MAKING LOW IMPACT DEVELOPMENT THE NORM (INSTEAD OF THE EXCEPTION)

Rocky Mountain Land Use Institute University of Denver Law School March 2015 • Don Elliott, FAICP Clarion Associates

• Karen Hancock City of Aurora OVERVIEW

1. What's the Problem?

2. Aurora's Innovations

• Andrew Earles, Ph.D., P.E. Wright Water Engineers 3. What Others Are Doing

OVERVIEW

What is Low Impact Development (LID) ?

LID is an approach to land development (or redevelopment) that works with nature to manage stormwater as close to its source as possible.

LID employs principles such as preserving and recreating natural landscape features, minimizing effective imperviousness to create functional and appealing site drainage that treat stormwater as a resource rather than a waste product.



OVERVIEW

What is Low Impact Development (LID) ?

- Bio-retention Facilities
- Vegetated Roofs (Green Roofs)
- Rain Barrels
- Rain Gardens
- Permeable Pavements



OVERVIEW

And Why is it Important?

- Reduces peak and total stormwater runoff, which . . .
- Reduces suspended pollutants that enter waterways
- Reduces costs of hard infrastructure (pipes) necessary to transmit stormwater downstream
- Reduces Combined Sewer Overflows



Very Popular Idea

Lots of papers and examples of how LID <u>can</u> work

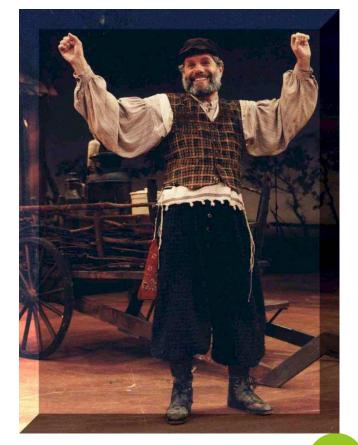






So Why is LID So Rare in Practice?

- 1. Tradition !!
- Many builders want to do what they did last time around
- Many engineering codes do not yet recognize LID options to installing hard infrastructure



So Why is LID So Rare in Practice?

2. Maintenance Concerns

• Like many sustainable practices, LID requires some commitment to ensure that pervious surfaces remain pervious over time . . . which means periodic maintenance.



• The question is . . . who will be responsible for that maintenance?

So Why is LID So Rare in Practice?

3. It's Not Required

Most LID "ordinances" are not regulatory

Most list examples of LID practices as options that can be considered . . .

But often require an extra layer of review / approval beyond that for traditional hard infrastructure



So Why is LID So Rare in Practice?

4. It Requires More – and Earlier – Coordination Between Planners and Engineers

It requires integrating stormwater management into preliminary site designs – not assuming you can engineer water off of almost any site



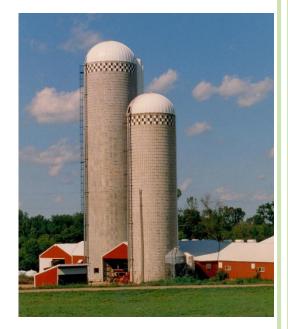
Unfortunately . . . All to often

1. Planners OK the Site Plan

and then

 Engineers apply infrastructure engineering standards to that Site Plan

> and often find conflicts that could have been avoided



Unfortunately . . . All to often

 Planners OK the Site Plan based on zoning/parking/landscaping standards ... <u>without</u> considering LID ... because those options are in the engineering standards

But public works engineers then find that the site plan does not contain enough pervious area to accommodate the required stormwater infiltration.

OR

Planners OK the Site Plan based on zoning/parking/landscaping standards ... and DO plan for LID by reducing the amount of impervious area on the site

But public works engineers then find that the pervious areas of the site are not located where they can effectively manage the onsite stormwater

To Avoid these Barriers

- 1. Wherever possible, LID needs to be made the standard planning and engineering requirement not an option
- 2. The use of hard infrastructure to convey on-site stormwater needs to be made the option, and one that requires extra justification
- 3. HOAs (or the City) need to be clearly responsible for continued maintenance
- 4. A stormwater engineer needs to be involved in site planning but limited to evaluating conceptual design information

Example: Pittsburgh PA Requires

- Incorporating LID features from a detailed list, and disconnection of impervious areas from the storm sewer system, unless a licensed engineer presents documentation that the incorporation of those features is impracticable.
- Applies to most land development over 10,000 sf in area that creates more than 5,000 sf of new impervious areas
- Applies to all publicly funded or publicly assisted projects.



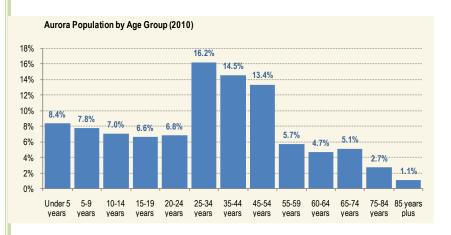
AURORA'S INNOVATIONS

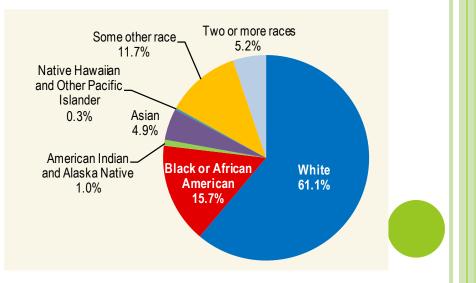


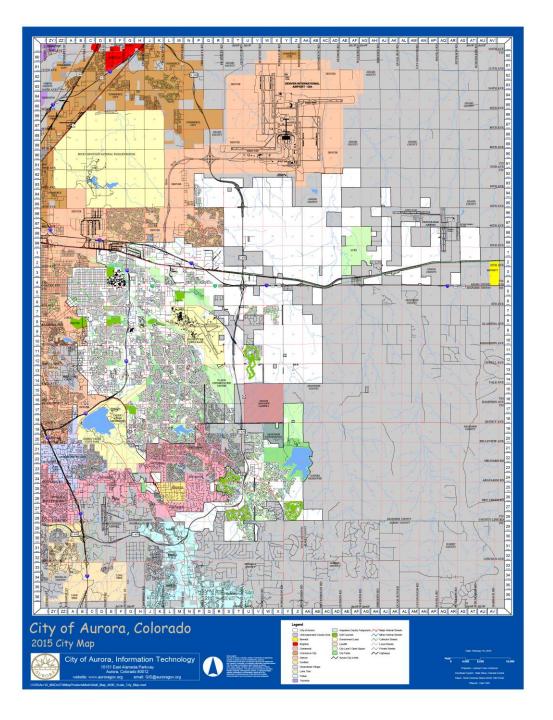
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WHO IS AURORA?

Population=350,000 Land Area=154 square miles ~50% developed Three counties: Adams, Arapahoe, Douglas











"GREEN" WAL-MART





RESIDENTIAL LANDSCAPING: TURF OPTION

Table 14.3A Home Yard Landscaping—Turf Option						
Front, Side, and Rear Yard Landscaping Requirements for Single-Family Detached, Two-Family, and Single Family Attached Duplex Homes						
FRONT YARD						
	(A) Plant Quality and Type	(A) Requirements				
1.	Turf. (At corner lots with a side yard visible to public view, turf areas shall include both front and side yard areas)	Minimum and Maximum Turf per Lot size Small (3,700 sf-5,999 sf)—40% and 50% Max. Standard (6,000 sf – 8,999 sf) –30% Min. and 40% Max Large (9,000 sf – 14,999 sf)—25% Min. and 40% Max Estate (15,000 sf +) –25% Min and 40% Max.				
2.	1 Shade Tree, and either	2 ½ inch caliper				
	1 Ornamental Tree	2 inch caliper				
	Or 1 Evergreen Tree	6 foot height				
3.	Front Yard shrubs per lot size: Small—8 Standard—16 Large—26 Estate—36	Shrubs—5 gallon container Min. –Plant material shall conform with <u>American Standard for Nursery Stock,</u> <u>Ansi Z60.1</u> current edition. Fabric may be omitted under annuals, perennials, and groundcovers. Use a variety of shrubs and plant materials that will provide visual interest during all seasons.				
SIDE YARDS						
Internal side yard, not exposed to public view—no plant material is required but mulches are required for soil stability. External side yards on corner lots exposed to public view—shall be landscaped with turf, and shrubs and trees at the rate of one tree and 10 shrubs per 40 linear feet of side yard.						

REAR VARDS

Turf or xeric landscaping is not required. In rear yards the use of natural turf shall be limited to not more than 45% of the area to be landscaped.

No maximum restriction shall apply to the use of the artificial turf. Rear yards at corner lots exposed to public view shall be landscaped with turf or xeric landscaping.







SOLUTION

- Grant: Western Resource Advocates
- Huddle with key staff
- Developed draft ordinance—starting point
- Hired consultant to test ordinance

DRAFT ORDINANCE

- Targets master development infrastructure
- Reduces impervious areas
- Leverages existing ordinances that address landscaping

TESTING

- Targets master development infrastructure
- Select BAU site plan
- Recalculate using LID/draft ordinance
- Tweak draft ordinance

LID EVALUATION USING DEVELOPMENT PLANS

 Calculated impervious area of "typical" residential lot

• Evaluated disconnecting three levels of impervious area: 40%, 60%, and 80%

 Compared WQCV with disconnected impervious area to WQCV without LID practices

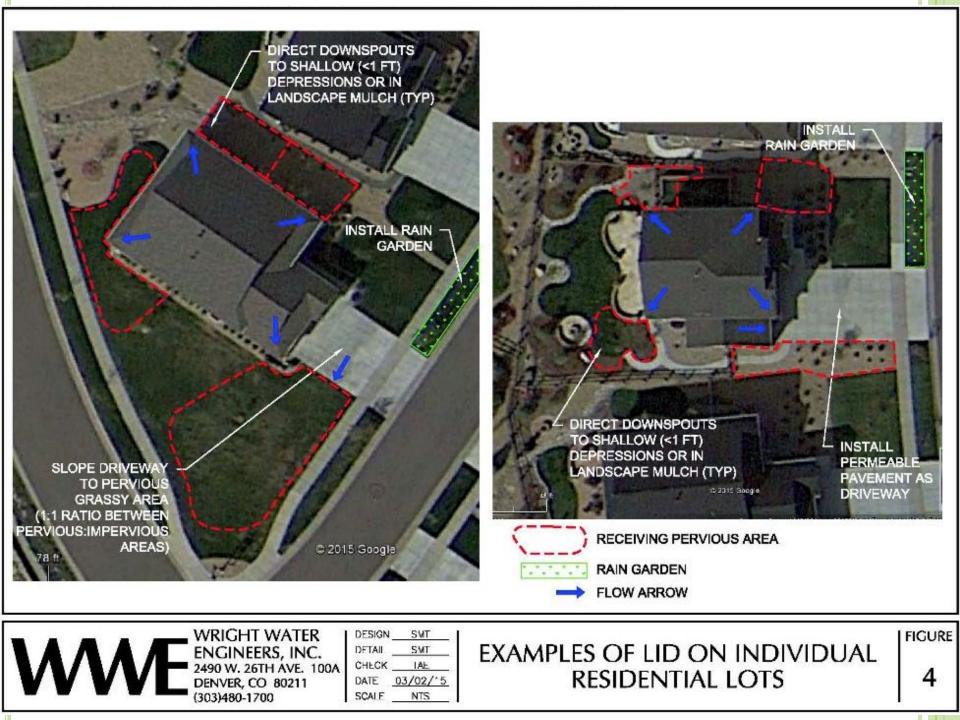
PRELIMINARY FINDINGS

Reduction in	Water Quality	Capture Volume
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40% Disconnected	60% Disconnected	80% Disconnected
Impervious Area	Impervious Area	Impervious Area
20%	30%	50%

• Impervious area draining to a pervious area must be at a 1:1 ratio

• Not a one-size-fits-all solution to incorporate LID into a suburban development



LOW IMPACT DEVELOPMENT (LID) IN SEMI-ARID ENVIRONMENTS

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StormwateReport

Home

The Report 💿

Why is LID challenging in a semiarid environment



Colorado's "Taupe Infrastructure"

February 5, 2014 | 1 Comment

Colorado is a headwaters state with pristine water quality from mountain streams.

Colorado is a headwaters state with pristine water quality from mountain streams. Low impact development (LID) is viewed as an option for maintaining those healthy waters and meeting high goals for receiving waters. Unlike many other parts of the U.S., combined sewer overflows are not a stormwater management driver in Colorado, and LID is typically implemented on a voluntary basis, rather than under consent decree requirements.

Through guidance from the Urban Drainage and Flood Control District, stormwater management approaches ---

such as swales, buffers, and disconnecting directly connected impervious areas - have been in place since the 1990s. Recently, some cities, including Fort Collins and Denver, have further emphasized and encouraged the use of LID in their jurisdictions.

However, this water-limited region faces unique challenges, including its semi-arid climate and western water law. As the U.S. Environmental Protection Agency moves forward with a national stormwater rule requiring onsite retention, Colorado looks at new ways to manage stormwater.

"There are ways to work within water rights laws. But it won't be easy, and there is no simple solution," said Andrew Earles, vice president at Wright Water Engineers, Inc.

LID BARRIERS

- Physical
- Institutional
- Barriers for municipalities
- Barriers for engineers
- Barriers for the public



http://wrightwater.com/wpcontent/uploads/2011/10/LID_Barriers_White_Paper_FINAL.pdf

MOST FREQUENTLY IDENTIFIED BARRIERS

- Costs—design, construction, operation and maintenance, life cycle
- Potential for mixed messages from government (different departments)
- Maintenance and durability
- No clear economic incentive



MOST FREQUENTLY IDENTIFIED BARRIERS

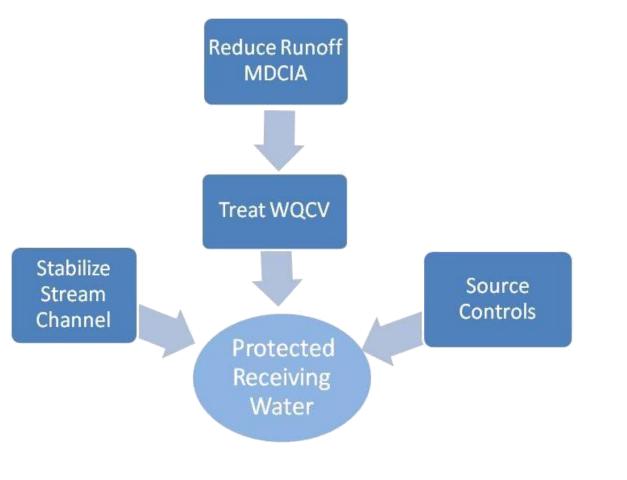
- Not integrated early enough in planning process
- LID does not altogether eliminate need for other types of BMPs and drainage infrastructure
- o "Recommended" not "required"
- Few successful local demonstration projects

What works?



THE FUNDAMENTALS HAVE NOT CHANGED

4 Step Process



Directly Connected Impervious Area



This is what we want to avoid!



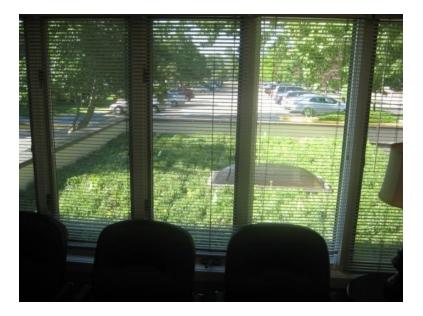
MDCIA



• Minimize Directly Connected Impervious Area



Photographs from Wenk Associates, Comprehensive Approaches to Stormwater Management. Presentation by WWE, Wenk and Sand County Studios for Iowa Economic Development Authority.





RUNOFF REDUCTION



• Reduce Impervious Area

BIORETENTION (RAIN GARDENS)



TAXI- DENVER, CO





COMMON PROBLEMS





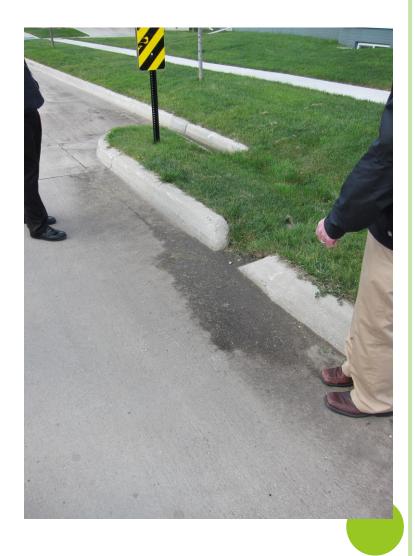


Wrong Growing Media & Poor Mixing On-Site

Sod Layer on Raingarden Surface

POOR CONSTRUCTION/ DETAILING





POOR PLANT SELECTION / NO PLAN FOR SEDIMENT REMOVAL



Photographs from Wenk Associates, Comprehensive Approaches to Stormwater Management. Presentation by WWE, Wenk and Sand County Studios for Iowa Economic Development Authority.

POOR PLANT SELECTION/ HIGH LEVEL OF POLLUTANTS





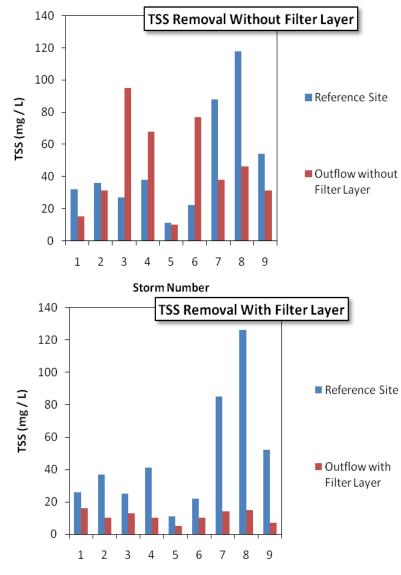
APPROPRIATE PLANTING/ BUT LACKING AN UNDERDRAIN



APPROPRIATE PLANTING, SYSTEM ACCOMMODATES MODERATE SEDIMENTATION



(PPS)

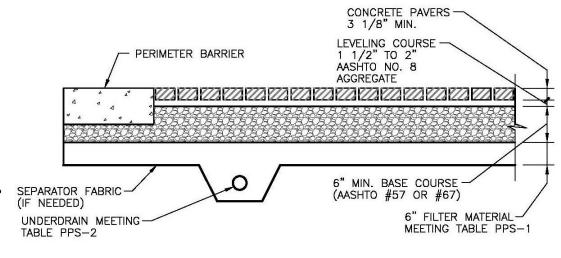




Storm Number

PERMEABLE INTERLOCKING PAVEMENT (PICP)

- Can be used for traffic calming.
- Can be used in intersections.
- Can be placed back if utility cuts or other patches are required.
- Maintains infiltration rates well.
- Provides flexibility in design options such as color and patterns.
- LEED credit potential.

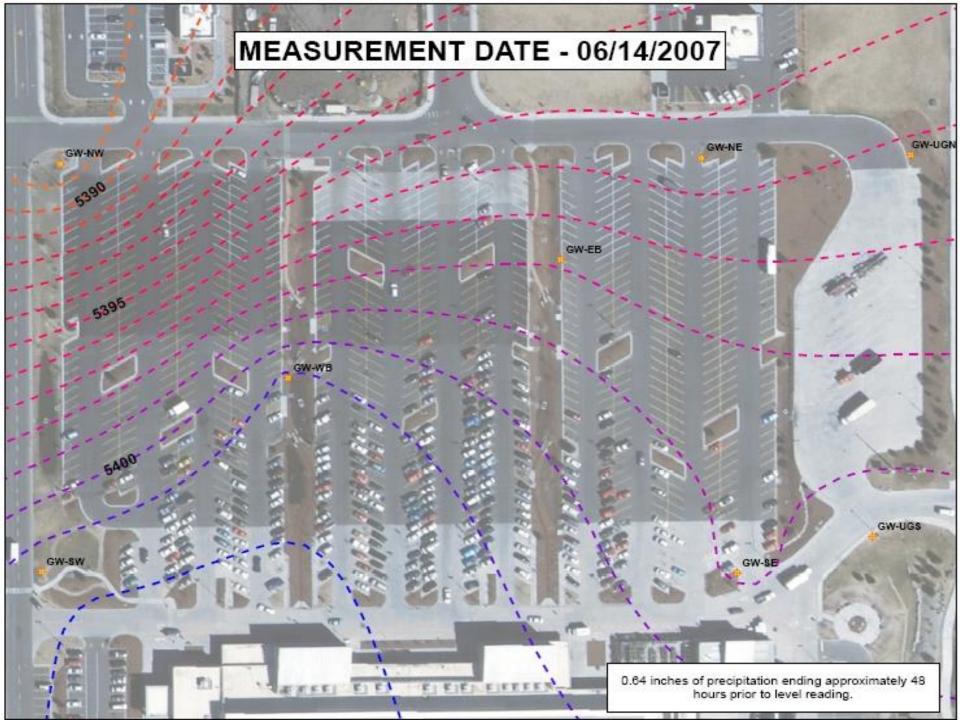


NOTES:

1. THIS SECTION IS DESIGNED FOR PARTIAL INFILTRATION AS DESCRIBED IN BMP FACT SHEET T-10. SEE FIGURE PPS-1 FOR MODIFICATIONS FOR USE WITH NO INFILTRATION OR FULL INFILTRATION SECTIONS.

2. A PAVEMENT DESIGN SHOULD BE PERFORMED IN AREAS OF VEHICULAR USE.

FIGURE PICP-1 PICP PAVEMENT SECTION



PICP









PERVIOUS CONCRETE

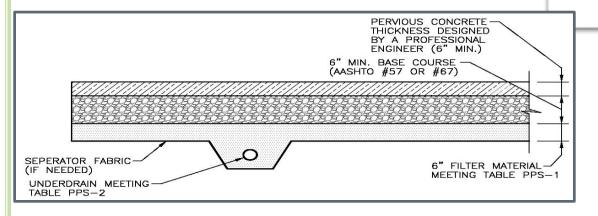




Specifier's Guide for Pervious Concrete Pavement Design Version 1.2

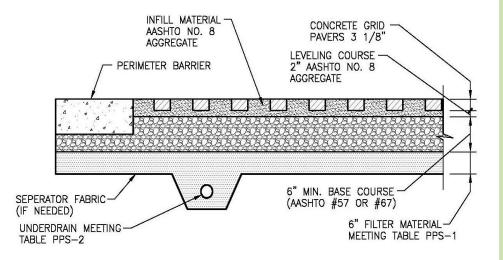
Colorado Ready Mixed Concrete Association 6855 South Havana Street Suite 540 Centennial, CO 80112 303-290-0303 crmca@crmca.org www.crmca.org





CONCRETE GRID PAVEMENT









PERMEABLE GRASS PAVING



POROUS GRAVEL





CISTERNS?



Source: Colorado AWARE: http://picasaweb.google.com/buildgreeninfrastructure

No one likes "ugly" stormwater management facilities!

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