Design Evolution

The future of sustainable land development

By Rick Harrison

If humans remained in caves and had not invented the wheel, it would be safe to say there would be no need for a magazine such as *Storm Water Solutions*. But we did evolve and impact the environment with every structure and the conduits to serve them. It was not until recently that humans have become aware of the damage development causes to the environment. A more disconcerting issue is that our development patterns have been in stagnation for more than half a century: Our awareness has changed, but not the way we develop land.

Our simple but wasteful pattern of development increases the burden on storm water systems and those who design them. Storm water is unique in engineering, as each area has an authority that may regulate it differently. Storm water engineering is not precise compared to the coordinate geometry we use to develop subdivision plans. What is assumed is that the calculations used in storm water engineering are based on collective impact of impervious surfaces.

Impervious vs. Pervious

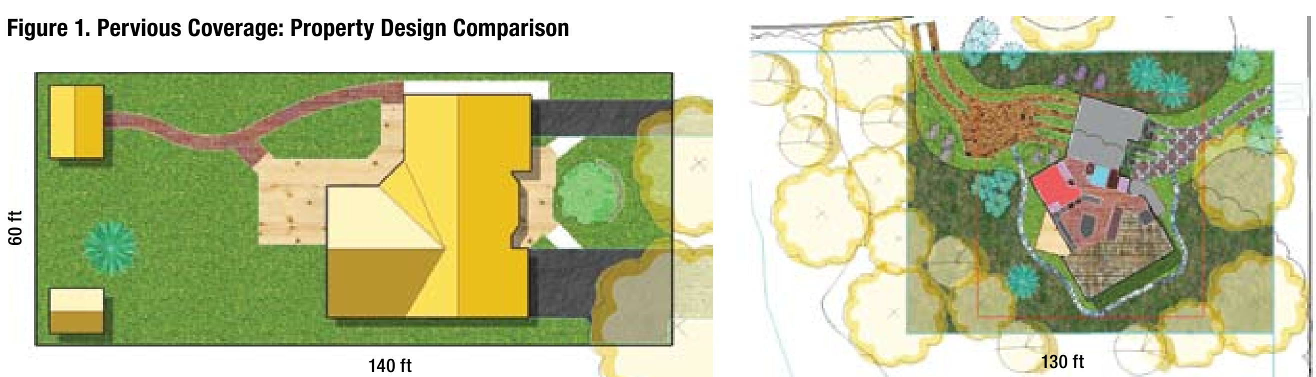
What do you think would happen if we could decrease impervious surfaces in new development by 5%, 10%, 20% or 30% by using more efficient design methods? This can be done by paying more attention to detail than we have been doing in the past—both in the design of buildings and the land plan.

Figure 1 depicts the plans for two homes. Both have three levels (two upper floors and a lower level). Home A is a 1936 Cape Cod covering 2,130 sq ft in structures and totaling 3,102 sq ft in impervious area, including impervious drives and walks. The home measures 2,300 sq ft, and its garage houses two cars. Home B is a "green"-certified home built in 2009 that covers 2,000 sq ft, with a total of 2,548 sq ft in impervious paving. This home measures 3,600 sq ft, and its garage houses four cars.

The new dwelling consumes 18% less impervious area because of more efficient architecture and driveway design. It also serves as an empty-nester home because of its elevator. Traditionally, builders serve the empty-nester market by offering single-level homes. A single-story 3,600-sq-ft house with four garage spaces would consume a 4,550-sq-ft foundation area. The home's elevator cost $20,000, which is less than the cost of an extra 2,614 sq ft of foundation and roof area.

The trend to develop single-level

Figure 1. Pervious Coverage: Property Design Comparison



Home A – 1936 Cape Cod

Impervious Areas	
Driveway	830 sq ft
Structures	2,130 sq ft
Concrete Walk	142 sq ft
Total Impervious Area	3,102 sq ft
Compared to Total Site	37%

Home B – 2009 Green Certified

Impervious Areas	
Main Level	1,924 sq ft
Main Driveway	548 sq ft
Porch	77 sq ft
Total Impervious Area	2,548 sq ft
Compared to Total Site	20%

homes to serve the empty-nester market produces an extreme excess of impervious surface area. A great architect can make a 2,200-sq-ft home function as well as a 2,500-sq-ft (the national average) and feel larger as well. This is but a single example of how developers can reduce impervious surface area by 5%, 10% or even more than 50% with smarter architectural design.

The designs of today's subdivisions were set by the mid-1960s. The foundation developers use to determine their success and failure is that site plan. Unfortunately, it does not include lessons on targeting waste in site design. To make matters worse, the technology today reduces to quickly throwing a course of action together almost as fast as the designer can sweep a mouse pointer across a screen. Technology always has been about producing fast plans rather than great, efficient neighborhoods.

A collection of new design methods and technologies based on the promise to reduce infrastructure while maintaining density results in less impervious surface area, significantly reducing both land development costs and storm water load impact. These methods include new models called coving, blended architecture, connective neighborhood design, neighborhood marketplace, pull-back, pedestrian-oriented design and more.

Conventional vs. Coved

Figure 2 illustrates a 62.4-acre conventional subdivision containing 89.5-acre lots and the same neighborhood using coving. Coving is the first organized method of planning that breaks the relationship of home and street using independent meandering patterns. To demonstrate the power of coving, we use this San Antonio-area site plan for which the maximum allowed impervious surface coverage is 20%, or 12.5 acres, in walks, streets, driveways and homes.

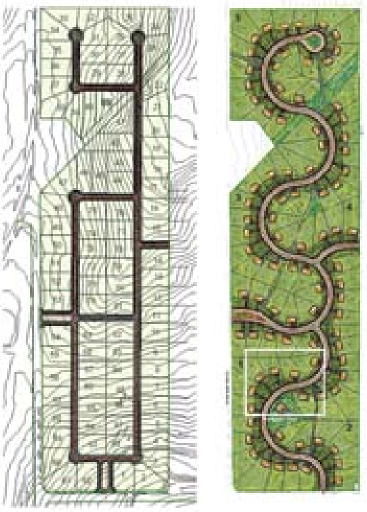
The original grid plan was approved, but the developer faced excessive impervious surface area that allowed only 6.8 acres for homes and driveways. The market for these upscale lots would demand a three-car garage, so, after subtracting the typical driveway surface area, the largest home footprint allowed would average 1,866 sq ft. The three-car garage and wall thickness left a living area of 1,200 sq ft. The developer needed to rethink the plan and used coving as the solution.

The coved design reduced the street length by more than 20%, yet it maintained the 89-lot density with 0.5-acre minimums. There was enough area left over to include a 1.1-acre community center, and public street area decreased by 28%.

Using new methods to design sculpted driveways that are more attractive with less surface area, the driveway surface decreased slightly despite the fact that the homes have three-car garages and deeper setbacks, on average. The developer reduced walk area by 11%, even though the meandering surfaces are between 5 ft and 8 ft wide compared to the conventional 4-ft-wide walks. The coved layout, therefore, offers better pedestrian connectivity.

Figure 2. Conventional vs. Coved Design

	Conv.	Coved
Street Paving	5.5 acres	4.1 acres
Walks	1.3 acres	1.2 acres
Total	6.8 acres	5.2 acres
No. of Lots	89	89
Driveway	1.8 acres (estimated)	1.8 acres (actual)



Conventional Coved Detail

The coved plan allows the average home footprint to be 2,675 sq ft, which is about 2,000 sq ft of living area after deducting the area taken by the garage. If the homes were the same size per lot, the coved design would have reduced impervious surface area by more than 800 sq ft per home without having to reduce a single existing ordinance minimum.

The conventional plan has long, straight streets to increase runoff velocity and require storm water to make 90-degree turns. The organic, flowing coved design, on the other hand, calms the storm flow and provides extra space for surface drainage systems. Curb appeal, functionality, traffic flow and livability are improved, and the developer has an environmentally responsible and economically sound development.

Tech Support

The examples cited in this article were performed using a new form of technology known as Performance Planning System (PPS), a combination of software and education. PPS precision geometry tracks areas called "shapes," referring to the various colors and textures in this article's figures. Areas called "pave" have a texture that looks like concrete. A switch tells PPS if pave is pervious or impervious to automatically track surface volume as the development is designed.

Software cannot devise decisions, but it can provide the tools to make the decision process easier and experiment with the best possible balance between livability, economics and environment. Welcome to the new future of sustainable development. SWS

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