Zen & the Art of Land Use Planning

A primer for stormwater and floodplain managers toward more effective development codes

AGENDA

10:00 am – 11:30 am	Connecting land use policies and development codes to stormwater and floodplain management
11:30 am – 12:30 pm	Lunch provided by Randall Miller & Associates, Inc.
12:30 pm – 2:00 pm	Implementation through specific examples and case studies

SPEAKERS

Sheila McKinley
smckinley@cbbel-in.com
317.266.8000
CHRISTOPHER B. BURKE ENGINEERING, LLC

Heather Williams
Heather.Williams@amec.com
317.713.1700
amec foster wheeler

Bryan Wallace
BWallace@lochgroup.com
812.725.7900
LOCHMUELLER GROUP

Zen and the Art of Land Use Planning

A primer for stormwater and floodplain managers toward more effective development codes

INAFSM Stormwater and Floodplain Committees Workshop
September 23, 2015

CHRISTOPHER B. BURKE
ENGINEERING, LLC

True or False

* Where and how a community grows affects water resources

TRUE or ~~False~~

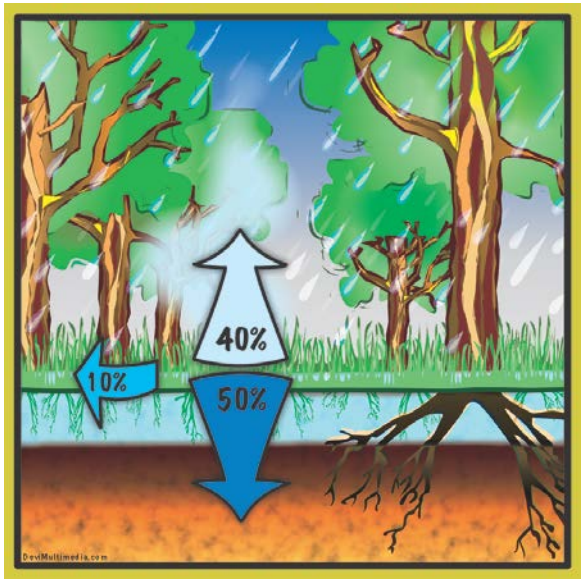
* Land development practices drive impervious cover and land cover conditions
* Policies embedded in land use codes

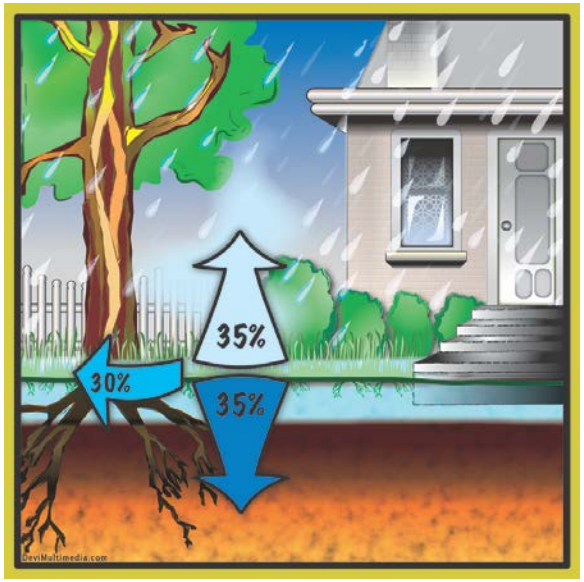
True or False

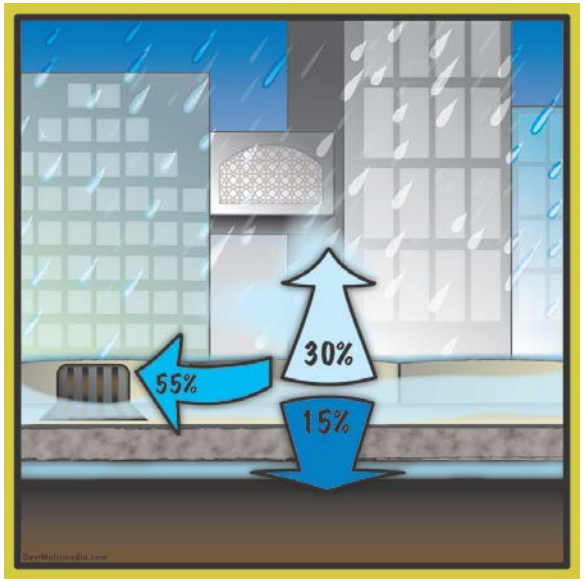
* Impervious is one of the most important indicators of overall watershed health

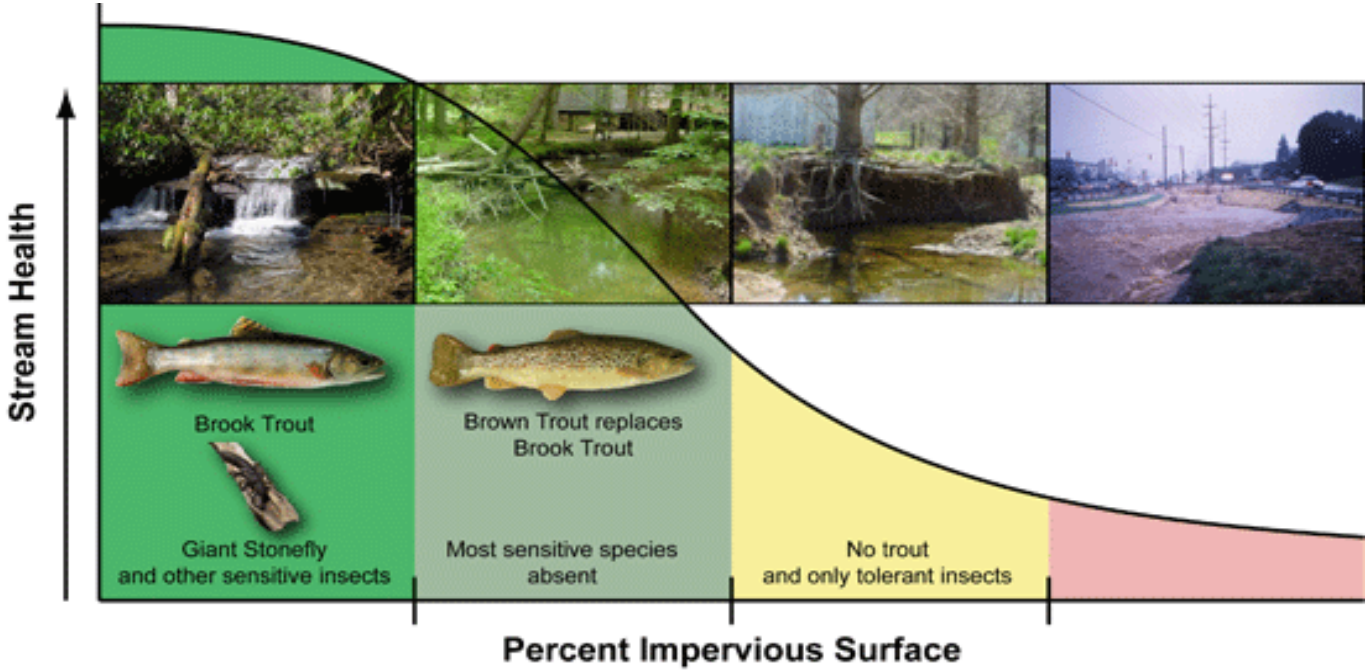
TRUE or ~~False~~

* Impervious is relatively easy to measure and numerous studies have correlated it to runoff volume and stream health
* Land use codes dictate impervious cover


40%
10%
50%


35%
30%
35%


30%
55%
15%



<5%	5-10%	10-20%	>20%
• Water cool and clean • Stream banks and bottom typically stable • Trout can be found • Endangered species can be found • Many fish species • Many salamander species • Many freshwater mussels • Many insect taxa	• Water may be warmer and slightly polluted • Erosion may be evident • No brook trout • Most rare and endangered species absent • Many pollution tolerant fish • Fewer salamander species • Only tolerant mussels • Fewer insect taxa	• Water warmer • Erosion usually obvious • Trout absent • Rare stream species absent • Fewer fish species • Only three tolerant salamander species • No native mussels • Mostly tolerant insects	• Water warm and pollution usually evident • Unstable habitat • Trout absent • Non-native species dominate some streams • Only tolerant fish species • One salamander species • No native mussels • Only tolerant insects

True or False

* Site level practices for stormwater and floodplain management can restore degraded waterbodies

~~True~~ or **FALSE**

* Restoration of degraded waterbodies requires a watershed approach
* Land development process addresses stormwater and floodplain issues at the site level

How do we get there?

1. Evaluate land development codes
2. Integrated strategies
3. Watersheds-based planning

1. Evaluate Codes

* Are your land use codes consistent with your stormwater and floodplain management goals?
* Codes to evaluate:
  * Zoning Ordinance
  * Subdivision Codes
  * Street Standards & Road Design Guidelines
  * Parking Requirements
  * Setback Requirements

Center for Watershed Protection

Code & Ordinance Worksheet

Development Feature	*Your Local Criteria*

1. Street Width

What is the minimum pavement width allowed for streets in low density residential developments that have less than 500 daily trips (ADT)? _____ feet

*If your answer is between **18-22 feet**, give yourself **4 points** @*

At higher densities are parking lanes allowed to also serve as traffic lanes (i.e., queuing streets)? YES

*If your answer is **YES**, give yourself **3 points** @*

Notes on Street Width (include source documentation such as name of document, section and page #):

2. Street Length

Do street standards promote the most efficient street layouts that reduce overall street length? YES

*If your answer is **YES**, give yourself **1 point** @*

Notes on Street Length (include source documentation such as name of document, section and page #):

http://www.gflrpc.org/ProgramAreas/Planning/Water Resources/COWForm.pdf

17. Buffer Systems

Is there a stream buffer ordinance in the community? YES

*If your answer is **YES**, give yourself **2** points* @

If so, what is the minimum buffer width? ____ feet

*If your answer is **75 feet or more**, give yourself **1** point* @

Is expansion of the buffer to include freshwater wetlands, steep slopes or the 100-year floodplain required? YES

*If your answer is **YES**, give yourself **1** point* @

Notes on Buffer Systems (include source documentation such as name of document, section and page #):

18. Buffer Maintenance

If you do not have stream buffer requirements in your community, skip to question No. 19

Does the stream buffer ordinance specify that at least part of the stream buffer be maintained with native vegetation? YES

*If your answer is **YES**, give yourself **2** points* @

Does the stream buffer ordinance outline allowable uses? YES

*If your answer is **YES**, give yourself **1** point*

22. Stormwater Outfalls

Is stormwater required to be treated for quality before it is discharged?	YES
*If your answer is **YES**, give yourself **2** points* @	
Are there effective design criteria for stormwater best management practices (BMPs)?	YES
*If your answer is **YES**, give yourself **1** point* @	
Can stormwater be directly discharges into a jurisdictional wetland without pretreatment?	YES
*If your answer is **NO**, give yourself **1** point* @	
Does a floodplain management ordinance that restricts or prohibits development within the 100-year floodplain exist?	YES
*If your answer is **YES**, give yourself **2** points* @	

Notes on Stormwater Outfalls (include source documentation such as name of document, section and page #):

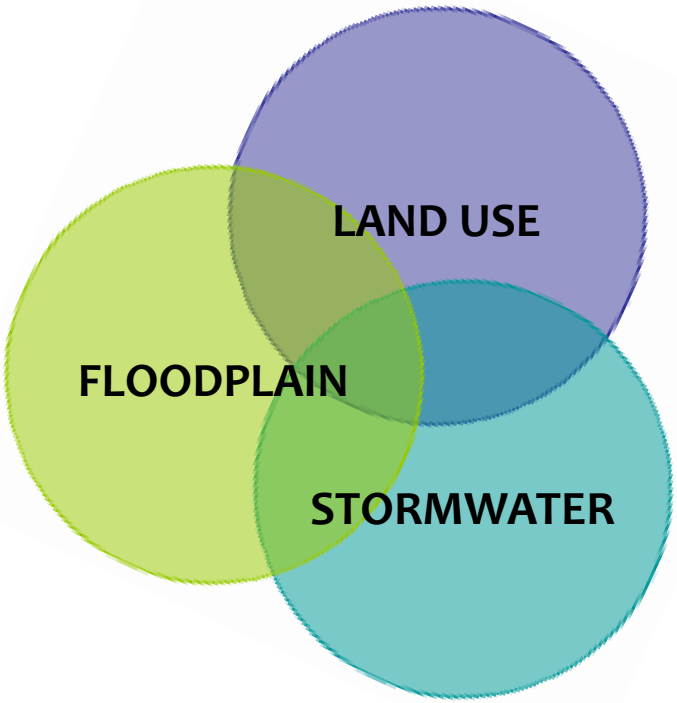
SCORING (A total of **100** points are available):		
Your Community's Score		
90- 100	@	Congratulations! Your community is a real leader in protecting streams, lakes, and estuaries. Keep up the good work.
80 - 89	@	Your local development rules are pretty good, but could use some tweaking in some areas.
79 - 70	@	Significant opportunities exist to improve your development rules. Consider creating a site planning roundtable.
60 - 69	@	Development rules are inadequate to protect your local aquatic resources. A site planning roundtable would be very useful.
less than 60	@	Your development rules definitely are not environmentally friendly. Serious reform of the development rules is needed.

2. Integrating Strategies

* Who is your land use planner?
* Does your Comprehensive Plan include goals for stormwater and floodplain management?

Common Ground

* Preserve open space, floodplains, wetlands
* Efficient use of land and resources
* Public safety and resiliency
* Livability and quality of life



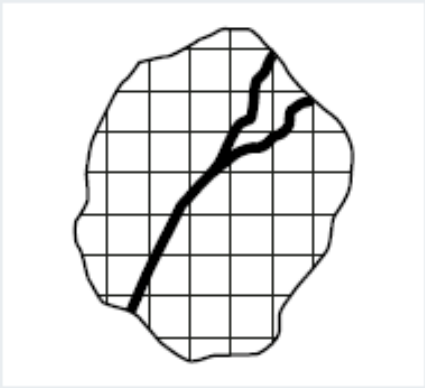
Services you can provide to land use planners:

* Land Use – estimate the stormwater and flooding impacts of growth alternatives
* Redevelopment – identify innovative solutions to remove runoff treatment and storage barriers
* Transportation – integrate conservation and/or mitigation into linear corridors
* Economic Development – determine where/what improvements meet both water and business needs
* Parks & Open Space – identify parcels for stormwater treatment and flood storage

3. Watershed-based Planning

* Benefit to local resources:
  * Drinking water supply
  * Recreational water uses
  * Protection of sensitive areas
  * Preserving healthy waterbodies
  * Restoring degraded waterbodies

Scenario A



10,000 houses built on 10,000 acres produce:

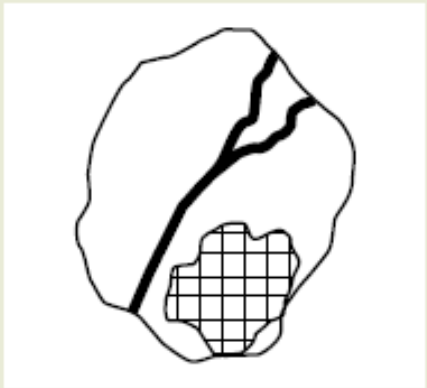
10,000 acres x 1 house x 18,700 ft^3/yr of runoff =

187 million ft^3/yr of stormwater runoff

Site: 20% impervious cover

Watershed: 20% impervious cover

Scenario B



10,000 houses built on 2,500 acres produce:

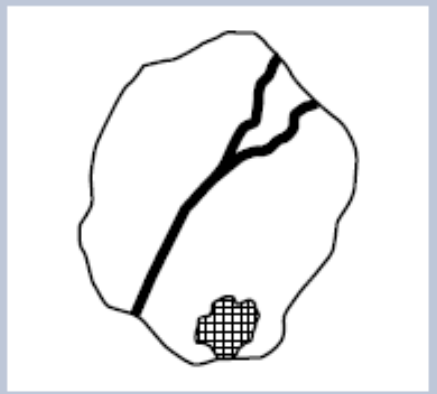
2,500 acres x 4 houses x 6,200 ft^3/yr of runoff =

62 million ft^3/yr of stormwater runoff

Site: 38% impervious cover

Watershed: 9.5% impervious cover

Scenario C



10,000 houses built on 1,250 acres produce:

1,250 acres x 8 houses x 4,950 ft^3/yr of runoff =

49.5 million ft^3/yr of stormwater runoff

Site: 65% impervious cover

Watershed: 8.1% impervious cover

Watershed Characteristics	Integrated Strategies to Consider[a]	Approaches That May NOT Be Appropriate
Special receiving waters: drinking water, trout streams, wetlands, etc.	▶ Overlay zoning and performance standards ▶ Conservation development ▶ Special stormwater criteria ▶ Low-impact development ▶ Purchase of Development Rights (PDR) ▶ "Sending" area for Transfer of Development Rights (TDR)	▶ Large-lot zoning (disperses and spreads out development impacts) ▶ Relying solely on stormwater ponds and basins ▶ Urban road sections ▶ Utility and transportation expansions
Existing flooding problems	▶ Overlay zoning and performance standards ▶ Special stormwater criteria ▶ Low-impact development ▶ Street design ▶ Fee-in-lieu program	▶ Relying solely on site-by-site stormwater approaches that are not coordinated at watershed scale ▶ Wide roads, urban road sections
Impaired streams (303(d) listed) or other water quality problems	▶ Special stormwater criteria ▶ Special use permits for certain uses (e.g., hotspots) ▶ Performance standards ▶ Low-impact development ▶ Conservation development	▶ Relying solely on stormwater ponds and basins ▶ Urban road sections

True or False

* Climate change is predicted to greatly affect the water resources that we depend upon

TRUE or ~~False~~

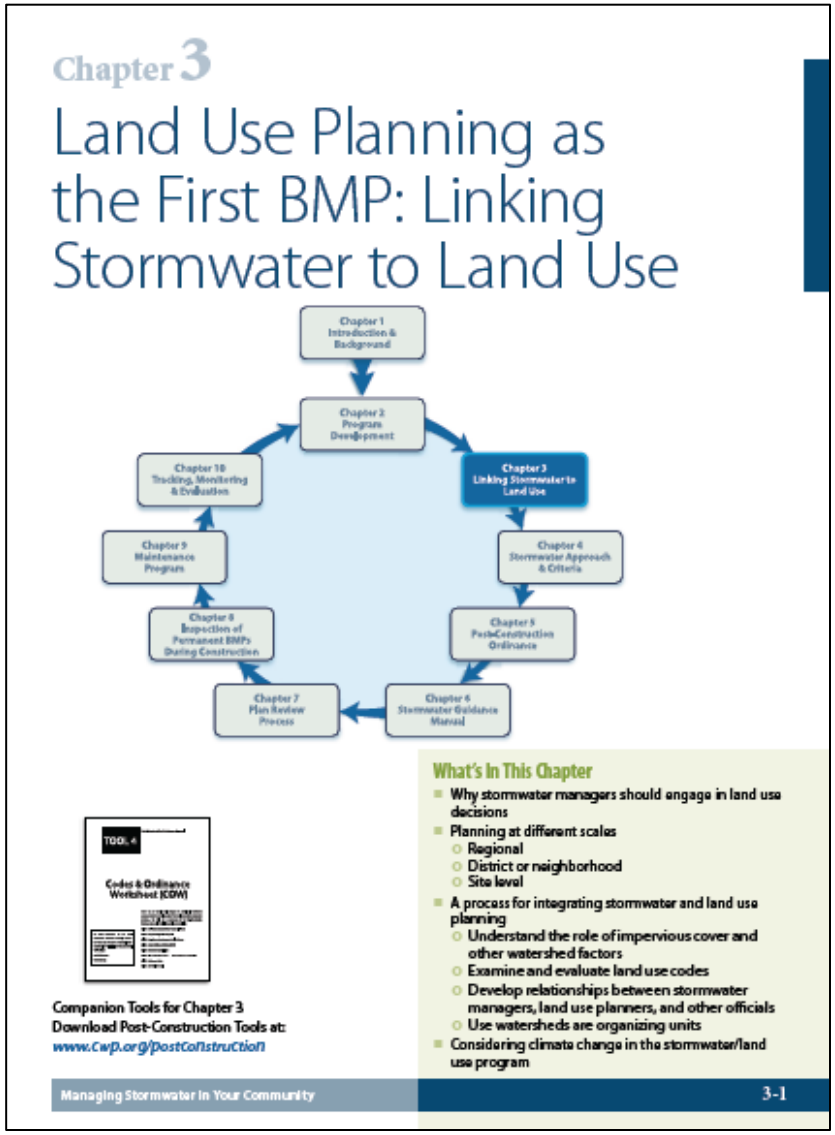
* Climate change has altered, and will continue to alter, the water cycle (distribution and intensity of events)
* Solutions for stormwater and floodplain management, water conservation, and energy consumption influenced by land use planning

Hydrologic Adaptations

* More frequent flooding
* More prolonged droughts
* Increase temperature of runoff
* More combined sewer overflow events

Policy Adaptations

* Reduce carbon emissions
* Increase carbon sequestration
* Increase clean, renewable energy sources


Chapter 3

Land Use Planning as the First BMP: Linking Stormwater to Land Use

TOOL 4
Codes & Ordinance Worksheet (COW)

Companion Tools for Chapter 3
Download Post-Construction Tools at:
www.cwp.org/postconstruction

What's In This Chapter

- Why stormwater managers should engage in land use decisions
- Planning at different scales
  - Regional
  - District or neighborhood
  - Site level
- A process for integrating stormwater and land use planning
  - Understand the role of impervious cover and other watershed factors
  - Examine and evaluate land use codes
  - Develop relationships between stormwater managers, land use planners, and other officials
  - Use watersheds are organizing units
- Considering climate change in the stormwater/land use program

Managing Stormwater in Your Community 3-1

Center for Watershed Protection
Managing Stormwater in Your Community: *A Guide to Building an Effective Post-Construction Program*
www.cwp.org

Discussion

Sheila McKinley, ASLA, AICP, CFM, LEED Green Associate
Christopher B. Burke Engineering, LLC
115 W. Washington St., Ste. 1368
Indianapolis, IN 46204
317.266.8000
smckinley@cbbel-in.com

CHRISTOPHER B. BURKE ENGINEERING, LLC

Good Things Are Happening for Our City!

~

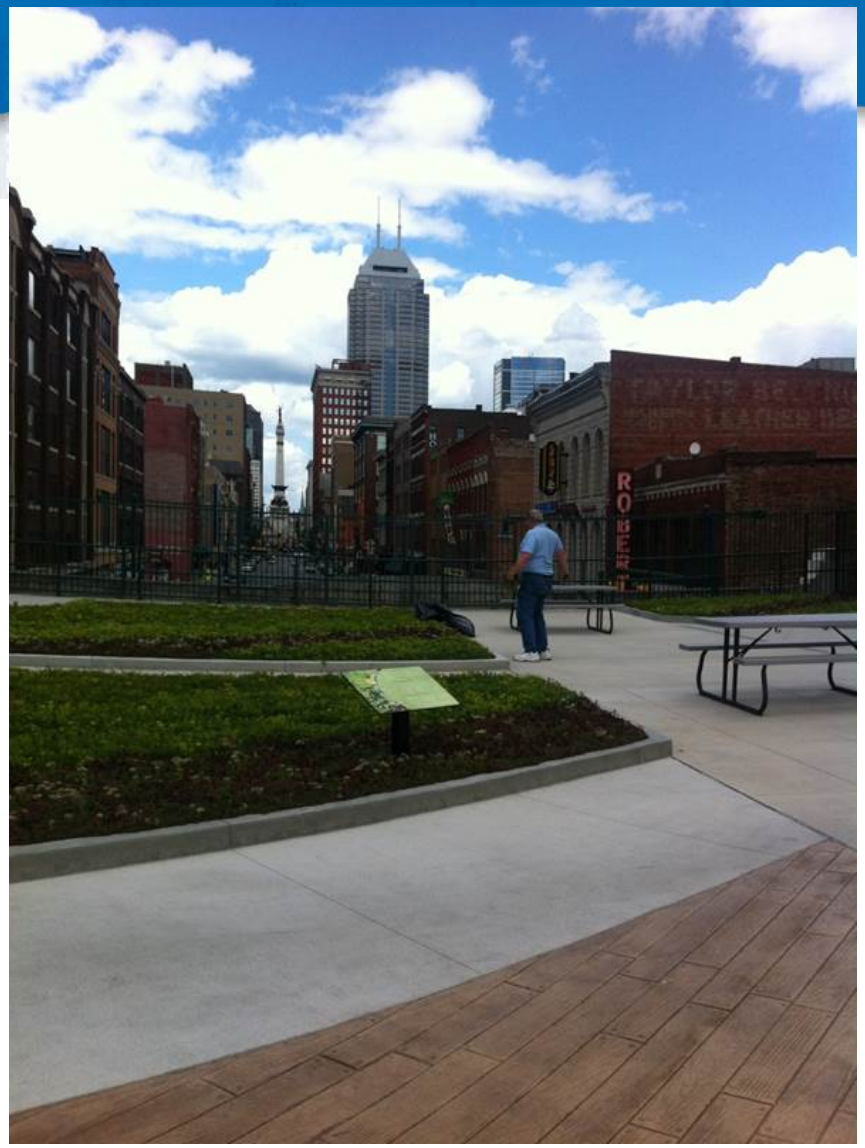
Indy Rezone: Building a Dynamic and Sustainable Community.

Zen and the Art of Land Use Planning
September 23rd, 2015, 10:00am-2:00pm

amec foster wheeler

www.indyrezone.org

What is Indy Rezone?



Update our zoning ordinances and related development regulations to be more sustainable and to improve our residents' quality of life.

2010 Community Challenge Planning Grant of $1.19M

US Department of Housing and Urban Development (HUD)/ Partnership for Sustainable Communities

6 Livability Principles

- Provide more transportation choices
- Promote equitable, affordable housing
- Enhance economic competitiveness
- Coordinate policies & leverage investment
- Support existing communities
- Value communities & neighborhoods

Why do we need to change?

Our situation has changed.

But our ordinances have not.

Indy's Challenges

People want this...

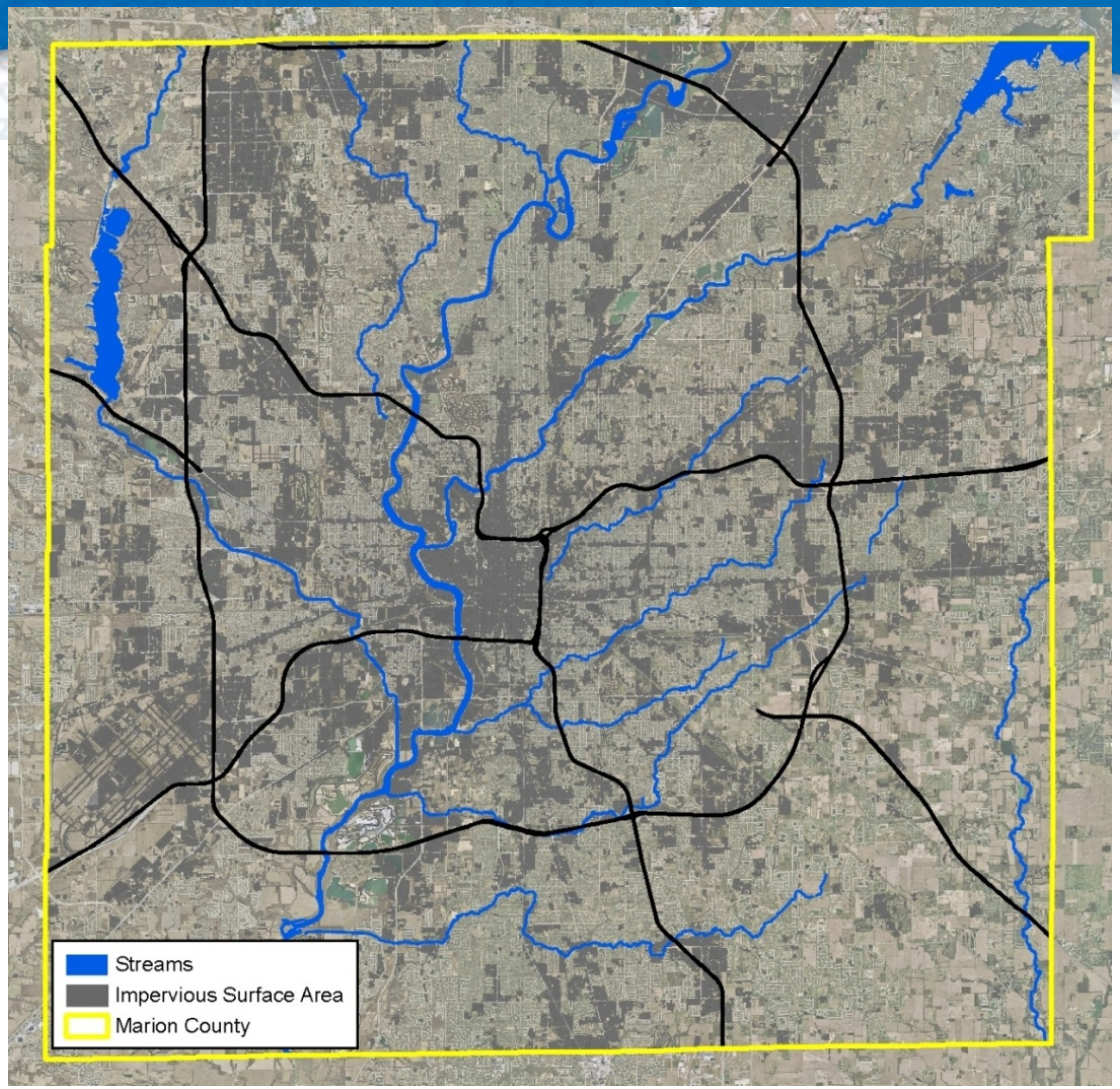
Indy's Challenges

Our standards give us this…

Indy Rezone can help by…

CHANGING the rules to make it easy to do the right thing!

Indy's Challenges



- *2 billion square feet of impervious surface*
- *1" rainfall generates 1.3 BILLION gallons of stormwater*
- *Stormwater carries a huge pollution load from everything it encounters*

Organization of Indy Rezone

Core Team

- Tammara Tracy, DMD
- Jeremy Moore, MPO
- Jamison Hutchins, SustainIndy
- John Neal, DMD
- Annette Darrow, IndyGo
- Ryan Hunt, Economic Development
- Brooke Thomas, DMD
- Adam Collins, DCE
- Angela Nicholson, DPW
- Nathan Sheets, DPW
- Brad Beaubien, BSU
- David Hirschle, LEED AP, SustainIndy

Core Team: Diverse Contractors

Heather Williams,Leed AP, Amec Foster Wheeler

Phil Seng, DJ Case & Associates

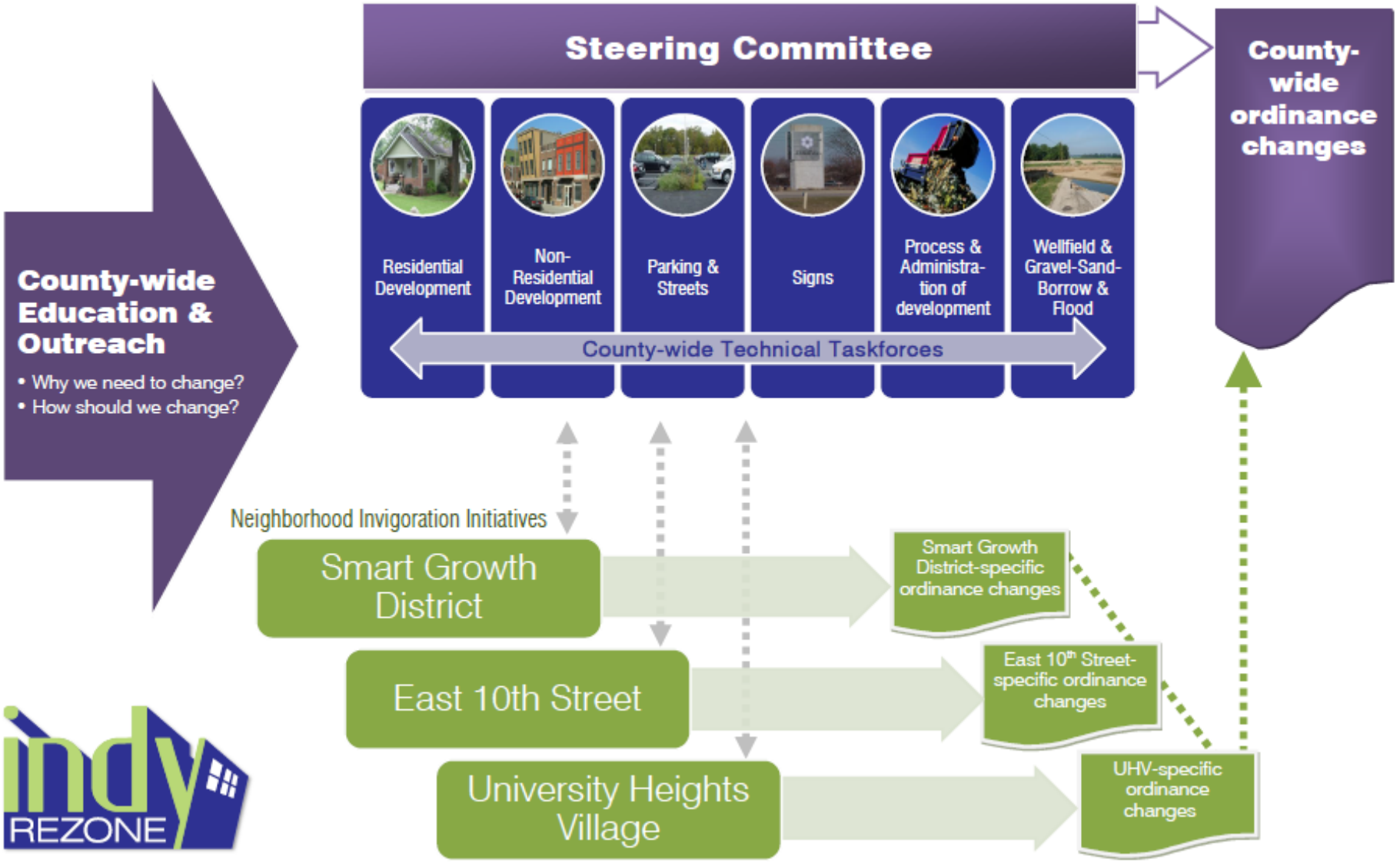
Don Elliott, FAICP, Clarion Associates

Jill Hoffman, Empower Results

Elizabeth Williams, AICP, EBW, Inc.

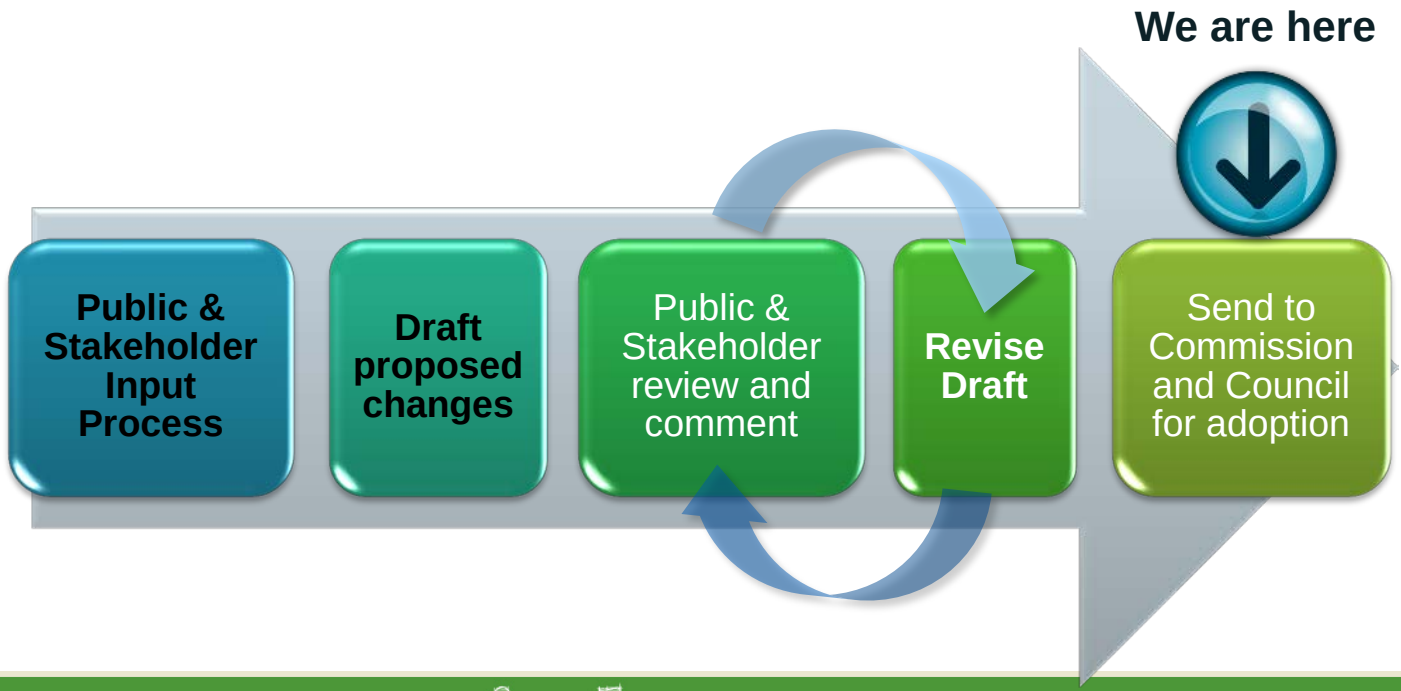
Alex Joyce, AICP Fregonese Associates

Project Organization



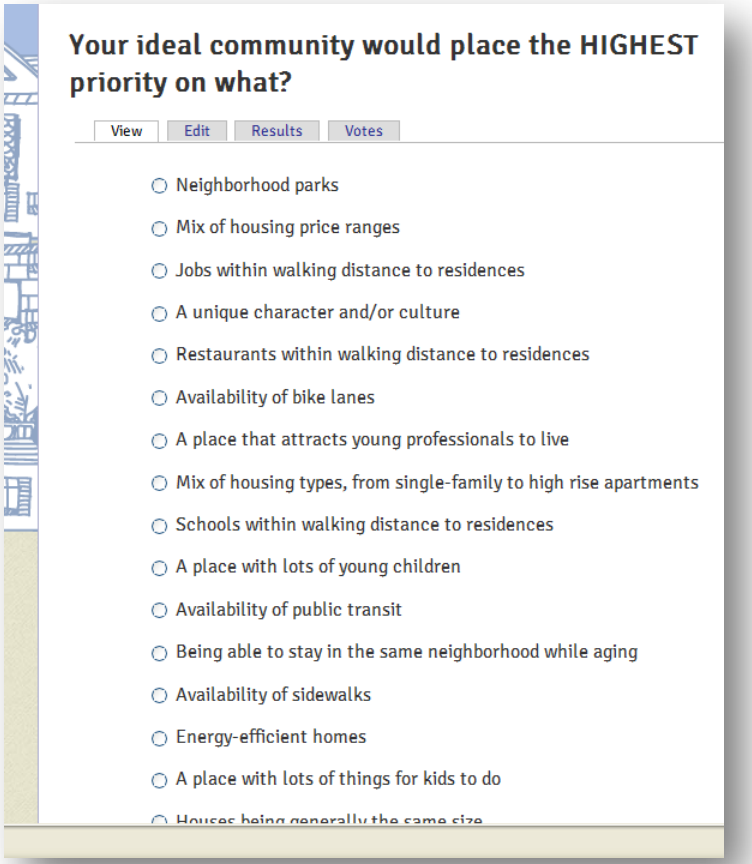
Where we are in the process

- **FINAL EDITS COMPLETE**
- June to Commission
- Effective date: 4-6 month after adoption



Fun Outreach Tools

- **www.indyRezone.org** – project website
- **Quick Polls** – checking the public's pulse
- **E-newsletters** – Sign Up Today!
- **Blogs** – live, interactive web-based discussions
- **Topical Podcasts** – technical experts speak of changes



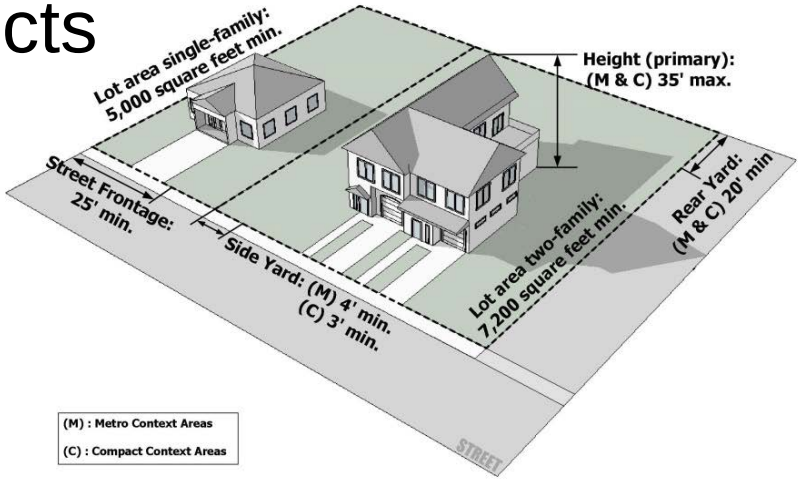
Fun Outreach Tools

Zoning Shapes Your World

- Zoning ordinance = Map and Text (Rules)
- Zoning determines what a property can be used for and how it can be developed
- Zoning establishes the base level of acceptable development for a community

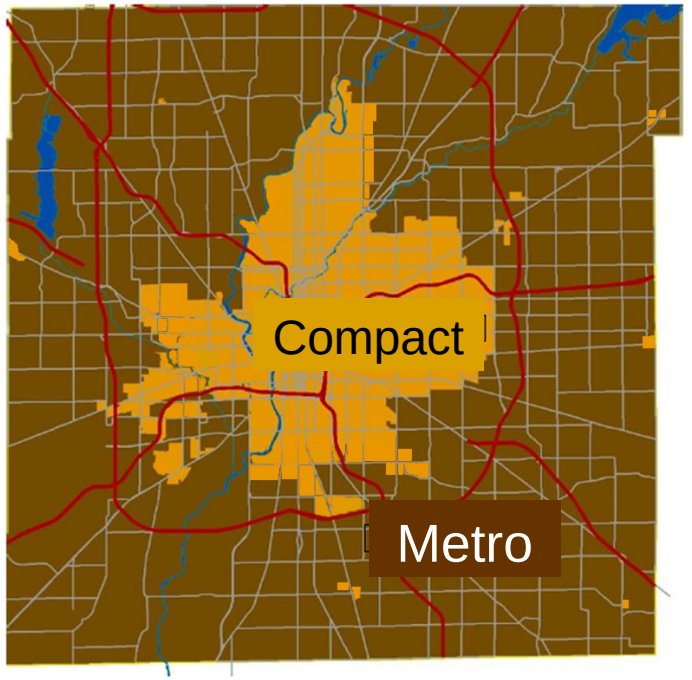
Hundreds of Changes

- User-friendly, Consolidated Framework: less legalese, graphics, tables
- Districts added: four Mixed Use (MU) and two SU
- Many Uses added to districts
- Few Uses removed from districts



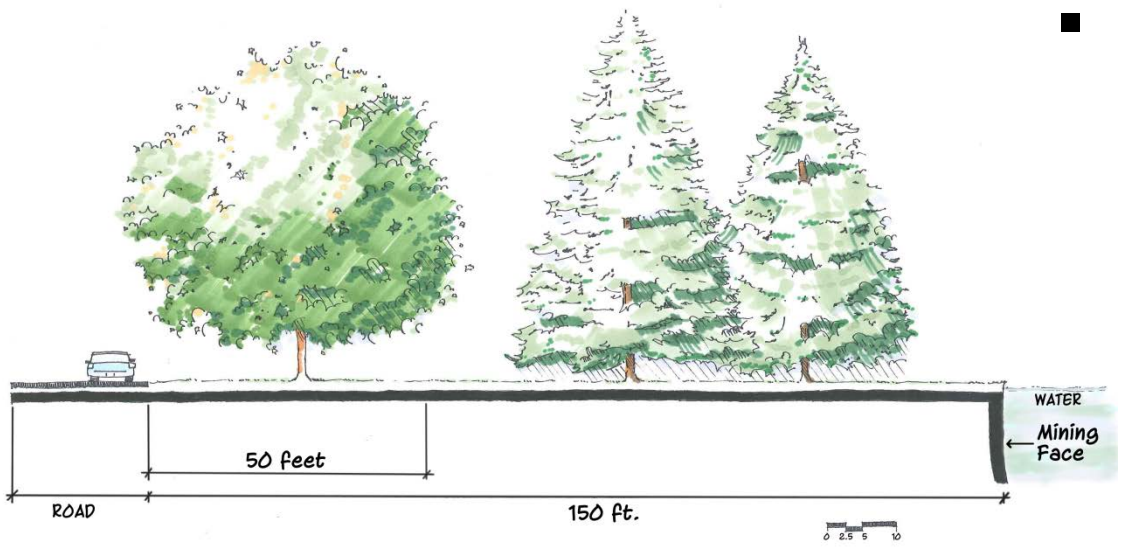
Hundreds of Changes

- Compact and Metro Contexts established
- Dimensional standards adjusted
- Parking for autos & bikes
- Transparency
- Lighting
- Landscaping integrated with drainage in the Green Factor
- Renewable energy



Hundreds of Changes

- Flood Control: Compensatory Storage required, Critical facilities prohibited
- Wellfield Protection District: underground storage tanks prohibited, secondary containment required



- Gravel-Sand-Borrow district: blasting limitations, buffering requirements

Organization

Chap. 740 General Provisions

- Definitions
- Measurements & Calculations
- Compact and Metro Context Areas
- Application & Nonconformities
- Procedures
- Permits

Chap. 741 Subdivision Regulations

Chap. 742 Districts

- Primary Districts
- Secondary Districts

Chap. 743 Uses & Use Standards

- Use Table (arranged by use category)
- Use-Specific Standards (arranged by use category)

Chap. 744 Development Standards

- Lot & Building Dimensions
- Access & Connectivity
- Parking, Loading and Drive-Through
- Landscaping and Screening
- Street and Exterior Lighting

Chapter 742, Article I
Primary Districts

Primary District Changes: Mixed Use Districts added

Currently few options with existing ordinance

Four MU districts

- **MU-1**: Freestanding MU Tower
- **MU-2**: MU corridor-type development (was C-3C, C-2)
- **MU-3**: Mixed use village
- **MU-4**: Mixed use village w/ rapid transit required

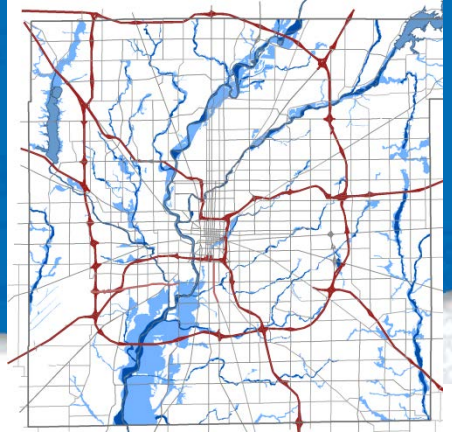
use alone or in combination with other districts to fulfill transit typology needs

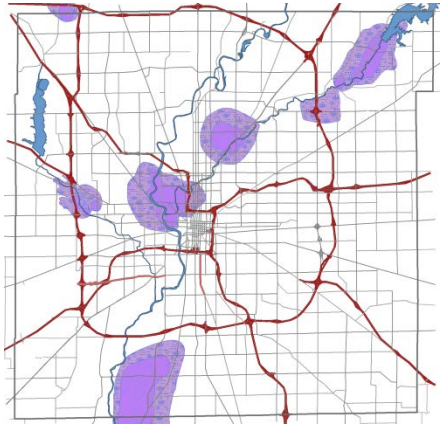
Mixed Use Districts

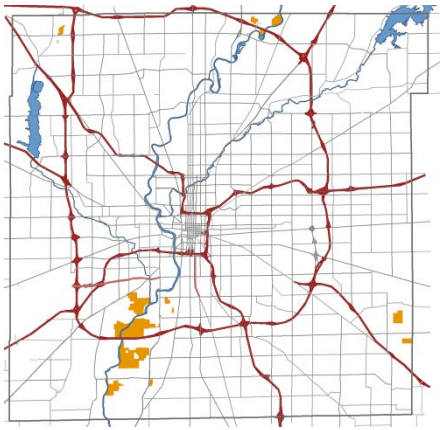
- Emerging trend for new development
- Redevelopment opportunities
- Standards to create walkable areas:
  - » Setbacks: close to street
  - » Parking: amounts reduced
  - » Windows & doors (transparency)
  - » Lighting required at entrances
  - » Minimum Building Height
  - » Lot coverage

Chapter 742, Article II
Secondary Districts

Five Secondary Districts







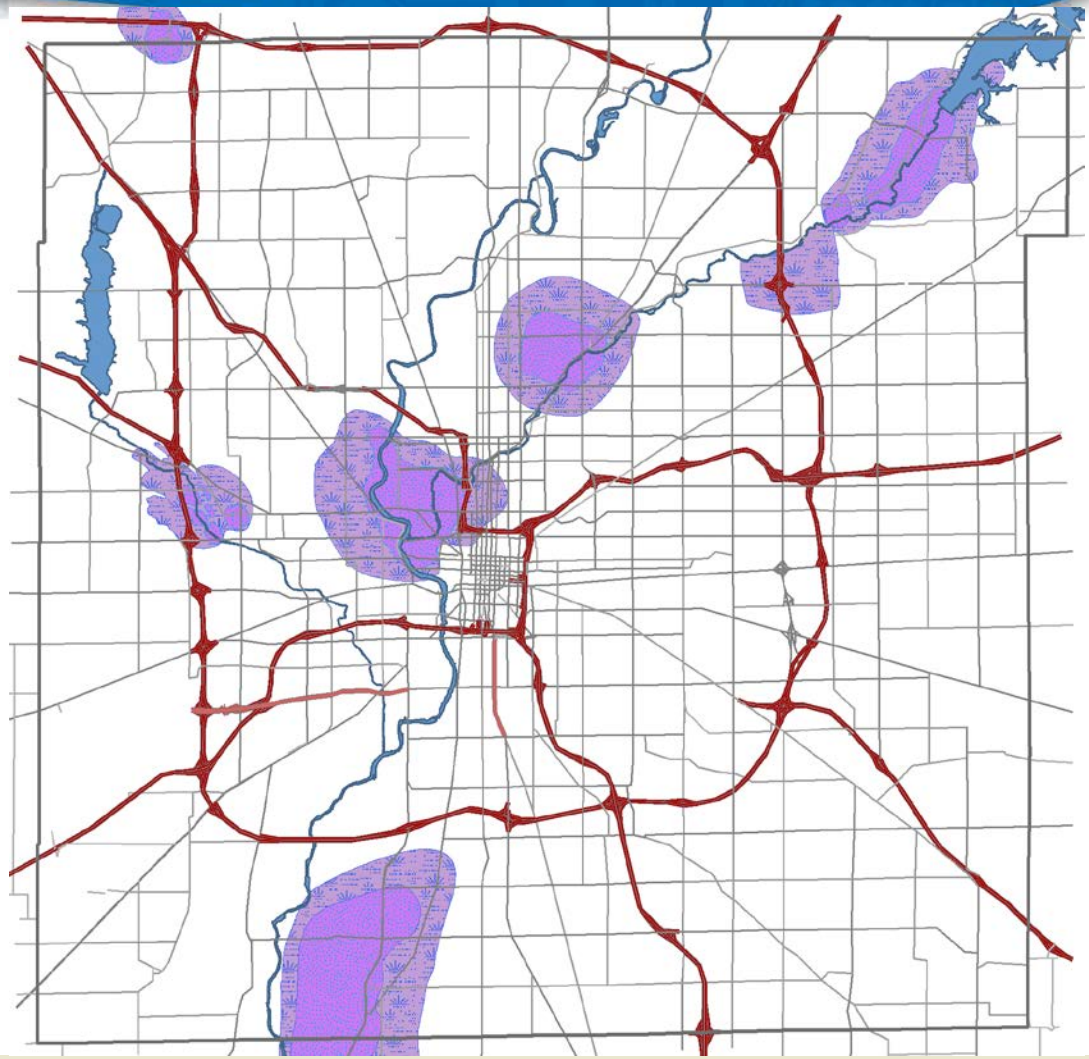
- Regional Center– no changes
- Flood Control
- Wellfield Protection
- Airspace – no changes
- Gravel, Sand and Borrow

Wellfield Protection

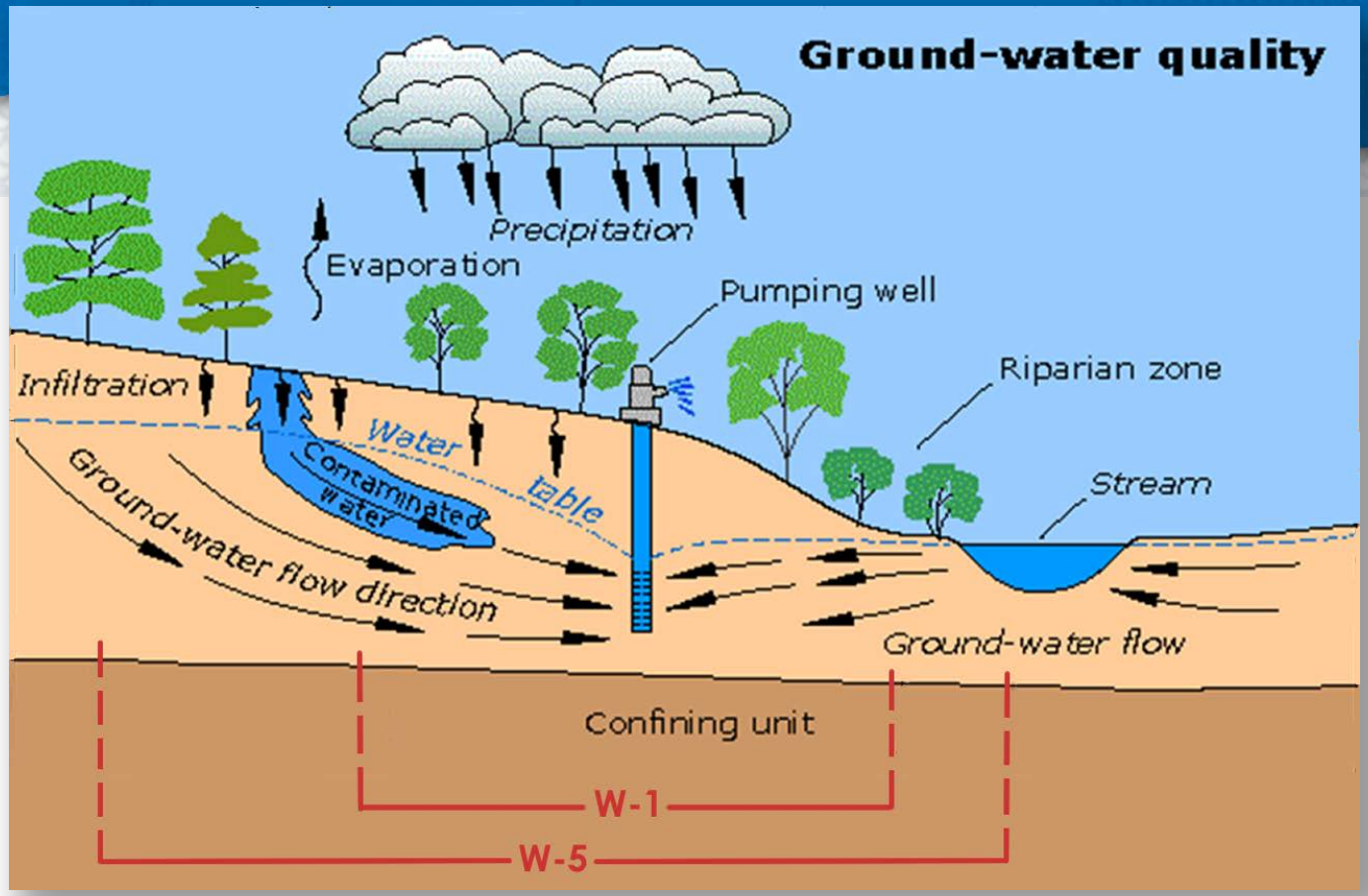
W-1 = One year time of travel to the wellhead

W-5 = Five years time of travel to the wellhead

25% of our water comes from wells



Wellfield Protection Districts

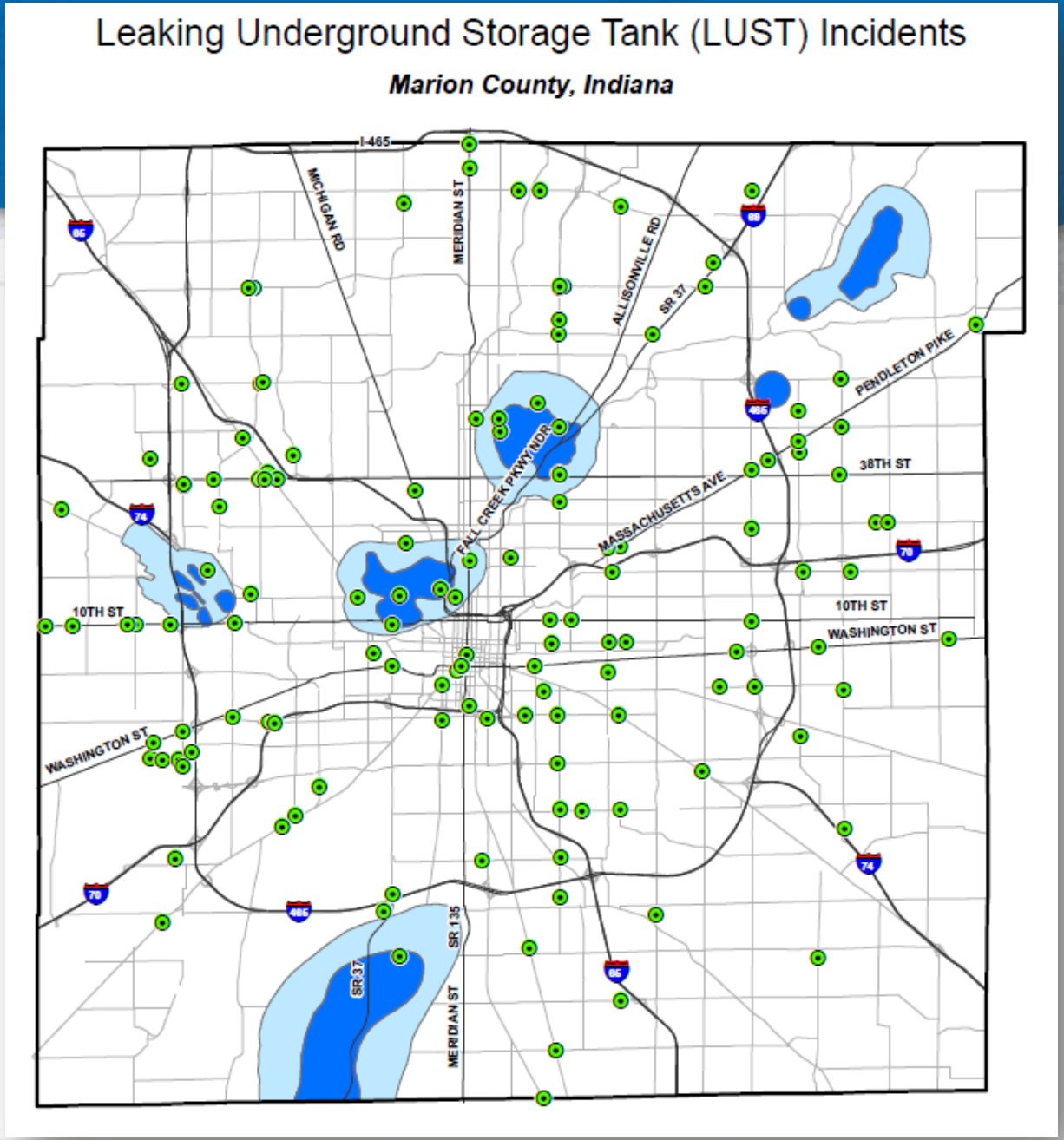


W-1 = One year time of travel to the wellhead

W-5 = Five years time of travel to the wellhead

Contamination plumes extend rapidly in well fields due to the well's pull.

- 146 known leaks
- Cause for 90% of releases is unknown (leak autopsies needed)
- Location of release is unknown for 50% (leak autopsies needed)
- Discovery method for 92% of releases is closures or subsurface investigation; not because of the leak detection technology that was present.



Underground Storage Tanks (UST)

- All USTs have the potential to leak
- Very few leaks are actually caught with required/heavily regulated leak detection systems

Zoning Classification of W-1 land	Acres	% of W-1 land
C3-C7	310.46	3.4%
PK2	40.12	0.4%
All Other districts	8,849.85	96.2%
Total Land Zoned W-1	**9,200.42**	**100%**

- **100%** of Marion County uses our groundwater resources

Protection facilities & Operations

- Zoning (review or inspection) is limited to new development, redevelopment and substantial expansions
- Requires physical protections: Containment areas and secondary containment areas
- Triggered at specified levels

Wellfield Protection Changes

- ✓ No underground storage tanks in W-1
- ✓ Prohibits bulk petroleum and chemical storage in wellfields (W-1 and W-5)
- ✓ Operational standards (Containment areas required)

*Partnership with **Marion County Public Health Department** to establish licensing and long term implementation and inspection*

Flood Control

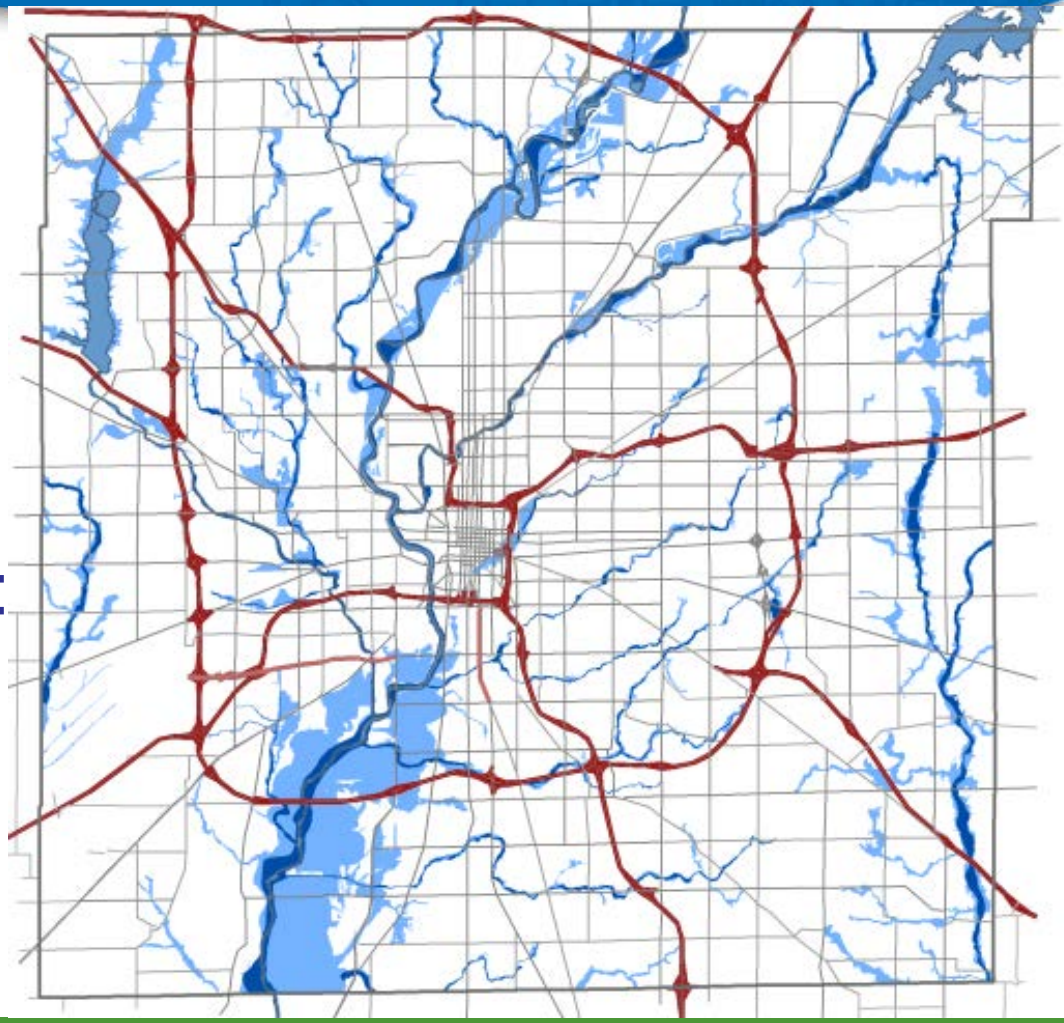
Current

- Floodway (FW):

  no build

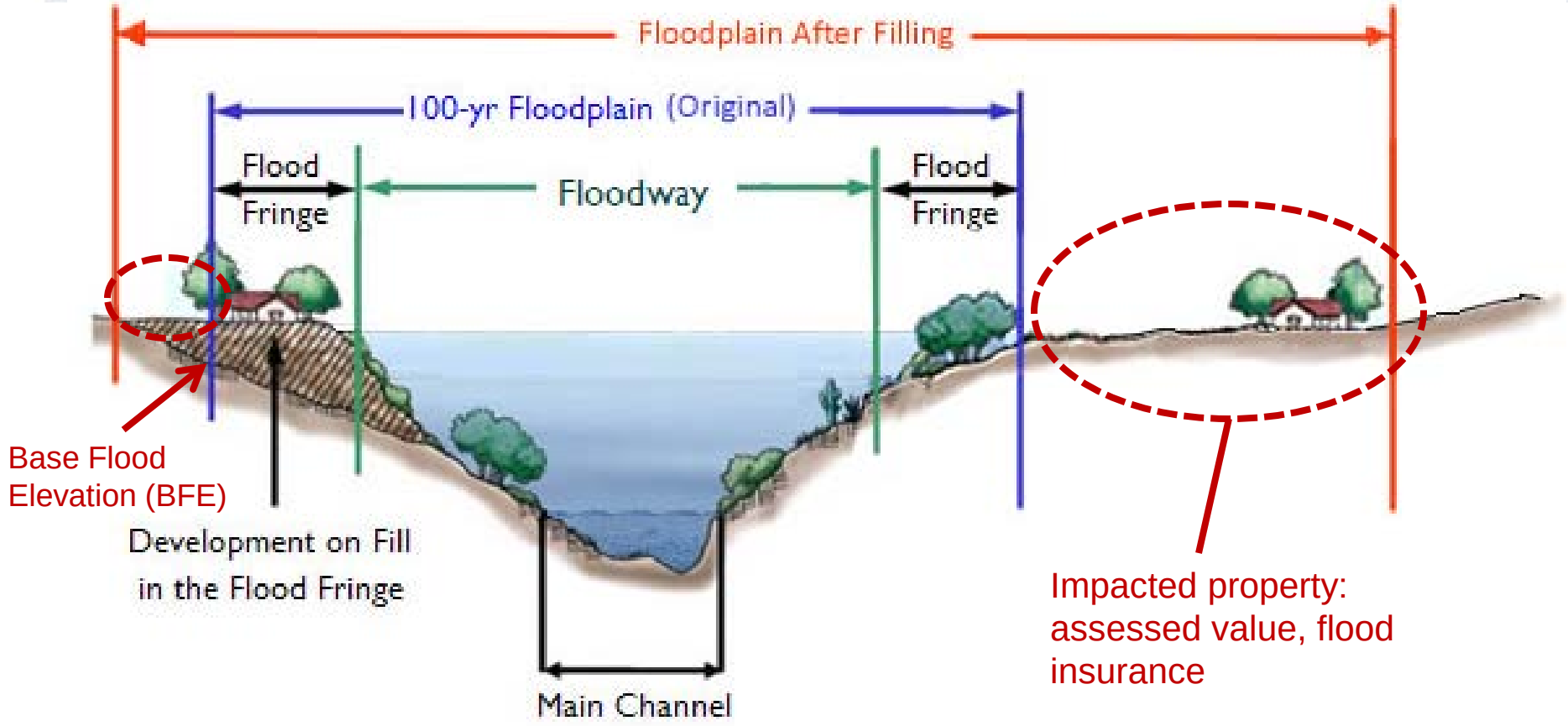
- Floodway Fringe (FF):

  build if elevated 2’ above BFE



Of the 4,150 acres of floodway fringe (FF), approximately 800 acres, or 20%, is park land

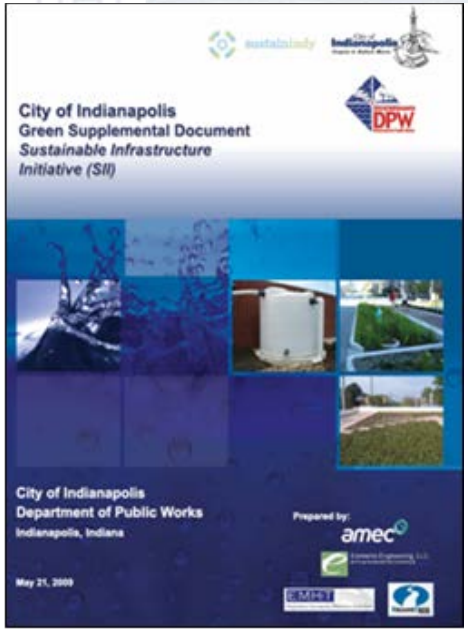
Flood Control



Of the 6,130 insurance policies, approx. 1,100 policies covered properties NOT in a FW/FF area. This equates to $5.1M in flood insurance premiums paid, or $1B in coverage.

Flood Control Changes

- Compensatory storage offset required
  - ✓The volume of the loss of floodwater storage due to filling in the special flood hazard area shall be offset by providing an equal volume of flood storage by excavation or other compensatory measures at or adjacent to the development site.
    - Protection of riparian corridors
    - Restoration of riparian corridors
    - Green infrastructure
    - Multifunctional parks and open space



Flood Control Changes

- Prohibit development of critical facilities in a floodplain (schools, hospitals, special populations, etc)
- Indy participates in the FIRM Community Rating System therefore yields in lower flood insurance rates.

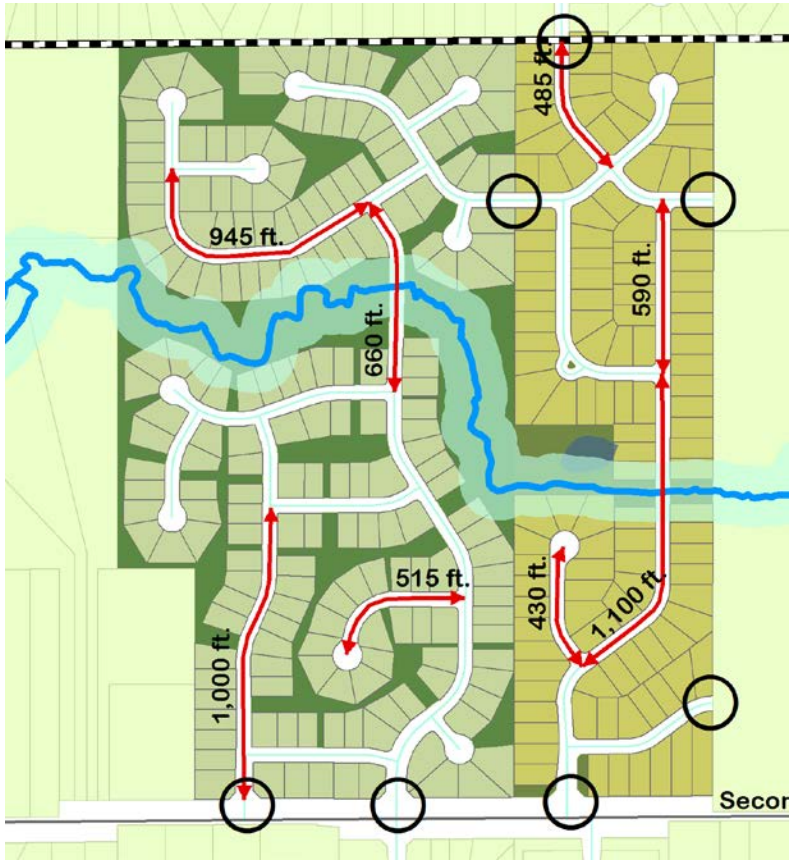
Chapter 744
Development Standards

Highlights from Article III

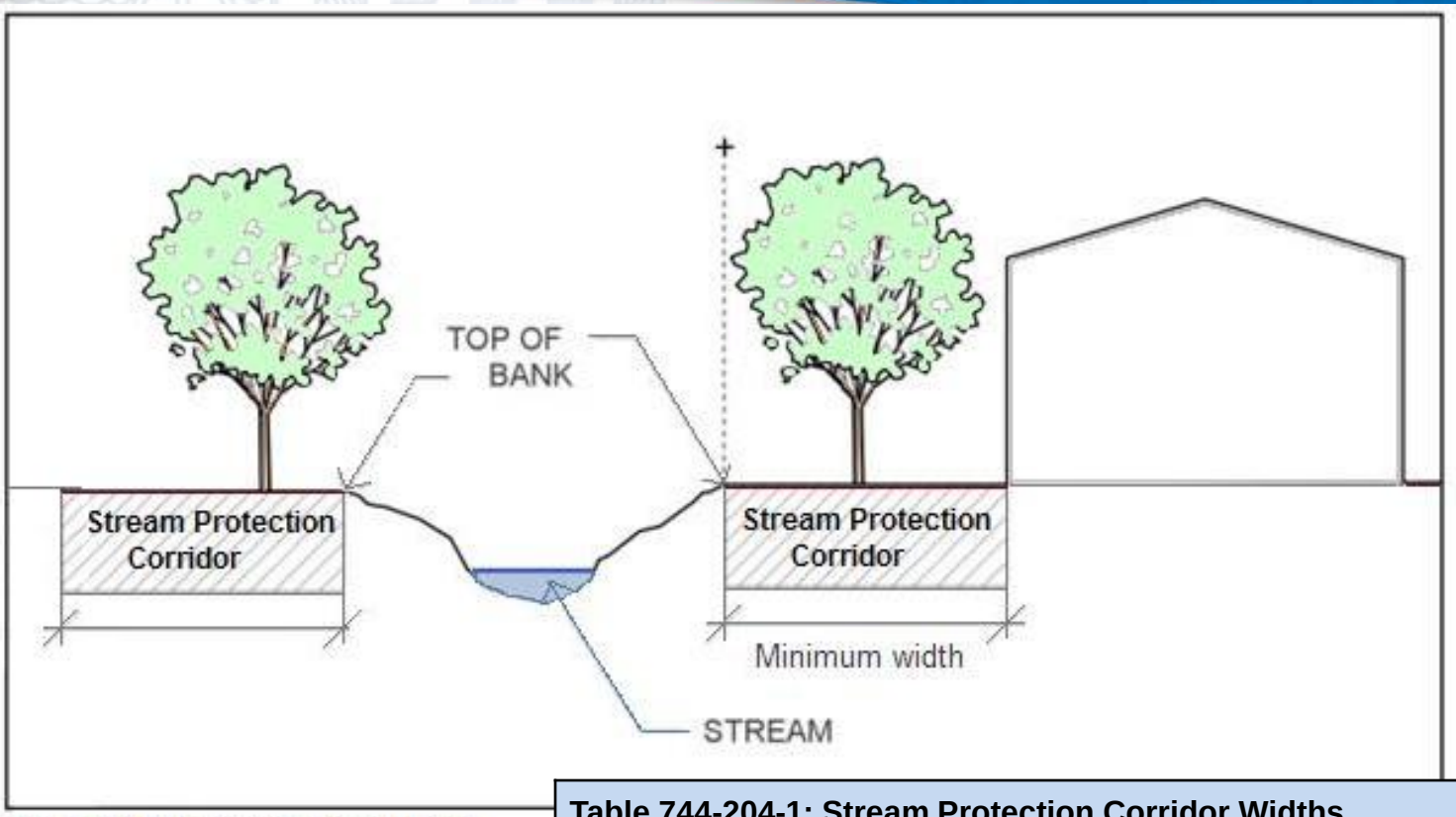
Access & Connectivity

New Neighborhoods

- Requirements for access and connectivity in street layout
- Bicycle lanes in larger subdivisions
- Low impact drainage facilities in the Metro Context
- Trees on each lot according to lot size
- Applies subdivision controls to commercial and industrial developments



Stream Corridors



Stream Protection Corridor

Table 744-204-1: Stream Protection Corridor Widths		
	First Rank Streams (Listed)	Other Mapped Streams
Compact Context	60 feet	25 feet
Metro Context	100 feet	50 feet

Landscaping and Green Factor

- Development except residential subdivisions & CBD must meet basic landscaping (proscriptive) and minimum **Green Factor score of .30 for New Development and .22 for Redevelopment**
  - Frontage trees
  - Parking lot landscaping (if applicable)
  - Transitional / Edge Buffer (if applicable)
  - Stream Corridor protection (if applicable)

- Natural stormwater management (LID) techniques and stream buffer provisions count toward Green Factor landscaping requirements

Green Factor

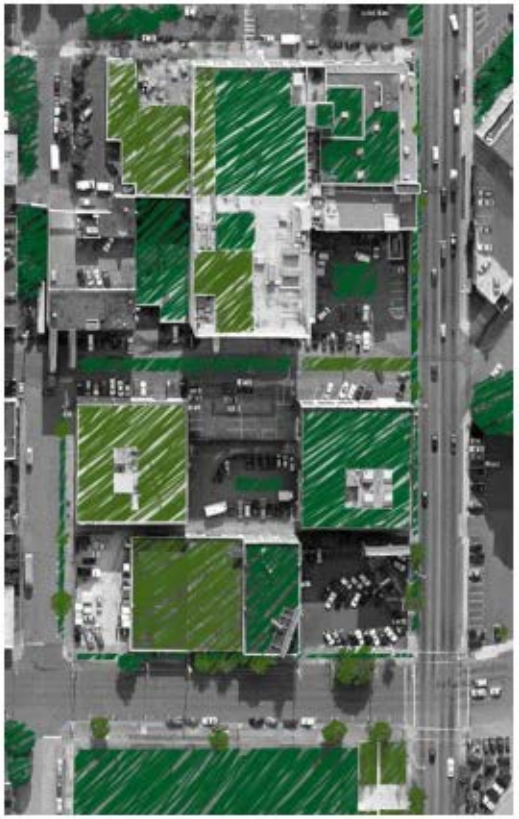
- What is the Green Factor
- Why use the Green Factor
- How would it apply to Indy
  - ✓New Site Design Example
  - ✓Redevelopment Site Design Example


Water Feature

Green Factor

Pre-Settlement Conditions

Historical Urban Development

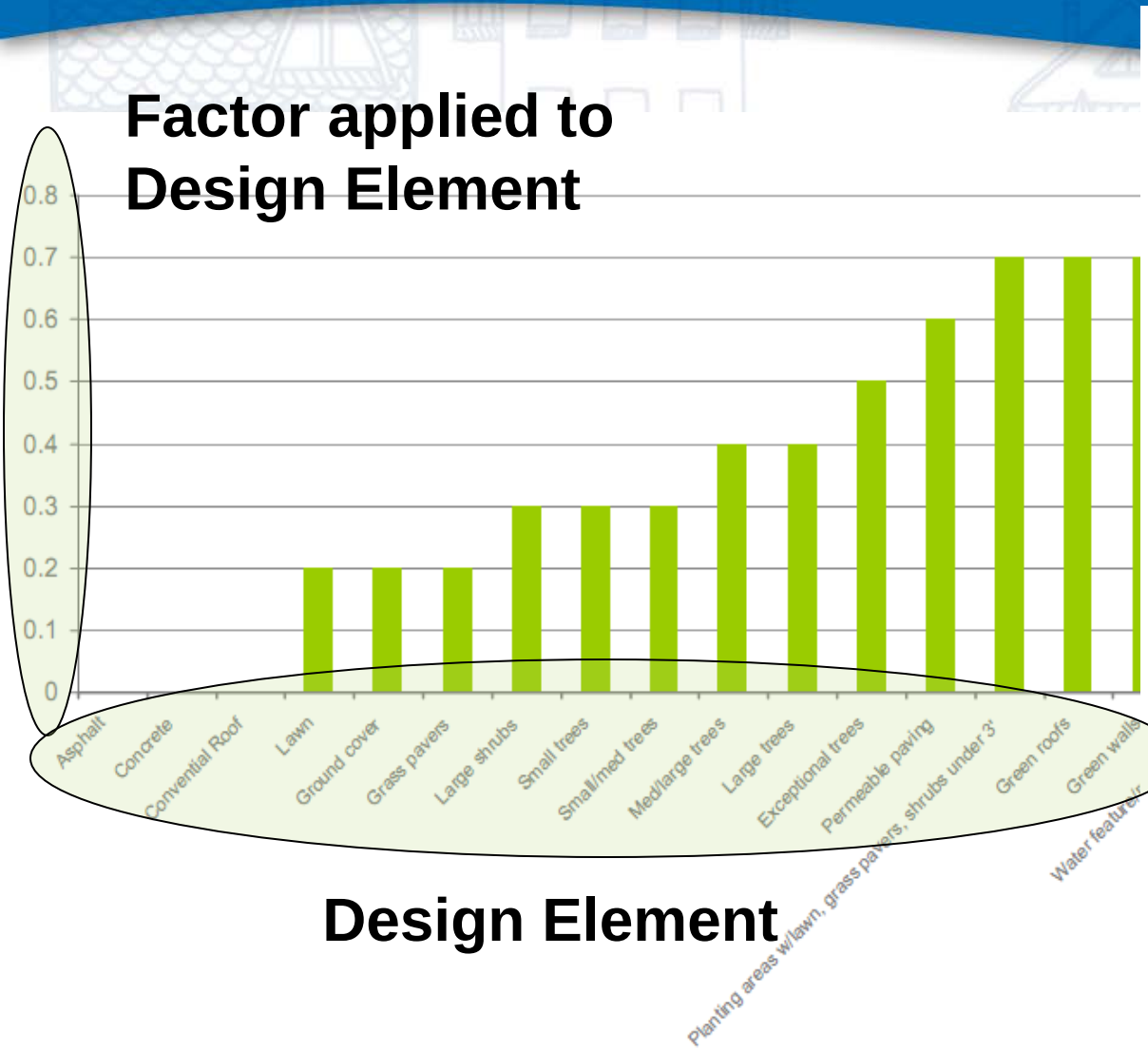


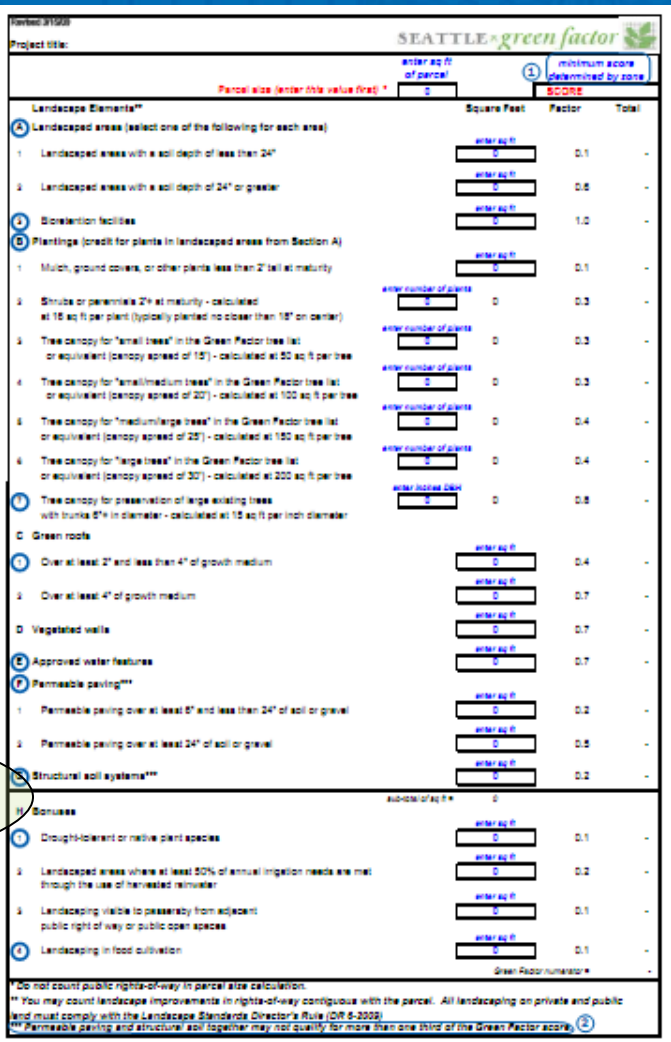
Urban Greening

Green Factor

- Design Elements
  - Soils
  - Bioretention/Rain Gardens
  - Planted Areas
  - Trees
  - Green Roofs
  - Water Features
  - Permeable Paving

Green Factor




SEATTLE green factor

Project title:

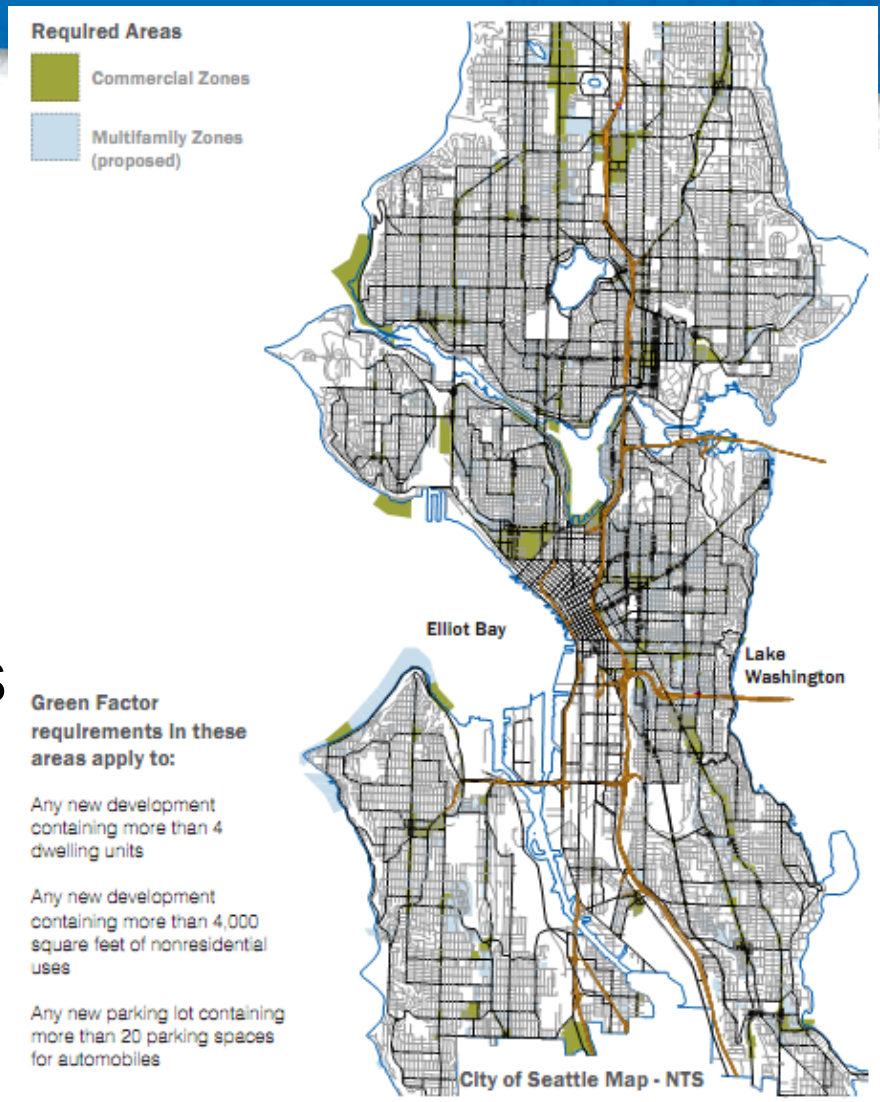
Parcel size (enter this value first) * — enter sq ft of parcel: 0 — minimum score determined by zone — SCORE

Landscape Elements**	Square Feet	Factor	Total
A Landscaped areas (select one of the following for each area)			
1 Landscaped areas with a soil depth of less than 24"	enter sq ft: 0	0.1	-
2 Landscaped areas with a soil depth of 24" or greater	enter sq ft: 0	0.6	-
3 Bioretention facilities	enter sq ft: 0	1.0	-
B Plantings (credit for plants in landscaped areas from Section A)			
1 Mulch, ground covers, or other plants less than 2' tall at maturity	enter sq ft: 0	0.1	-
2 Shrubs or perennials 2'+ at maturity - calculated at 16 sq ft per plant (typically planted no closer than 18" on center)	enter number of plants: 0	0	0.3 -
3 Tree canopy for "small trees" in the Green Factor tree list or equivalent (canopy spread of 15') - calculated at 50 sq ft per tree	enter number of plants: 0	0	0.3 -
4 Tree canopy for "small/medium trees" in the Green Factor tree list or equivalent (canopy spread of 20') - calculated at 100 sq ft per tree	enter number of plants: 0	0	0.3 -
5 Tree canopy for "medium/large trees" in the Green Factor tree list or equivalent (canopy spread of 25') - calculated at 150 sq ft per tree	enter number of plants: 0	0	0.4 -
6 Tree canopy for "large trees" in the Green Factor tree list or equivalent (canopy spread of 30') - calculated at 200 sq ft per tree	enter number of plants: 0	0	0.4 -
7 Tree canopy for preservation of large existing trees with trunks 6"+ in diameter - calculated at 15 sq ft per inch diameter	enter inches DBH: 0	0	0.6 -
C Green roofs			
1 Over at least 2" and less than 4" of growth medium	enter sq ft: 0	0.4	-
2 Over at least 4" of growth medium	enter sq ft: 0	0.7	-
D Vegetated walls	enter sq ft: 0	0.7	-
E Approved water features	enter sq ft: 0	0.7	-
F Permeable paving***			
1 Permeable paving over at least 6" and less than 24" of soil or gravel	enter sq ft: 0	0.2	-
2 Permeable paving over at least 24" of soil or gravel	enter sq ft: 0	0.5	-
G Structural soil systems***	enter sq ft: 0	0.2	-
	sub-total sq ft * 0		
H Bonuses			
1 Drought-tolerant or native plant species	enter sq ft: 0	0.1	-
2 Landscaped areas where at least 50% of annual irrigation needs are met through the use of harvested rainwater	enter sq ft: 0	0.2	-
3 Landscaping visible to passersby from adjacent public right of way or public open spaces	enter sq ft: 0	0.1	-
4 Landscaping in food cultivation	enter sq ft: 0	0.1	-
		Green Factor numerator *	-

* Do not count public rights-of-way in parcel size calculation.
** You may count landscape improvements in rights-of-way contiguous with the parcel. All landscaping on private and public land must comply with the Landscape Standards Director's Rule (DR 5-2009)
*** Permeable paving and structural soil together may not qualify for more than one third of the Green Factor score.

Green Factor

- Where to apply the factor?
  - What factor to apply?
- Flexible
  - Commercial Zones
  - Multi family Zones
- Pilot Areas
- Task Force Input



Green Factor

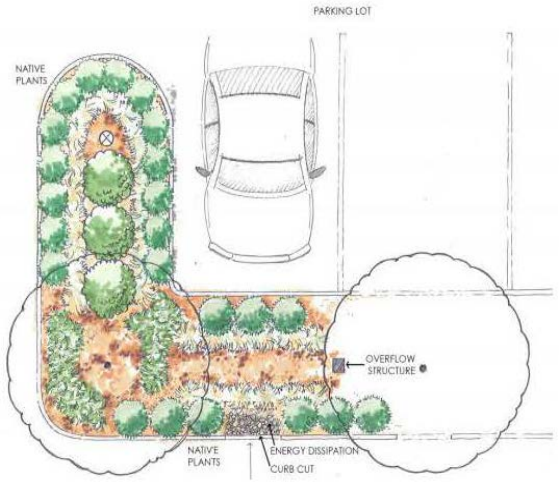
Table 744-504-1: Green Factor Calculation [1676]				
Column 1.	2.	3.	4.	5.
Type of Area **area**	Number of Plants	Area Equivalent in Sq. Ft.	Multiplier	Score
Parcel Size				
Vegetation with soil depth < 24 in.				
Lawn, grass pavers, ground covers, or other plants expected to be less than 3 ft. tall at maturity		Measured area	0.2	
Large shrubs		16. sq. ft. per	0.3	
Landscape elements with soil depth of ≥ 24 in.				
Lawn, grass pavers, ground covers, or other plants expected to be less than 3 ft. tall at maturity		Measured area	0.7	
Large shrubs		16. sq. ft. per	0.3	
Small trees		50 sq. ft. per	0.3	
Medium trees		100 sq. ft. per	0.3	
Large trees		200 sq. ft. per	0.4	
Preservation of Significant Trees (larger than 10 in. diameter at breast height)		250 sq. ft. per	0.5	
Permeable paving		Measured area	0.8	
Green roofs				
With < 2 in. but not > 4 in. growing depth		Measured area	0.4	
With ≥ 4 in. growing depth		Measured area	0.6	
Vegetated walls		Measured area	0.7	
Bioretention facilities including but not limited to rain gardens, stormwater planters, and bioretention swales		Measured area	1.0	
Bonuses applied to factors above				
Landscaping that consists entirely of drought-tolerant or native species, as defined by the Administrator			Additional 0.1	
Landscaped areas where at least 50% of annual irrigation needs are met through the use of harvested rainwater or grey water			Additional 0.3	
Landscaping visible to passersby			Additional 0.1	
Landscaping to be maintained in food cultivation			Additional 0.1	
Total Green Factor Score				

Tree species in each size category: [1677]
Small trees species =
Medium tree species =
Large tree species =

A x B x C = D

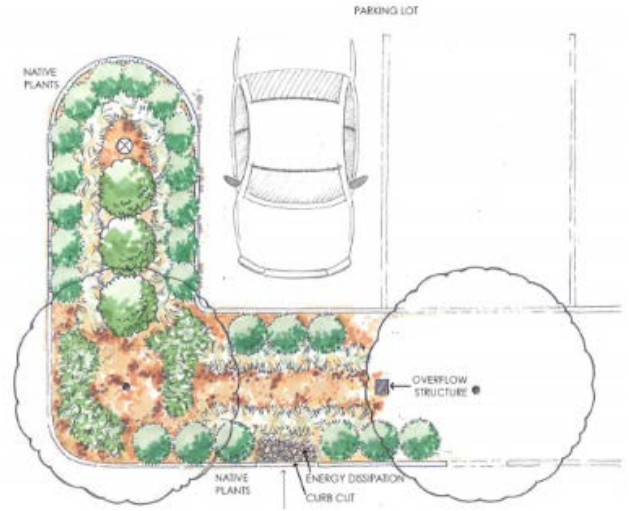
D / area = Score

TRAPEZOIDAL BIOSWALE
other types include rectangular, triangular, and parabolic

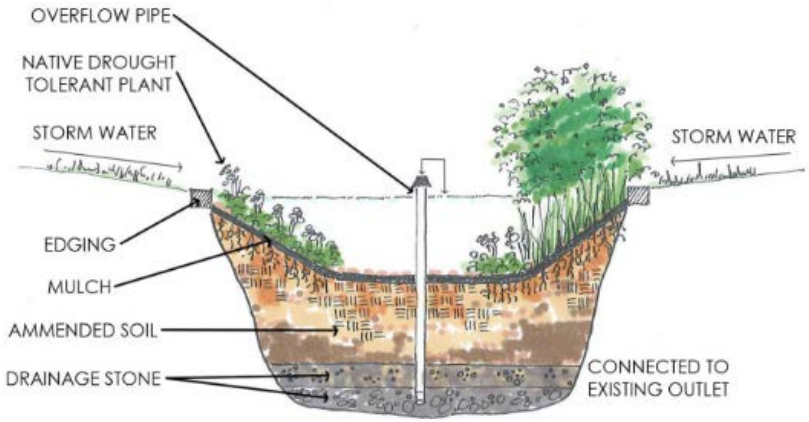


Bioretention

Plan view: Bioretention Parking Lot Island



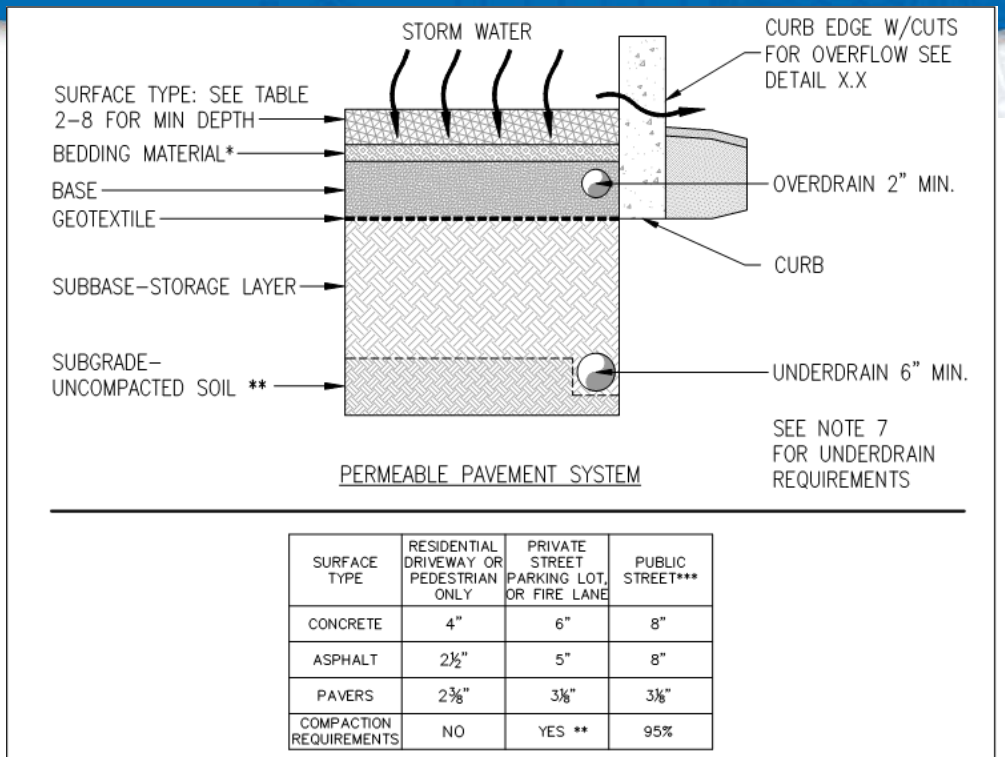
Profile view: Bioretention Parking Lot Island



- Storage capacity:

1.81 cf/sf

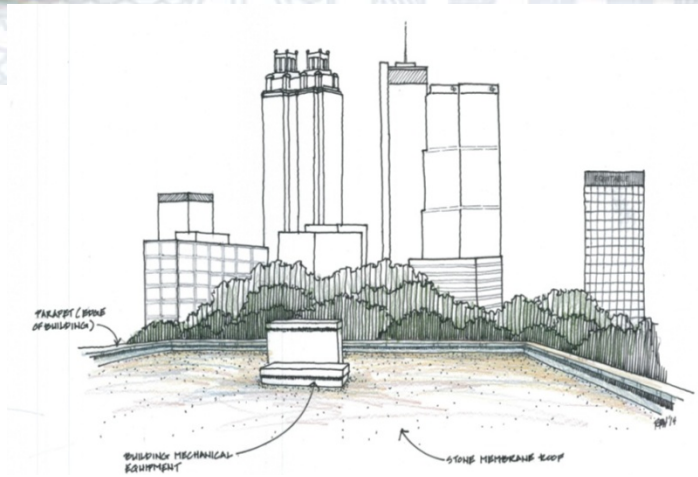
Permeable Pavement

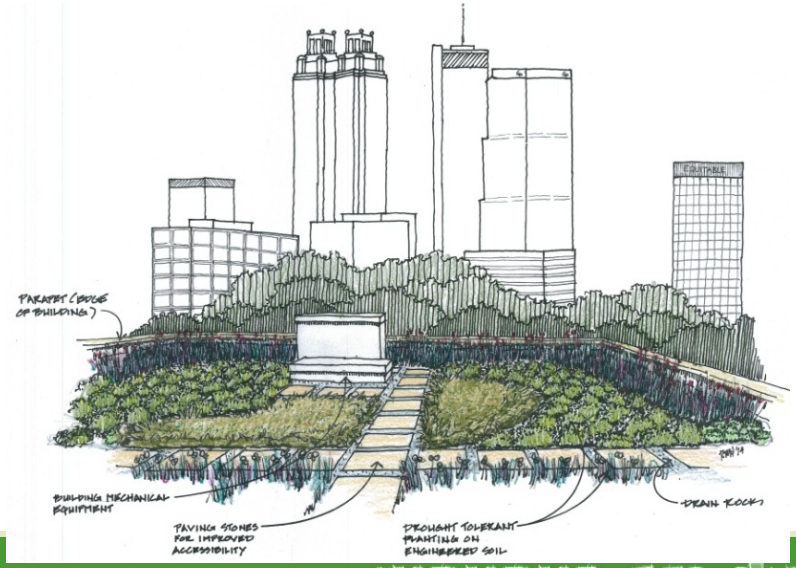


SURFACE TYPE	RESIDENTIAL DRIVEWAY OR PEDESTRIAN ONLY	PRIVATE STREET PARKING LOT, OR FIRE LANE	PUBLIC STREET***
CONCRETE	4"	6"	8"
ASPHALT	2½"	5"	8"
PAVERS	2⅜"	3⅛"	3⅛"
COMPACTION REQUIREMENTS	NO	YES **	95%

- Storage capacity: 1.2cf/sf

Green Roofs





- Storage capacity: 0.24 cf/sf

Next Steps

- Draft Ordinance approved by Metropolitan Development Commission (MDC)
- Code considered for adoption by City-County Council in September 2015
- *Voted to full council with a do pass recommendation. (Sept 28th vote)*
- 4-6 month implementation period
  - ✓Topical workshops and training

A More Sustainable, Livable City!

THANK YOU!

Support a more sustainable, more livable Indy!

City of Indy Project Manager:
Tammara.Tracy@indy.gov
Amec Foster Wheeler Project Manager:
Heather.Williams@amecfw.com

LAND USE PLANNING
CITY OF JEFFERSONVILLE

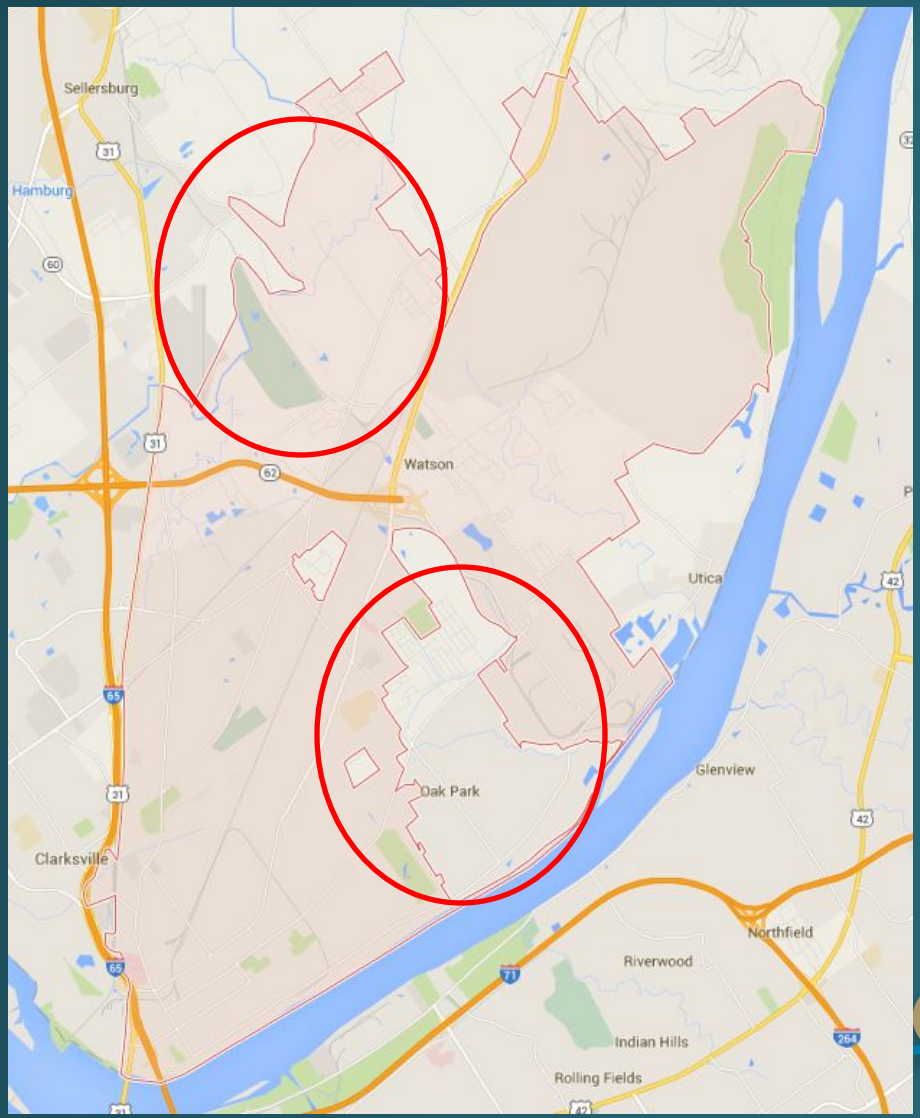
LOCHMUELLER GROUP

FLOODS = ☹

The #1 *Natural Disaster* in the U.S.

LOCHMUELLER GROUP

ANNEXATION



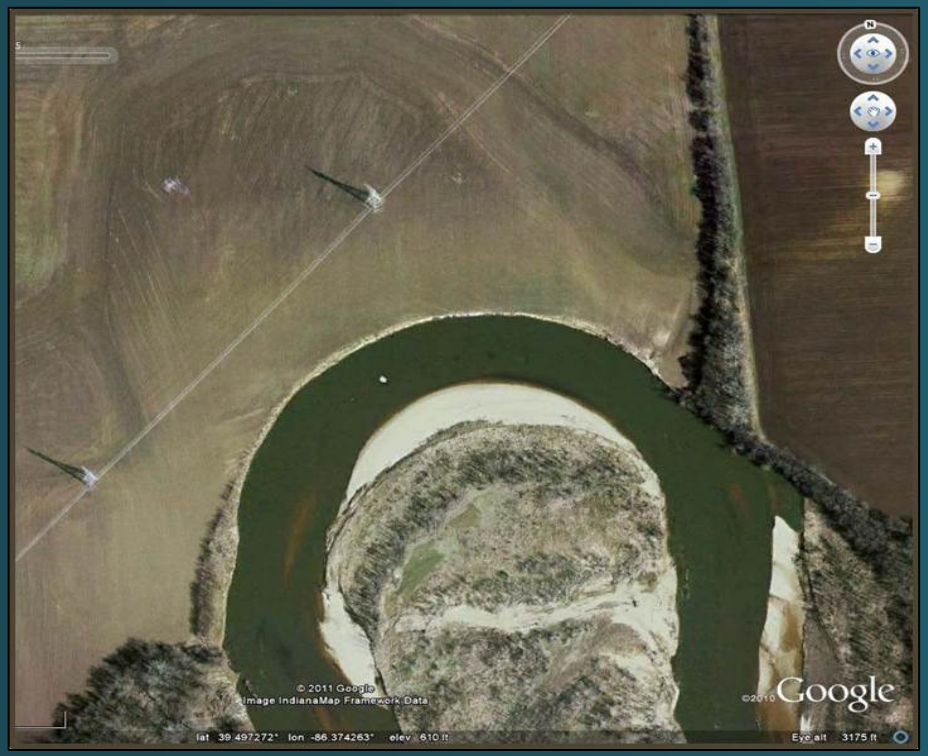
LOCHMUELLER GROUP

MINIMAL DRAINAGE RULES

- Who needs stormwater facilities?

LOCHMUELLER GROUP

STREAMS MOVE – WHITE RIVER

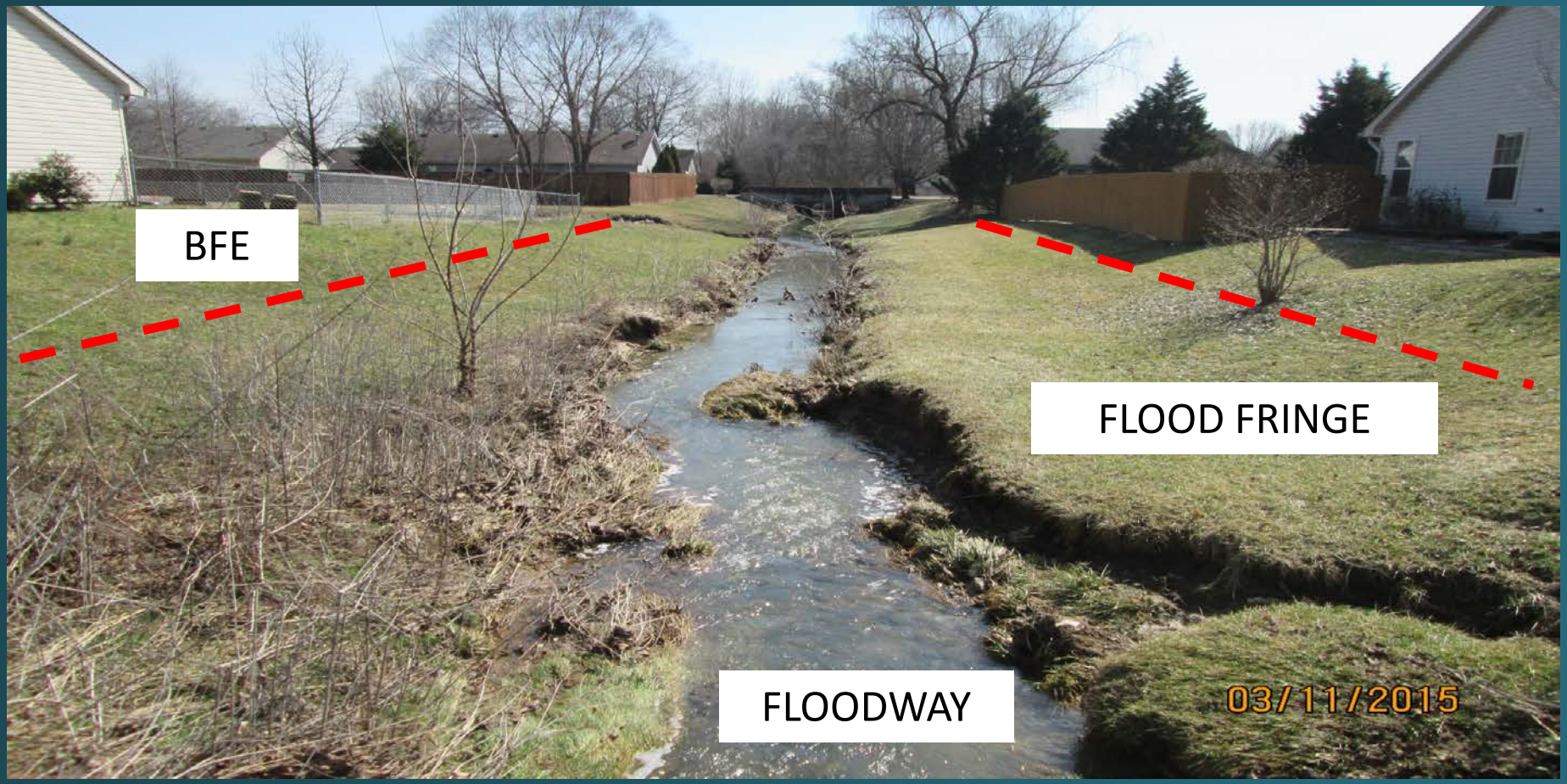


2005: Note the position of the power lines

2012: Note the same power lines

LOCHMUELLER GROUP

HOORAY FOR A VIEW WITH WATER



LOCHMUELLER GROUP

LOCHMUELLER GROUP

LOCHMUELLER GROUP

NO RULES MEAN ANGRY TAXPAYERS

- 4 hours of quality time spent with the public.

LOCHMUELLER GROUP

THE RESULTS ARE IN

- Lack of Planning:
  - Loss of Life.
  - Property Damage.
  - General Flooding.
    - Damaged infrastructure, utilities, roads.
  - Erosion Problems.
  - Angry Public.
  - Unhappy Elected Officials.

LOCHMUELLER GROUP

MOVING FORWARD

- The region is experiencing significant growth.
  - River Ridge (Amazon).
  - 2 Ohio River bridges being constructed.

HMUELLER GROUP

STORMWATER MASTER PLAN

- SWMP provides options to City Drainage Board.
  - Structural – build something.
  - Non structural – ordinance updates, green infrastructure manual.

Recommended Stream Studies

Stream	Target Study Area	Reason for Restudy					Suggested Method of Restudy
		Floodplain elevation discrepancy with BFE	Channel outside Floodway	Old H&H model and/ or data	No detailed study	Est. Stream Miles	
Ohio River	Mill Creek	X				12.5	Redelineation
Mill Creek		X	X	X		3.4	H&H
Hamburg Pike Tributary		X	X	X		1.2	H&H
Greenbriar Tributary		X	X	X		0.6	H&H
Lancassange Creek	OPCD		X	X		4.2	H&H
Woodland Court Tributary	Woodland Court		X	X		1.1	H&H
Lentzier Creek	Lentzier Creek		X		X	4.5	Partial H&H
Pleasant Run					X	2.0	Study
Battle Creek					X		Redelineation using LIDAR
Jenny Lind Run					X		Redelineation using LIDAR

City of Jeffersonville Stormwater Master Plan 2012

LOCHMUELLER GROUP

GREEN INFRASTRUCTURE MANUAL

3.4 DRY POND & WET POND

Also referred to as a dry extended detention basin, infiltration basin, wet pond, and retention basin

Dry and wet ponds are both earthen structures that provide temporary storage of stormwater runoff and release the stored volume of water over time to help reduce flooding. A wet pond maintains a permanent pool of water for aesthetics, recreation, and settlement of sediments.

RESPONSIBLE ENTITY *(for city owned BMPs only)*
City Drainage Department

TOOLS, TECHNIQUES, AND RESOURCES NEEDED
The following is a list of the tools, techniques, and/or resources needed to maintain the BMP:

- Reporting Form
- Plant Guide (for weeding and pest management
- Hand Rake
- Mower
- Backhoe/Dredging Equipment
- Infiltration Rate Test

PREVENTATIVE MEASURES
The following preventative measures may extend the life and effectiveness of the BMP as well as reduce the frequency of maintenance:

- Avoid use of fertilizer, herbicides, and pesticides in bioretention; limit use to adjacent lawn areas
- Critical design elements include size, shape, slope, soil composition, and plant selection; free flowing water is critical to prevent standing, stagnant water for insects to breed
- Stock wet pond with Sunfish, install purple martin or bat houses, or add foundation aerator to control mosquitos
- Hardiness of plants should be selected to match pollutants to be treated
- Side slopes should be maintained to promote dense herbaceous vegetation to prevent erosion and weed growth; remove all woody vegetation within 15' of toe of the embankment and 25' of the principal spillway
- Use organic, non-toxic deicers to melt ice and snow from adjacent areas rather than salt
- Maintain ingress/egress, including access roads, to design standards

MAINTENANCE INDICATORS
The following table provides a quick reference of corrective actions for structural, vegetation, and growing/filter medium problems:

Table 3-7 Dry Pond & Wet Pond Maintenance Indicators

PROBLEM	CORRECTIVE ACTION
Structural – clogged/ damaged inlets, outlets/overflows, and grates, cracked/exposed drain pipes, checkdams	• Remove sediment and/or debris from catch basin, trench drains; repair/ replace damaged components • Maintain checkdams per design standards
Vegetation – dead, wilted, or dying plants, invasive plants and weeds, < 90% coverage	• Irrigate • Replace plants per original planting plan or approved substitute • Remove plant debris and woody plants causing water to stand or stagnate • Mulch banks as needed • Prune to allow for sight lines and conveyance of stormwater at inlets/outlets • Remove weeds (manually, burn, or mow)
Growing/Filter Medium – erosion or exposed soil, failing embankments, scouring at inlet, inundated for longer than 48-72 hrs	• Till soil and replace bark mulch • Repair erosion and stabilize banks with small stones and approved plant material • Conduct infiltration rate test (0.5"/hr) • Replace splash pad at inlet(s) with gravel/rock

MAINTENANCE SCHEDULE
The following table lists the recommended frequency and maintenance activity to be completed. Maintenance activities should be tracked and reported using the form in Chapter 4 and Appendix 1 of this O&M Manual.

Table 3-8 Dry Pond & Wet Pond Maintenance Schedule

FREQUENCY	MAINTENANCE ACTIVITY
As Needed & Following > 1" Rainfall	• Irrigate if plants appear wilted or unhealthy; replace dead plants • Check/repair areas with erosion, cracking, embankment failure, burrowing animals, and sediment clogging the drain and other pipes • Repair erosion and bare soil • Remove woody vegetation < 15' toe of embankment and mow < 25' from spillway • Remove trash, debris, and sediment • Remove weeds and invasive plants
Monthly (during growing season)	• Irrigate 1" water/week during the first growing season; maintain low water levels to allow sufficient oxygen to the roots of establishing plants (wet pond shelf) • Check/clean inlets, outlets/overflows and trash racks from debris • Check plants for pest damage or disease • Remove trash, debris, and sediment • Mow side slopes and embankments, emergency spillways, and access road (dry pond – maintain bottom at 6-8"; wet pond – allow 5-10' of embankment to grow 24-30")
Semi-Annually (spring & fall)	• Check/remove sediment build-up and plant debris (especially < 18" of outlet) • Check water levels with design specifications (wet pond) • Check/repair any settlement of berms • Check/remove burrowing animals; repair holes in embankments
Annually	• Seed or sod to restore dead or dying grass/groundcover • Replace mulch every 3 years (min); replace topsoil every 10 years (min) • Remove accumulated sediment (> 50% capacity forebay, > 25% capacity pond). Minimum 2-10 years (dry pond), 5-10 years (wet pond)
Upon Failure	• Redesign and reconstruct

LOCHMUELLER GROUP

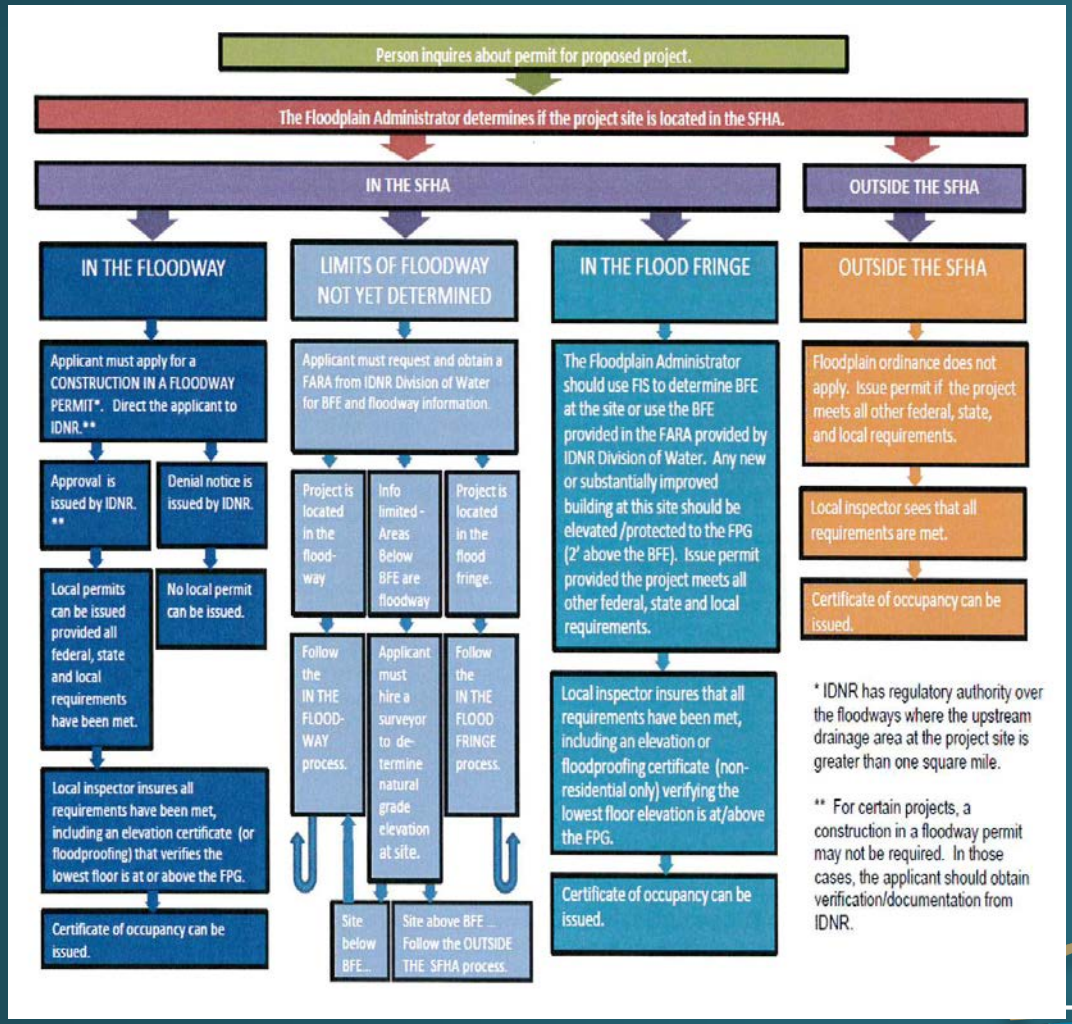
GENERAL CITY PERMIT PROCESS

- Planning and Zoning.
- Building Commissioner Office.
- Engineering.
- Drainage.
- Wastewater.

- Coordination through BS&A software.
- Which departments need ordinance updates?

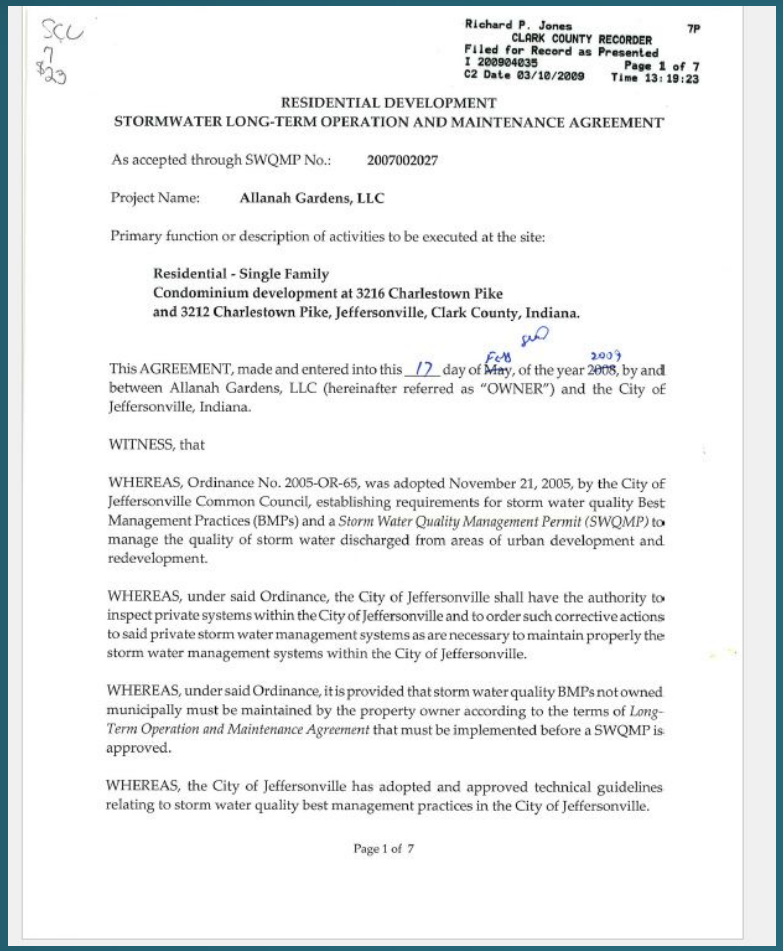
LOCHMUELLER GROUP

FLOODPLAIN PERMIT PROCESS



STORMWATER PERMIT PROCESS

- Stormwater Reviews:
  - City Engineer
  - Drainage Board
  - Stormwater SWPPP
  - Stormwater Long Term Maintenance Agreements



Richard P. Jones 7P
CLARK COUNTY RECORDER
Filed for Record as Presented
I 200904035 Page 1 of 7
C2 Date 03/10/2009 Time 13:19:23

RESIDENTIAL DEVELOPMENT
STORMWATER LONG-TERM OPERATION AND MAINTENANCE AGREEMENT

As accepted through SWQMP No.: 2007002027

Project Name: **Allanah Gardens, LLC**

Primary function or description of activities to be executed at the site:

Residential - Single Family
Condominium development at 3216 Charlestown Pike
and 3212 Charlestown Pike, Jeffersonville, Clark County, Indiana.

This AGREEMENT, made and entered into this 17 day of ~~May~~ Feb, of the year ~~2008~~ 2009, by and between Allanah Gardens, LLC (hereinafter referred as "OWNER") and the City of Jeffersonville, Indiana.

WITNESS, that

WHEREAS, Ordinance No. 2005-OR-65, was adopted November 21, 2005, by the City of Jeffersonville Common Council, establishing requirements for storm water quality Best Management Practices (BMPs) and a *Storm Water Quality Management Permit (SWQMP)* to manage the quality of storm water discharged from areas of urban development and redevelopment.

WHEREAS, under said Ordinance, the City of Jeffersonville shall have the authority to inspect private systems within the City of Jeffersonville and to order such corrective actions to said private storm water management systems as are necessary to maintain properly the storm water management systems within the City of Jeffersonville.

WHEREAS, under said Ordinance, it is provided that storm water quality BMPs not owned municipally must be maintained by the property owner according to the terms of *Long-Term Operation and Maintenance Agreement* that must be implemented before a SWQMP is approved.

WHEREAS, the City of Jeffersonville has adopted and approved technical guidelines relating to storm water quality best management practices in the City of Jeffersonville.

Page 1 of 7

LOCHMUELLER GROUP

FLOODPLAIN MANAGER

- Enhance public safety, reduce loss, protect the environment
- Ensure community eligibility for National Flood Insurance Program
- Reduce cost of NFIP for policy holders

FEMA

LOCHMUELLER GROUP

FLOODPLAIN MANAGER

- Issue permits and enforce ordinance.
- Provide guidance related to drainage improvements, flood protection, floodplain management, and mitigation projects.
- Explain development requirements to developers, public, insurance, financial, real estate professionals, elected officials.
- Maintain floodplain management files, Flood Insurance Rate Map (FIRM), building permits, variances, FEMA map revisions, elevation certificates.

LOCHMUELLER GROUP

STORMWATER MANAGER

- Reduce pollutants leaving the community.
- Protect the Waters of the U.S. and public health.

LOCHMUELLER GROUP

MS4 STUFF

- Public Education.
- Public Participation.
- Illicit Discharge Detection and Elimination.
- Construction.
- Post Construction.
- Good Housekeeping.

LOCHMUELLER GROUP

CRS POINTS

- Open space preservation.
- Stormwater management.
- Drainage system maintenance.

Some Natural Functions of Floodplains

WATER RESOURCES

Natural Flood and Erosion Control

- Provide flood storage and conveyance
- Reduce flood velocities
- Reduce peak flows
- Reduce sedimentation

Water Quality Maintenance

- Filter nutrients and impurities from runoff
- Process organic wastes
- Moderate temperature fluctuations

Groundwater Recharge

- Promote infiltration and aquifer recharge
- Reduce frequency and duration of low surface flows

BIOLOGICAL RESOURCES

Biological Productivity

- Rich alluvial soils promote vegetative growth
- Maintain biodiversity
- Maintain integrity of ecosystems

Fish and Wildlife Habitats

- Provide breeding and feeding grounds
- Create and enhance waterfowl habitat
- Protect habitats for rare and endangered species

– *A Unified National Program for Floodplain Management*
FEMA-248 (1994)

Table 110-2. Credit points awarded for CRS activities.

Activity	Maximum Possible Points [1]	Maximum Points Earned [2]	Average Points Earned [3]	Percentage of Communities Credited [4]
300 Public Information Activities				
310 Elevation Certificates	116	116	45	100%
320 Map Information Service	90	70	50	93%
330 Outreach Projects	350	175	72	89%
340 Hazard Disclosure	80	57	19	71%
350 Flood Protection Information	125	98	39	92%
360 Flood Protection Assistance	110	65	49	41%
370 Flood Insurance Promotion [5]	110	0	0	0%
400 Mapping and Regulations				
410 Floodplain Mapping	802	585	64	50%
420 Open Space Preservation	2,020	1,548	463	70%
430 Higher Regulatory Standards	2,042	784	213	99%
440 Flood Data Maintenance	222	171	87	89%
450 Stormwater Management	755	540	107	84%
500 Flood Damage Reduction Activities				
510 Floodplain Mgmt. Planning	622	273	167	46%
520 Acquisition and Relocation	2,250	1,701	165	24%
530 Flood Protection	1,600	632	45	12%
540 Drainage System Maintenance	570	449	212	77%
600 Warning and Response				
610 Flood Warning and Response	395	353	129	37%
620 Levees [6]	235	0	0	0%
630 Dams [6]	160	0	0	0%

Table 330-1. CRS topics and example messages.

Six Priority Topics	Example Messages
1. Know your flood hazard	Your property is subject to flooding You are in a repetitively flooded area Drive safely: five people died in the 2002 flood
2. Insure your property for your flood hazard ***NOTE:*** *At least one project must include a message on this topic*	You need flood insurance Renters should buy flood insurance for their contents Take advantage of a low-cost Preferred Risk Policy
3. Protect people from the hazard	Turn around, don't drown Know the flood warning signals: one long blast of the siren means a flash flood along Silver Creek Designate a place where your family can rendezvous after an evacuation order is issued
4. Protect your property from the hazard	Replace your flooded furnace with one elevated above the flood level Keep debris and trash out of the streams and ditches We can help you get a grant to elevate your home. Call us at _____
5. Build responsibly	Get a permit from . . . before you build Know the substantial damage rules (and the ICC benefits). You can see them at www..... All projects should be at least 10 feet from the property line so you don't alter the drainage between homes
6. Protect natural floodplain functions	No pollutants down the storm drains; they drain to the bay Protect our turtle nesting areas: stay off the beach after sunset Report broken silt fences: they help keep our streams clean
Examples of additional topics (developed by a community that has a Program for Public Information)	**Example Messages**
7. Hurricane preparedness *	Know your evacuation route
8. General preparedness *	Inventory and photograph your home's contents and put important papers and insurance policies in a safe place
9. Basement flooding *	Check your downspout—drain away from the house
10. Flood education *	Teach school children about flooding

Table 330-2. Basic scoring of example outreac

Example Outreach Projects (OP)	A Points per topic
OP#1. A brochure on flood insurance produced by FEMA is set out in various public places (informational material—1 point per topic).	1
OP#2. Local insurance agents have agreed to advise their clients that flood insurance is a good idea and give them the OP#1 brochure (general outreach—2 points per topic).	2
OP#3. Presentations are made to five neighborhood associations with messages under CRS topics 1, 2, 4, and 5. (general outreach—2 points per topic) The OP#1 brochure is handed out to everyone present.	2
OP#4. The neighborhood association presentation is taped and repeated twice a month on the public service cable TV channel. (general outreach—2 points per topic) This does not involve two-way communication, so it is counted as being delivered once a year.	2
OP#5. A mailing is sent each year to all residents of the SFHA. It has messages under the first five CRS topics. (targeted outreach—6 points per topic)	6
OP#6. "Do not dump" stencils are sprayed next to storm drain inlets. (general outreach—2 points per topic)	2
OP#7. The floodplain manager meets twice a year with the home builders association to discuss construction regulations and ways to incorporate flood mitigation into home improvement projects (general outreach—2 points per topic, CRS topics 4 and 5)	2
Total OP =	

YOUR MS4 COORDINATOR MAY HAVE ALREADY COMPLETED THESE TASKS

- Drainage structure monitoring and repair.
- Storm drain stenciling by volunteer community groups or municipal employees.
- Documentation of repaired silt fence at sensitive areas.
- Citizen hotlines, documented calls.
- Open space preservation.
- Public education about storm drains, wetlands, green space preservation.

LOCHMUELLER GROUP

YOUR FLOODPLAIN ADMINISTRATOR MAY ALREADY HAVE COMPLETED THESE TASKS

- Mapped sensitive areas and floodplain preservation areas.
- Completed a flood mitigation protect protecting or created new wetland areas.
- Participated in floodplain projects or channel modifications you are unaware of.
- Be aware of specific areas subject to erosion.
- Created mailing lists of properties along the river.

LOCHMUELLER GROUP

A SIMILAR SERVICE

Advise

Preserve

Reduce

Protect

LOCHMUELLER GROUP

CONTACT INFORMATION

- Bryan Wallace CFM, CSM, CMS4S
  - (502) 292-7569
  - BWallace@lochgroup.com

LOCHMUELLER GROUP