is little question that, in many parts of the nation, there is ample room for tightening requirements and ramping up expectations for performance in this regard. What this article does not cover so much, but the forthcoming PAS report does, is the set of larger issues and principles that should underlie the subdivision approval process as we move toward a much better-informed planning process with regard to floodplain management. It is important, as emphasized nearly six years ago in *Hazard Mitigation: Integrating Best Practices into Planning* (PAS 560), the best overall approach is to incorporate these subdivision standards into a holistic planning approach to risk management. The best way to anchor these enhanced subdivision standards is in a larger community strategy to achieve disaster resilience.

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Floodplain boundary markers are required in Licking County, Ohio. These permanent markers are steel posts, approximately four feet high with a clear label. In this subdivision, a floodplain boundary marker is required every other lot.

The use of bioswales in a parking lot, along a pedestrian path, and in front of a building on the campus of Colorado State University.

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Resources Discussing Decentralized Stormwater Management

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