

Zero Runoff: Is it a Realistic Goal in Urban Areas?

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*Illustration courtesy of
McGough Development, LLC.*

Zero Runoff: Is it a Realistic Goal in Urban Areas?



Answer: *YES*

But...

It Depends



Answering the Questions:

- **Context**
- **Modeling & Feasibility?**
- **Costs?**
- **Land Use & Zoning?**
- **Standards & Ordinances**
- **On-the-ground Examples**

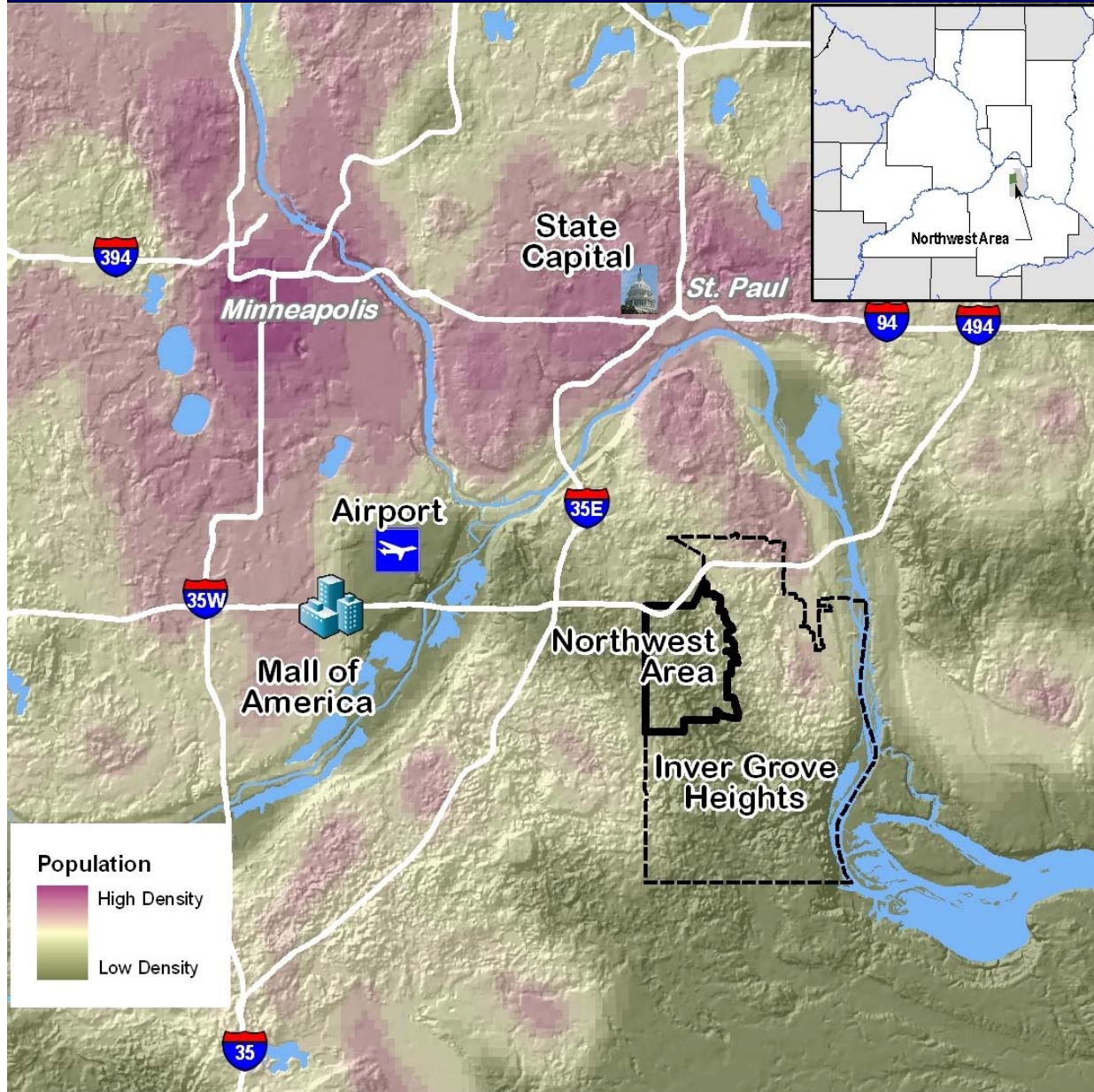


Context



Context

Urbanization – South East Metro



Location Map

**Inver Grove Heights
Area Along I-494,
Close to:**

- Airport
- Mall of America
- Downtown St. Paul

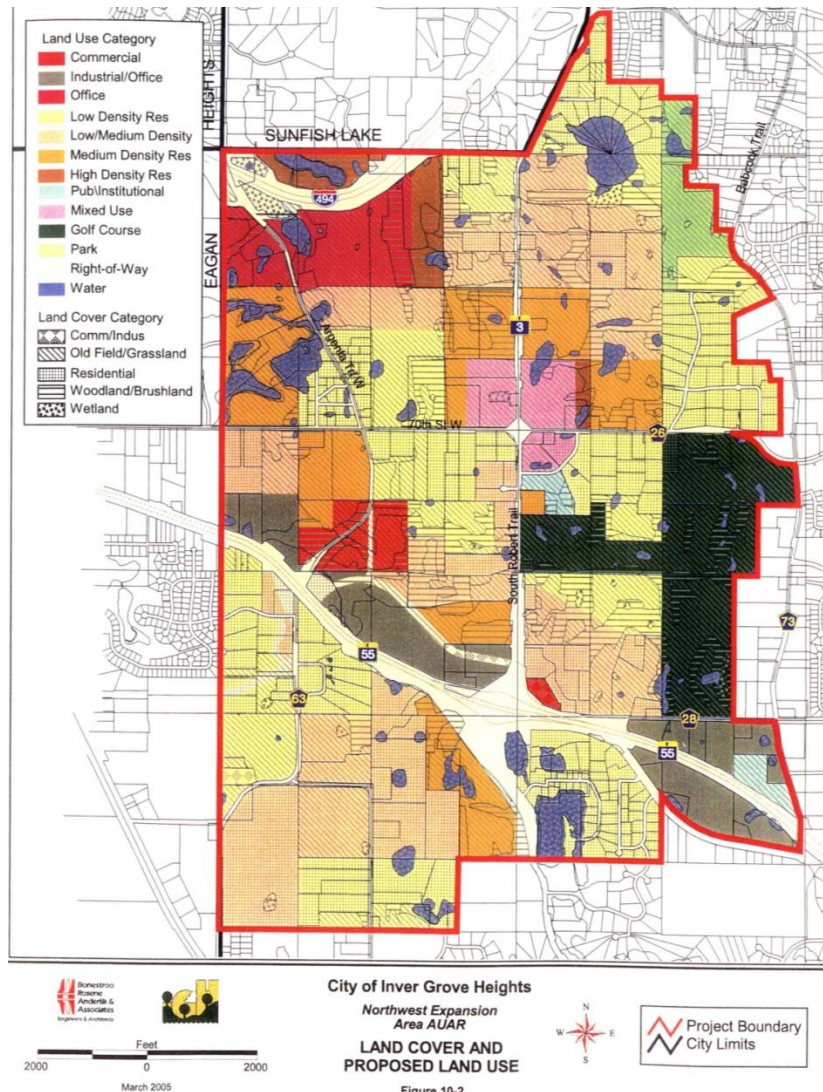
**Large Urban Expansion
Area for City**

- ~3,000+ Ac.

**Landlocked -
Infrastructure
Challenges**

Context

Land Use Plan



NW Area Land Use Plan

Mix of Urban Uses:

- Single Family Residential Suburban Lots (3-4 un/ac)
- Higher Density Residential
- Commercial
- Industrial/Office

Context

The Setting

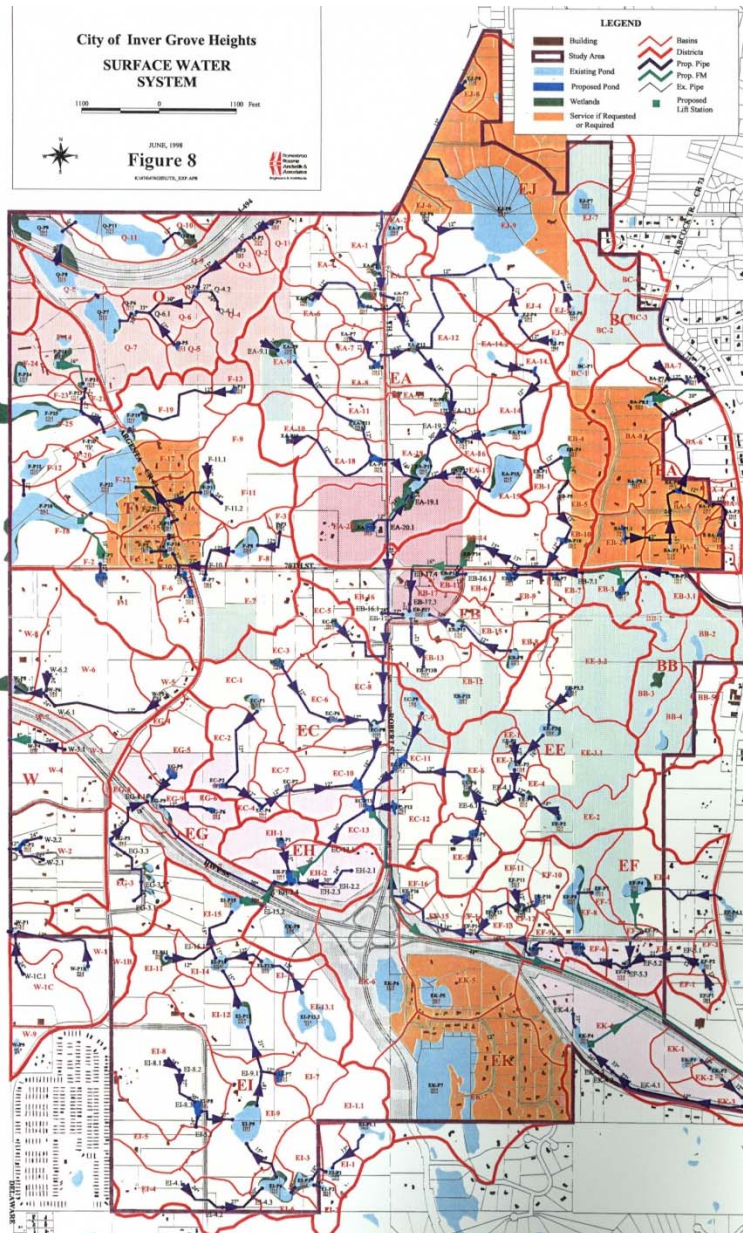
Can We Work within the Landscape:

- Rolling hills & agr fields, wooded slopes, lakes/wetlands, depressions
- No Natural Outlet – Landlocked/Closed
- Scenic “Character”



Context

Original Stormwater Plan - Traditional



Original Plan:

**Traditional “Pump & Pipe”
(Connect-the-Dots)**

Avoid High Quality Marcott Lakes

System:

- 13 Lift Stations
- New Outlet to Miss. River (4 mile long pipe)
- ~24 Miles of Storm Piping throughout
- Total Up-front Infrastructure Cost of \$30 million

Context

Can Water Be Managed Differently?

Concerns:

- Typical “Sprawl” – Character?
- Quality Lakes; New Outlet to Miss. River
- Costly

Group/Landowner Goals:

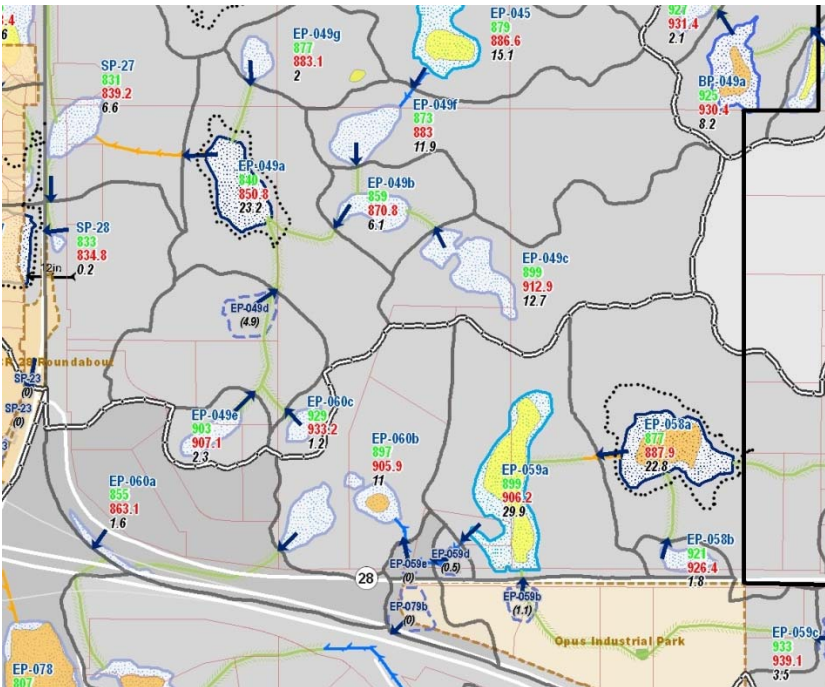
- Reduce Costs
- Why Not Use the Natural Systems that Works Well (without Outlets)?
- Retain Unique “Feel” of Landscape



**Low Impact
Development
(LID)**



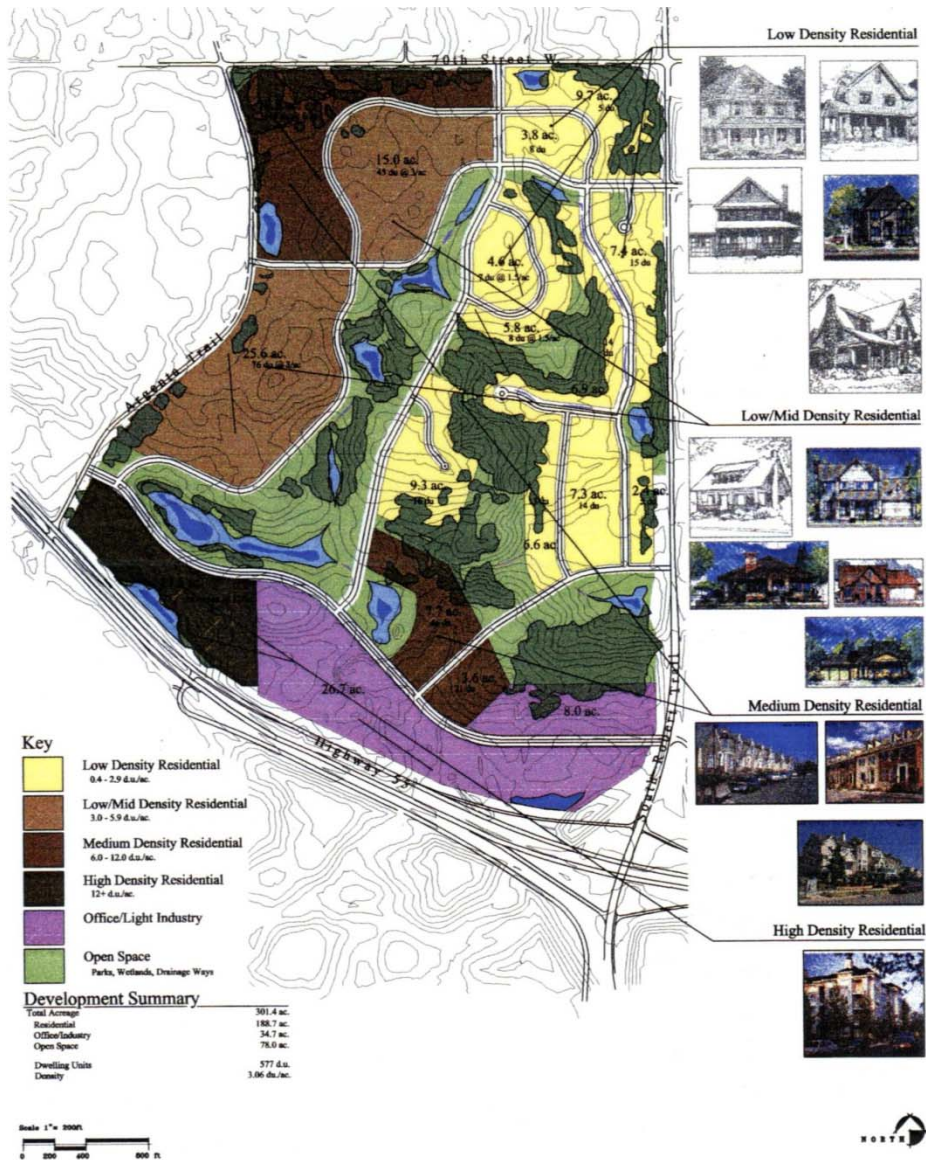
Modeling and Feasibility



How to Answer the Question?

- **Both W.Q. & Flood Control?**
 - Hydrologic & Hydraulic (H & H) Modeling
 - Pilot Area
 - Entire NW Area
- **How Does the System Work?**
 - Basin Monitoring Report, 2004-2005
- **Are We Sure?**
 - Calibration (incl. large 6" event)
- **Will it be too Costly?**
 - Cost Comparison
- **How do we Pay for System?**
 - Fee Structure (Comparisons)

Modeling and Feasibility



H & H - Pilot Area

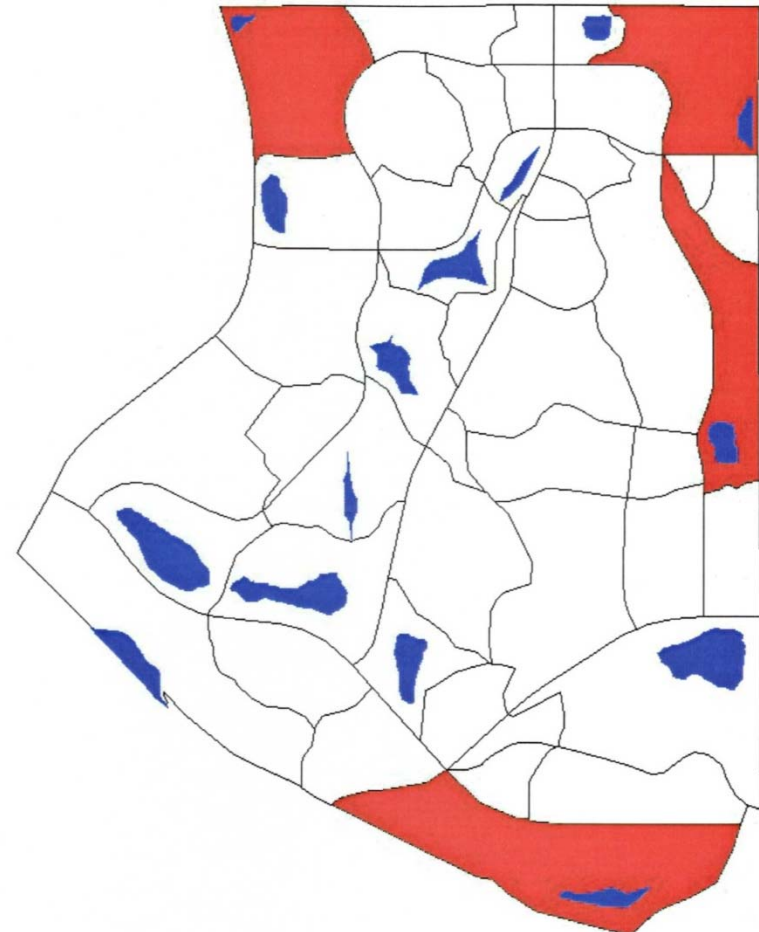
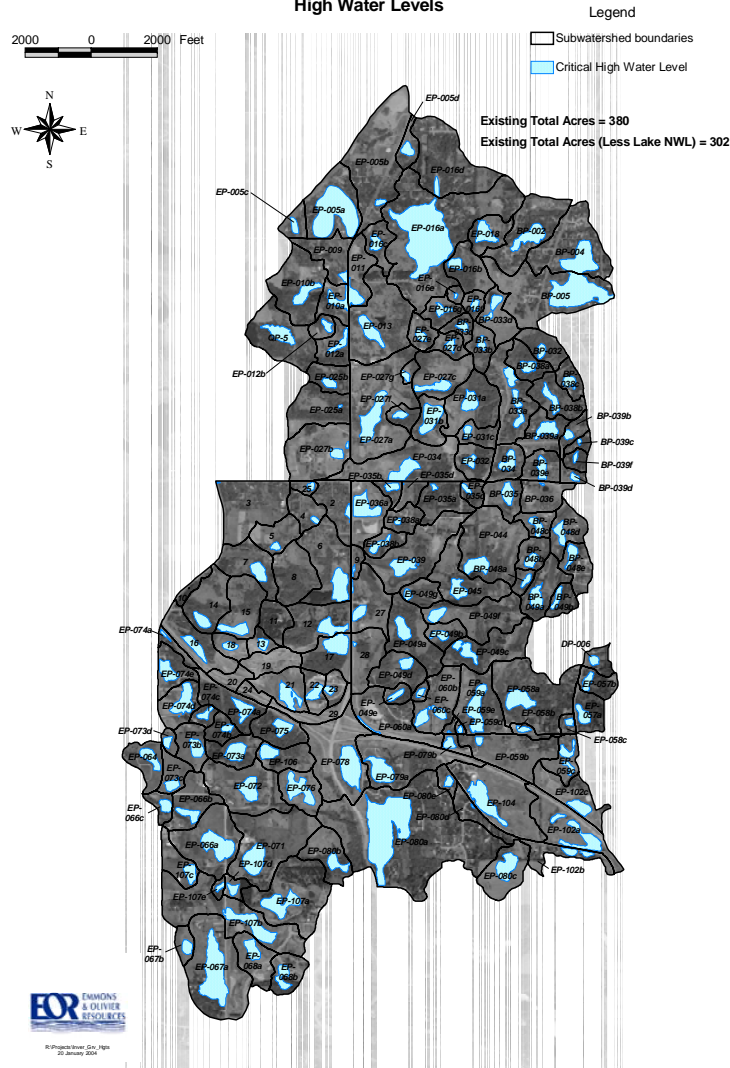


Figure 10. Ponds and their associated sub-basins that have strong potential for flooding.

EOR water
ecology
community

**Fig. 7 Existing Conditions
Worst Case Scenario
(10-day Snowmelt/Runoff Event)
High Water Levels**



- **Covers Entire NW Area**
- **Calibration with Data**
- **Key Regional (Natural) Basins**
- **Help Establish Runoff Standards**



Monitoring Report, 2004-2005

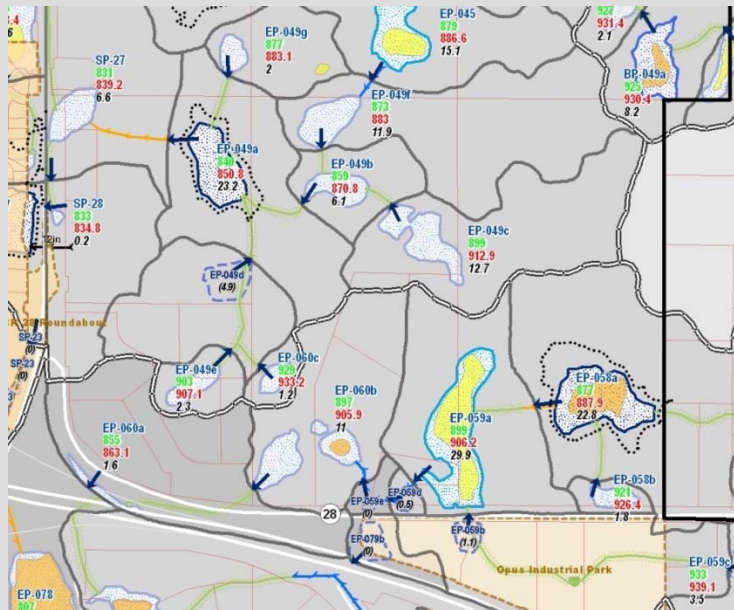
- Rainfall-Runoff Relationship
- Basin Infiltration Rates
- Large Event in Early Oct. 2005 (~6.0" in 24 hours)
- Calibration of Modeling

Modeling and Feasibility



Determined to be Feasible:

- Protect Natural Depressions (Large Events) - Overflows
- Mimic Natural Hydrology (Day-to-Day) – New Standards
- Better Outcomes ie Water Quality
- Less Pipes and Pumps
- Improved G.W. Recharge



Total Costs

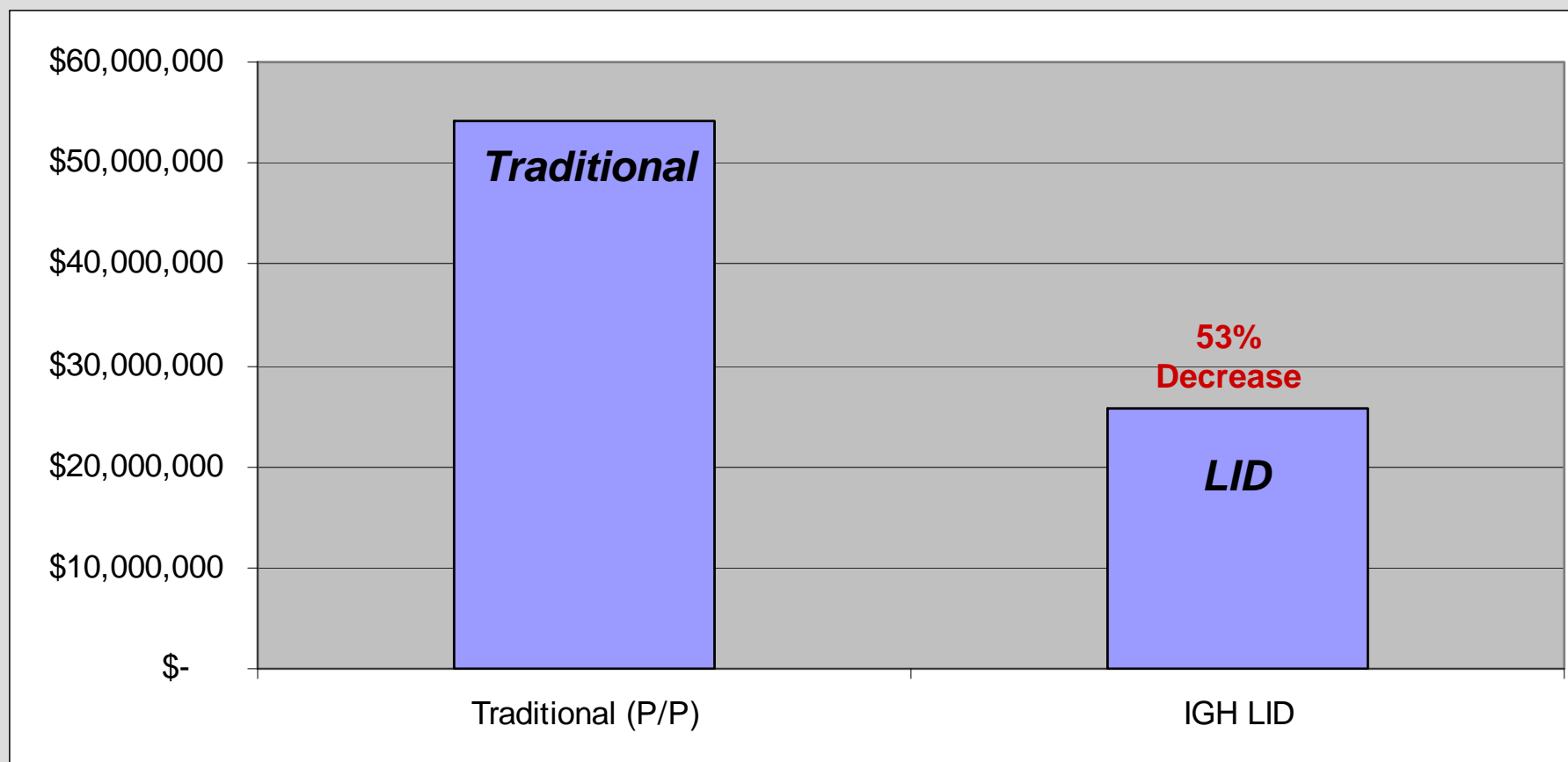
- Total Costs of Proposed Storm Water Infrastructure
- O&M Costs Included (Present Worth over 30 yrs)
- Includes Costs for Land

	Traditional	Proposed (LID)
Infrastructure (includes land)	\$29,635,000*	\$ 6,520,000
O & M	\$24,553,000	\$19,153,000
Total	\$54,188,000	\$25,673,000

Updated costs, 1/10/07, Jan. 2006 dollars (ENR Index of 7660)

**Includes approx. same land costs as LID (\$3,750,000)*

30-yr Lifecycle Costs (includes O&M)



Costs

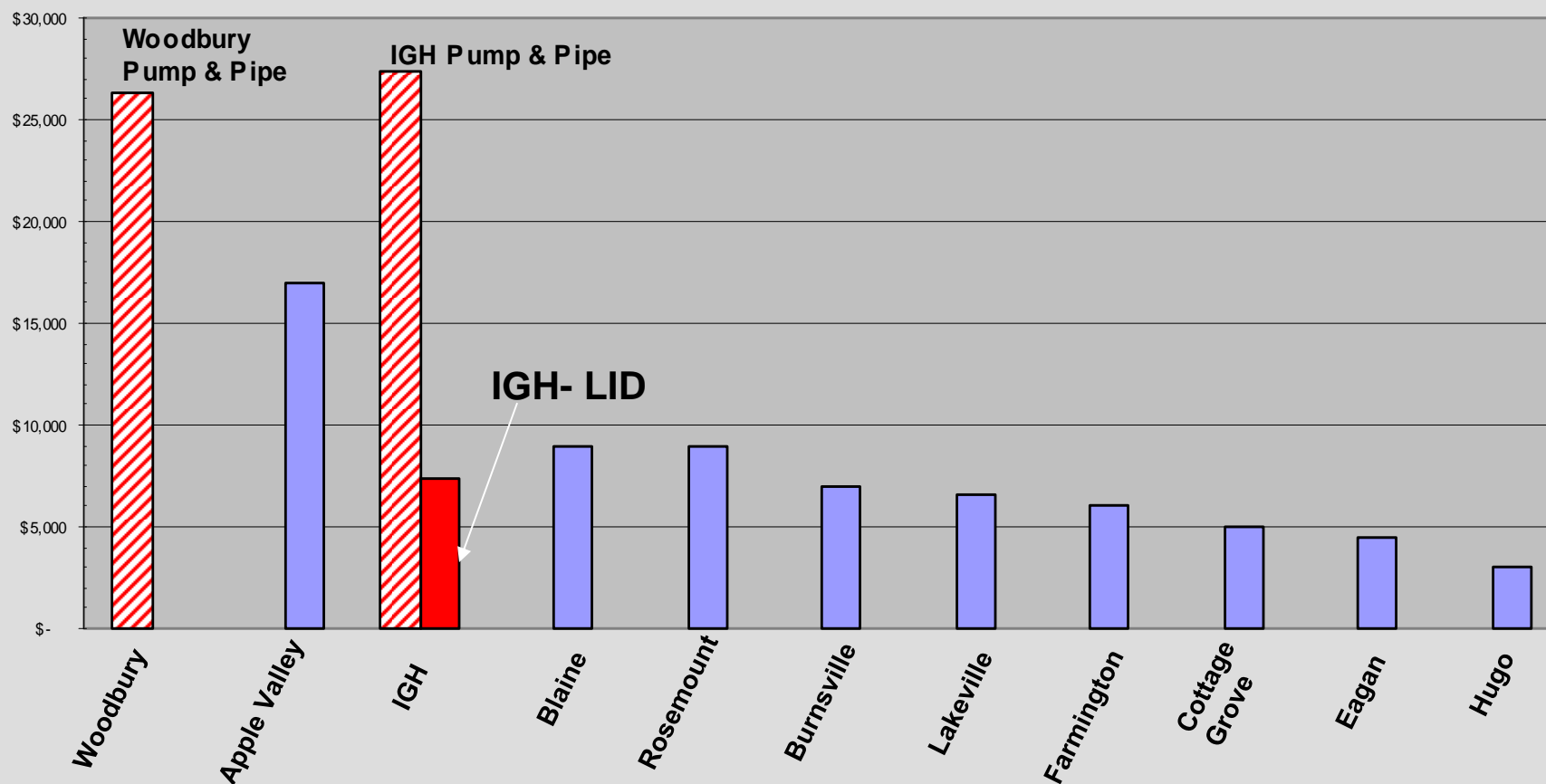
Stormwater Fees

Area Charge

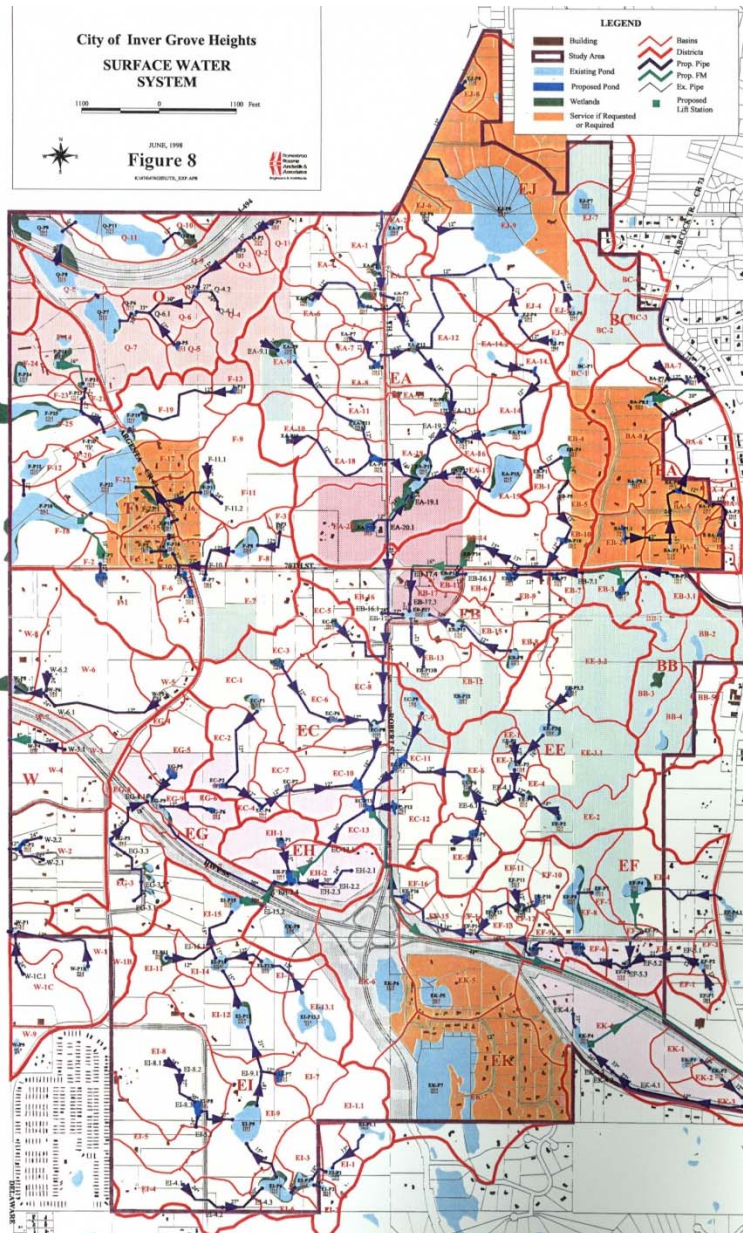
2006 Stormwater Area Charge

Single Family Residential

[per acre]



Original Plan - Traditional



Original Plan:

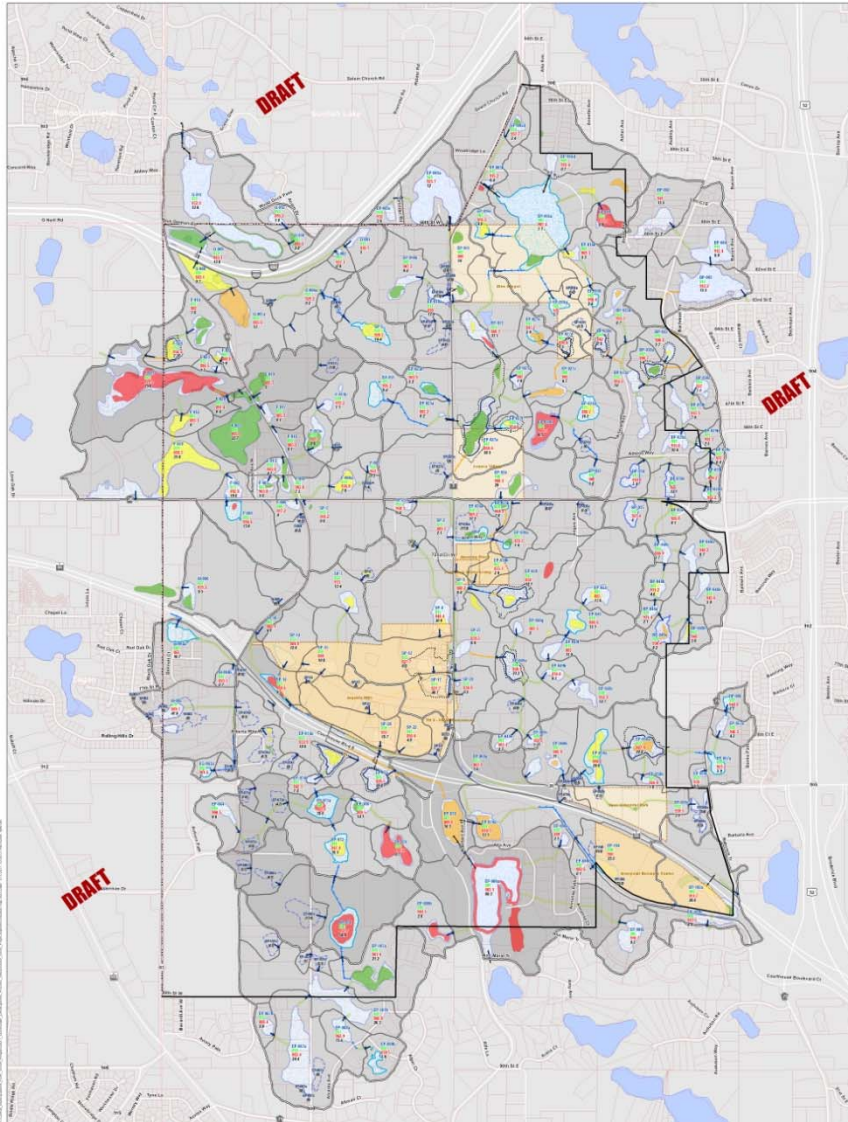
Traditional “Pump & Pipe” (Connect-the-Dots)

Avoid High Quality Marcott Lakes

System:

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LID Plan - Summary



LID Plan:

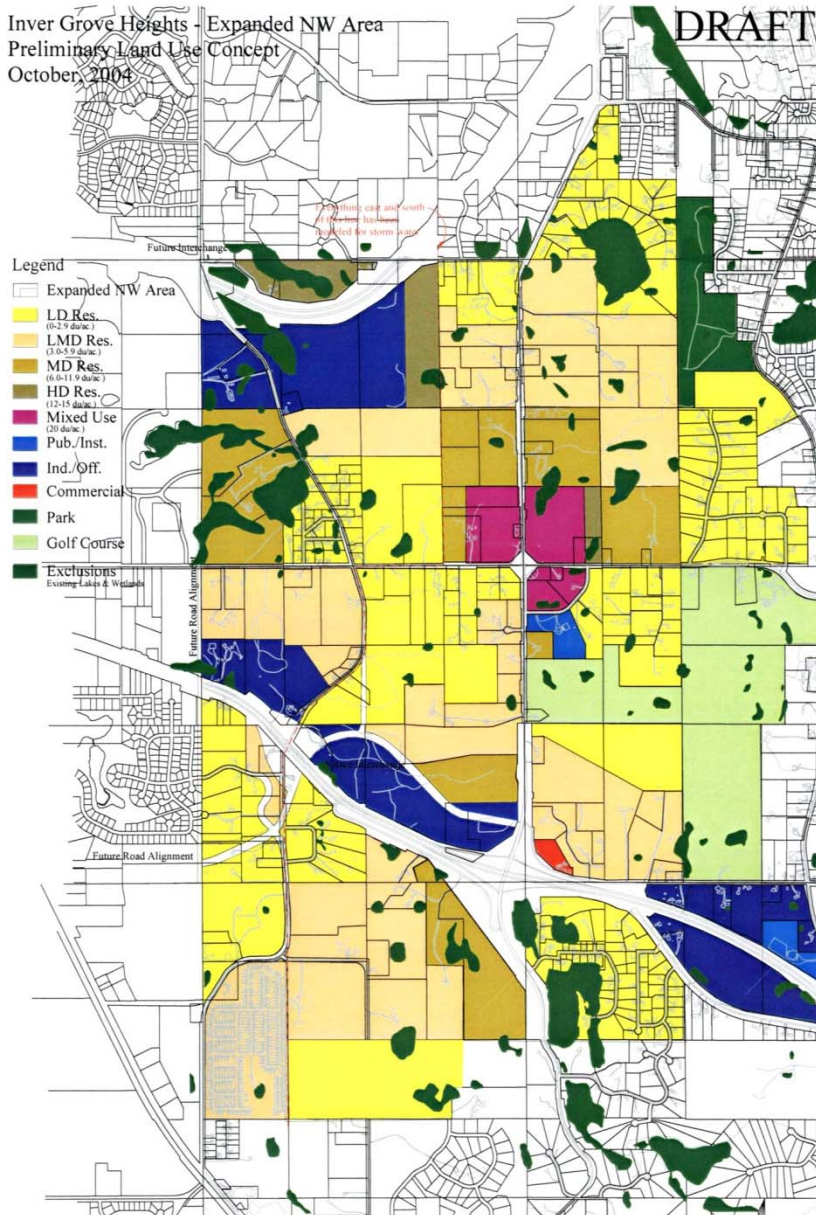
Use of Natural Hydrology

- Natural runoff (small storms)
- Protect natural storage/infiltr.
- Replenish GW (Marcott Lakes)

System:

- 0 Lift Stations
- No Outlet to Miss. River
- ~3 Miles of Storm Piping throughout

Land Use & Zoning



Open Space Preservation

- **Capacity Plan = Units for Area**
- **Open Space - 20% of buildable area:**
 - 50% Passive, 50% Can be active park or stormwater uses
 - 75% Contiguous
 - Minimum width of 100'
 - Protection of steep slopes
 - Protection of natural features (NRI)
 - Neighborhood linkages and connections to pockets of open space
 - Landscape Character

Land Use & Zoning

Flexibility in Permitted Uses/Densities

Relies on the basics of the underlying zoning district but provides for some flexibility in housing types.



**Hoisington-
Koegler
Group, Inc.**

USES	ZONING					
	ZONING DISTRICT					
	R-1C	C	R-2	R-3B	R-3C	MU
Single Family Dwellings	100%	100%	100%	10%	10%	10%
Townhome/Two-Family Dwellings	30%	100%	100%	30%	10%	15%
Multiple dwelling unit (8 or fewer units)	10%	30%	30%	100%	40%	100%
Multiple dwelling unit building (8+ units)	0%	0%	0%	50%	100%	100%

Note: % in tables represent the total percent of units allowed by unit type or “use” in each district. For each example, in the R-1C district, up to 30% of the total units in proposed PUD may be townhomes or two-family dwellings, or alternatively, the entire PUD could consist of all (100%) single family housing.

Parking

- **Strategies to reduce hard surface**
 - NW Area Max. = 75% of Previous City Min.
 - If exceeds new Max., must be porous or multi-level for half
 - Shared/joint parking





Volume Control (LID)

- **Maintain Existing Runoff Volume On-Site (Demonstrate with 5-yr event)**
- **Preserve Natural, “Regional Basins” (& Infiltration)**
- **20% Open Space**
 - Reduced runoff
 - Space for Regional Basins & BMPs
- **Sketch Plan Review**
- **Construction Plan – Phasing**
- **O&M Plans**

Standards & Ordinances

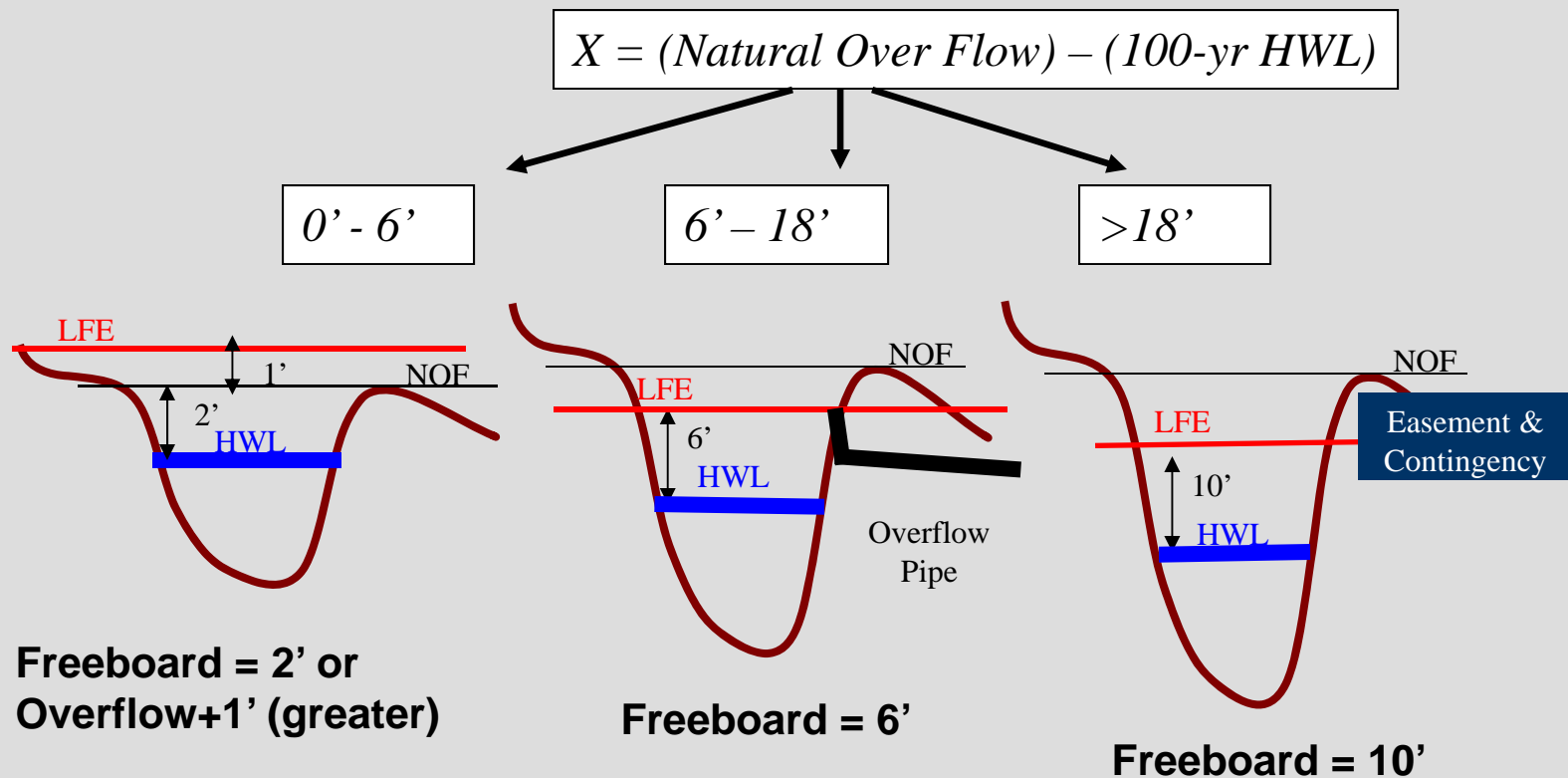
Low Floor Building Elevations

Existing

- 100-yr HWL + 2' Freeboard (FB)

Proposed

- 3-Tiered Approach

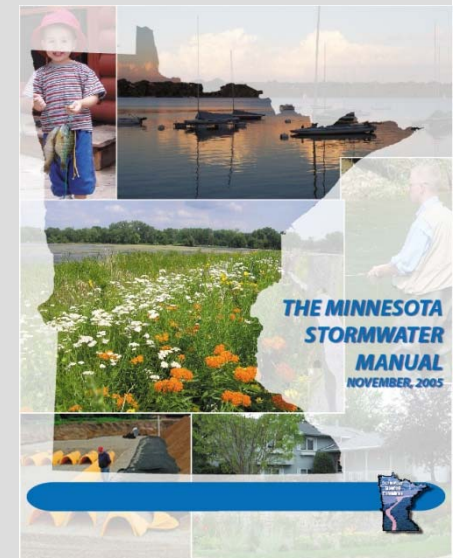
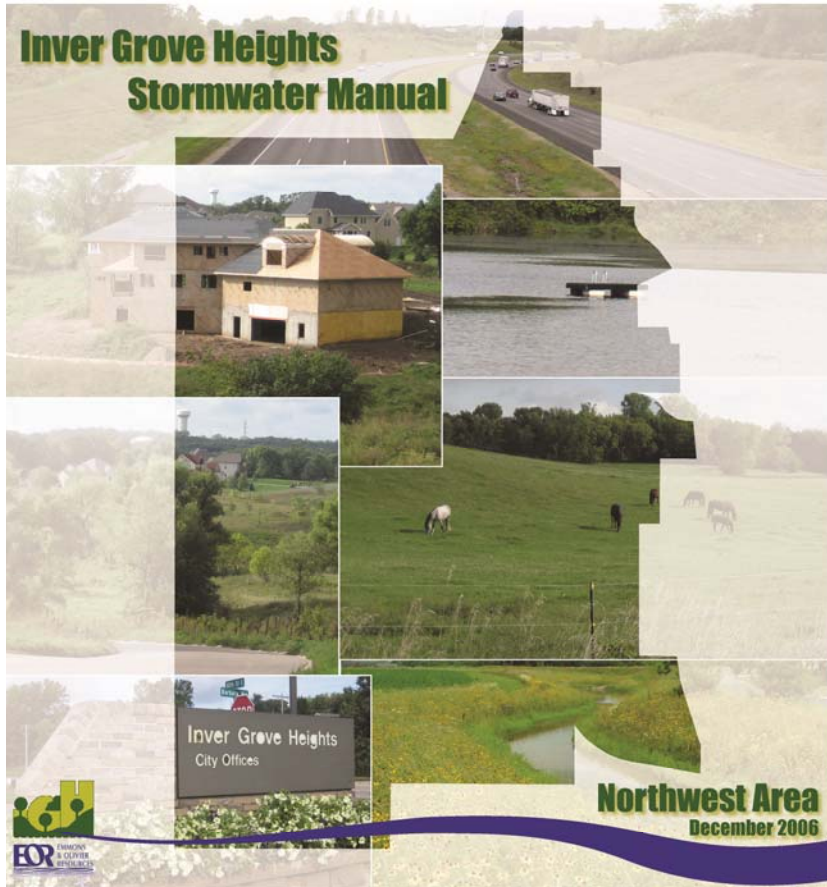


Standards & Ordinances

Inver Grove Heights Stormwater Manual

IGH NW Area Stormwater Manual (2007)

- Background on NW Area and Unique Needs
- Established Standards
- Design Guidance
- Construction Guidance
- O&M Guidance
- Based on MN



Summary- How Zero Runoff Works? (Key Ingredients)

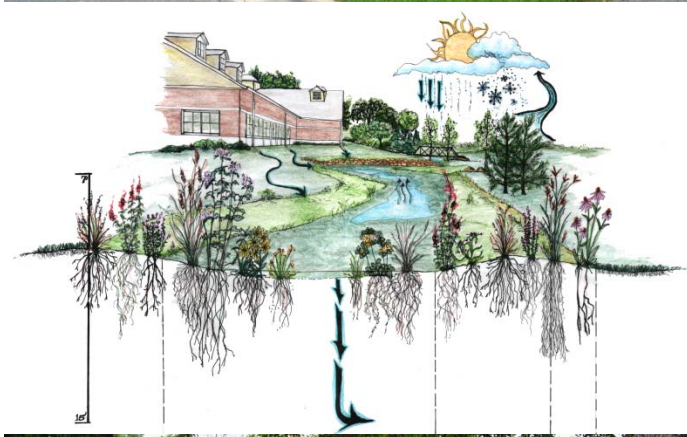


**Keep Water at the Source
(Mimic Natural Hydrology)**

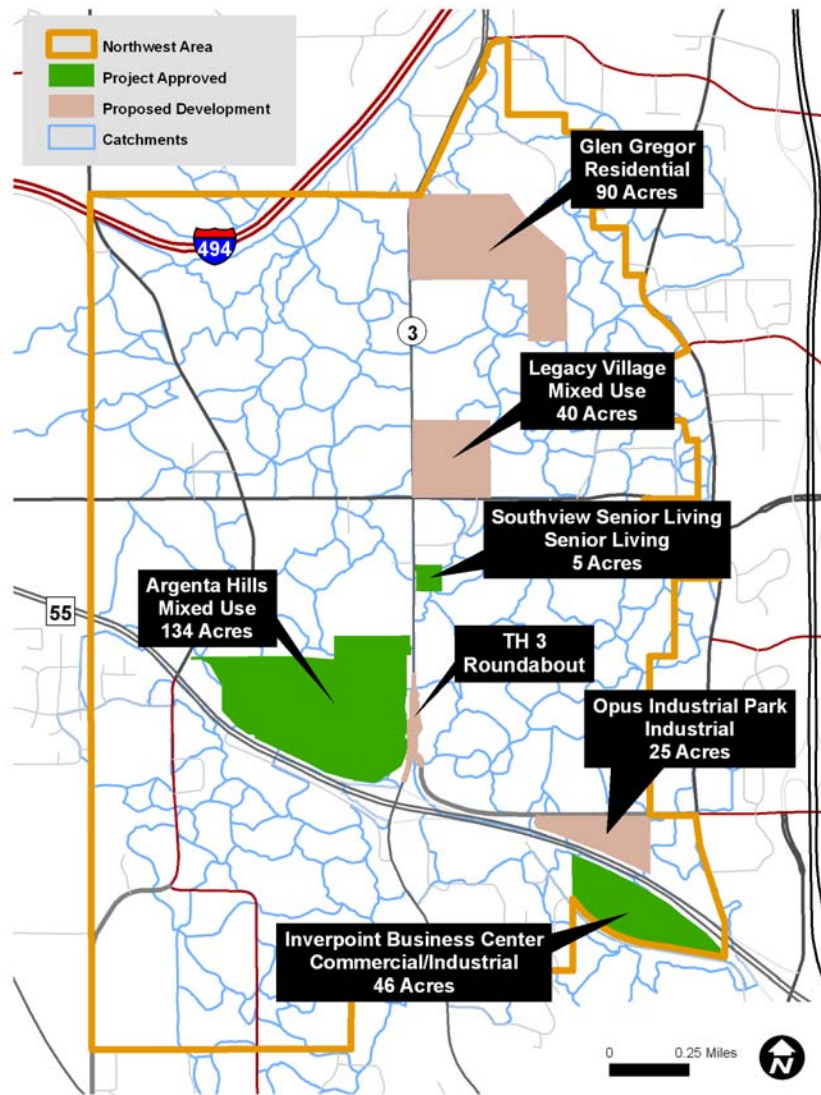
**Integrate Land Use &
Stormwater**

**Use Natural Assets -
Depressions & Soils**

**Strong Resources –
Ordinances, Manual, O&M,
Fees**



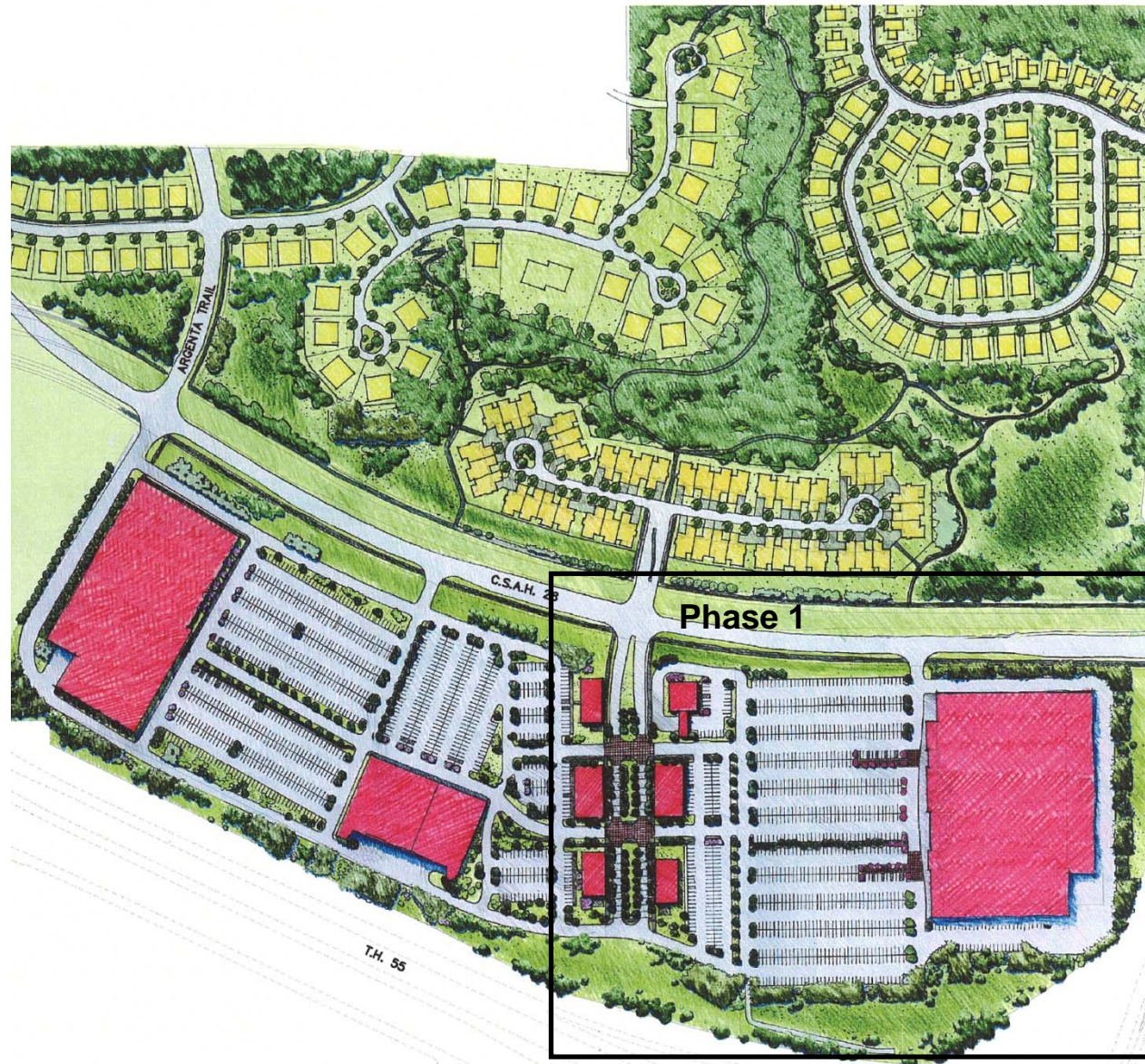
LID Applied



The First Projects:

- Argenta Hills – Mixed Uses
- Senior Housing
- Office/Business Park
- Residential
- Road Roundabout

Argenta Hills Master Plan

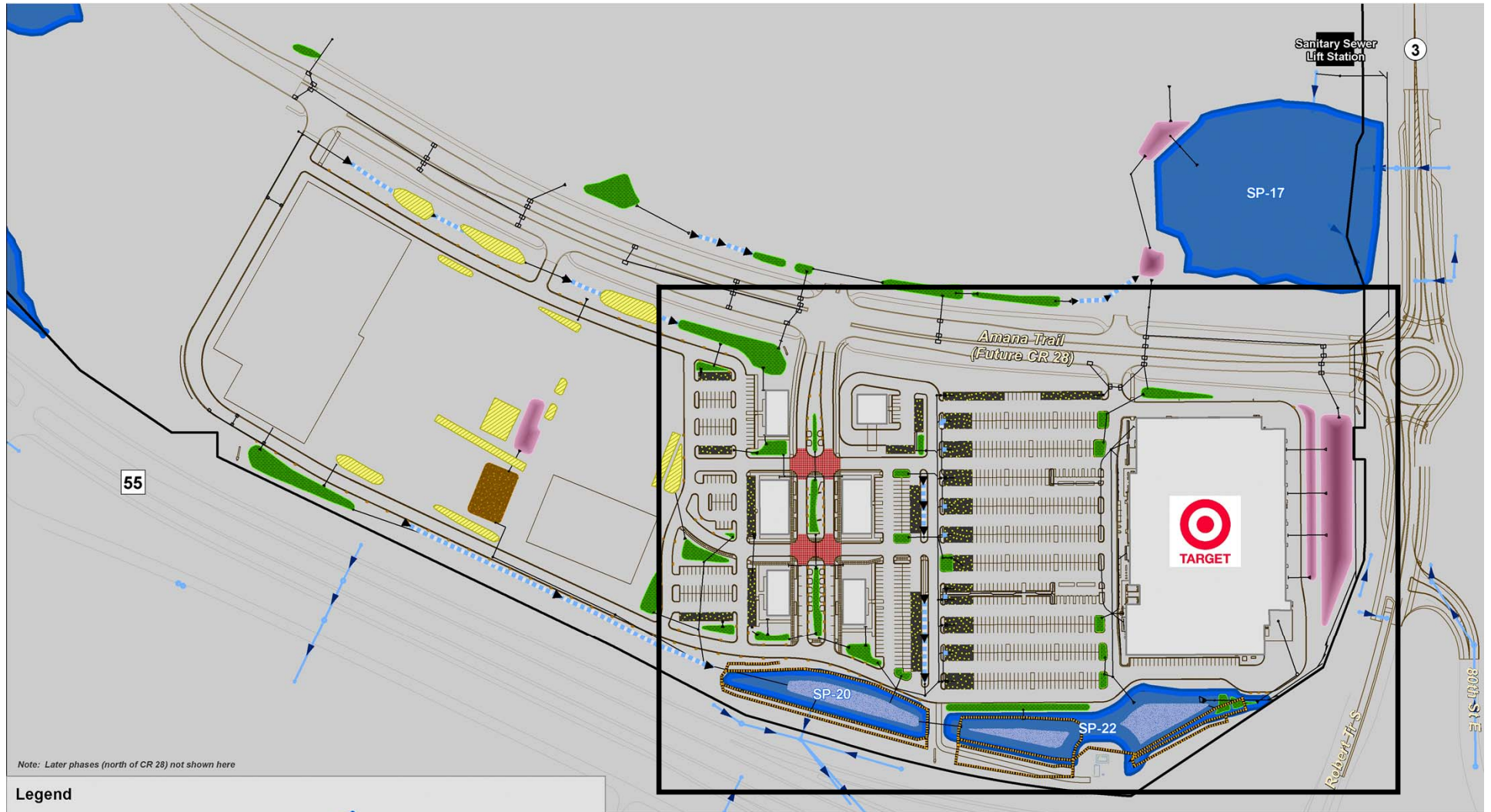


Argenta Hills



Illustration courtesy of McGough Development, LLC.

Construction – Argenta Hills Site



Legend

Phase I

- | | |
|--|------------------------------|
| Raingarden (~35 Units) | Regional Basin |
| Porous Asphalt (~25 Units) | Phase II Stormwater Features |
| Infiltration Basin / Garden (~5 Units) | Swale |
| Porous Pavers (2 Units) | Storm Sewer |
| Sediment Basin (1 Unit) | Off Site Drainage |
| | Infiltration Tile System |

Argenta Hills Development, Phase I
Inver Grove Heights, MN
 - Schematic Stormwater Plan -



0 100 200 400 Feet

11/13/20

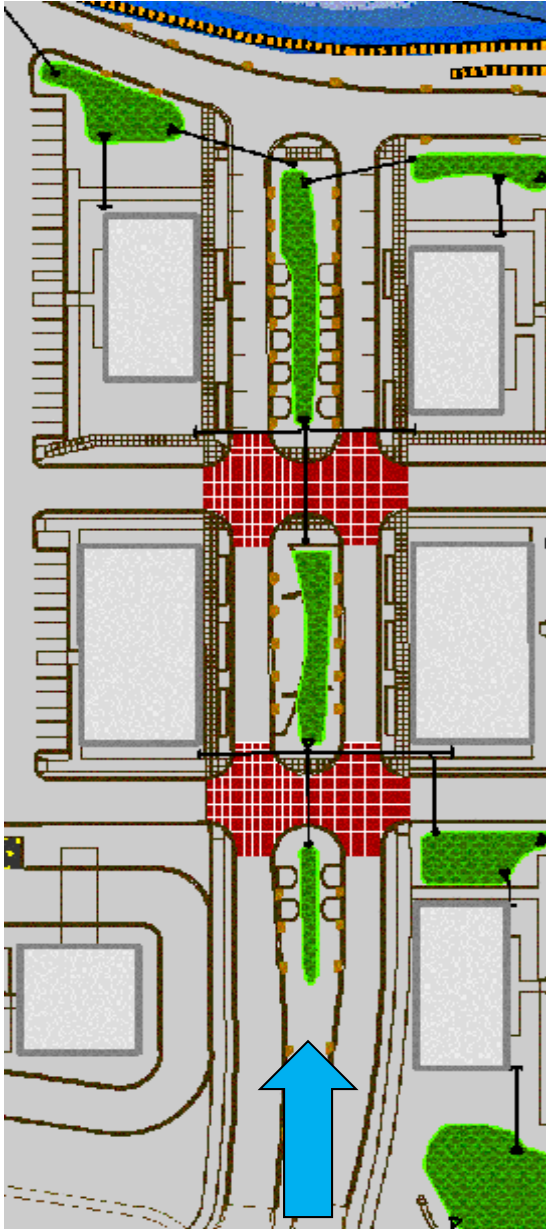
Infiltration Feature Construction



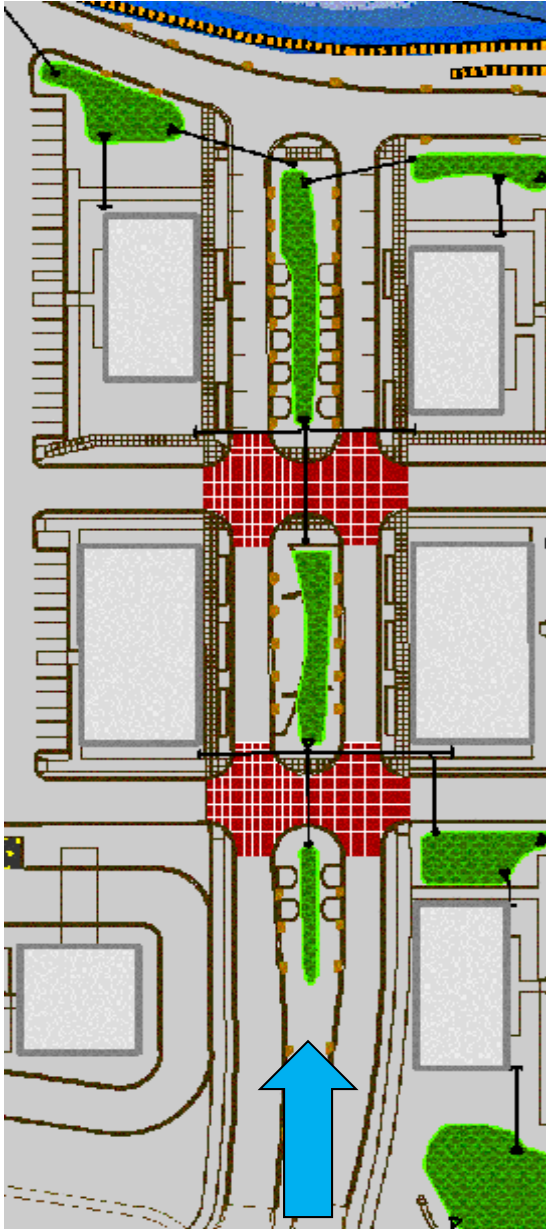
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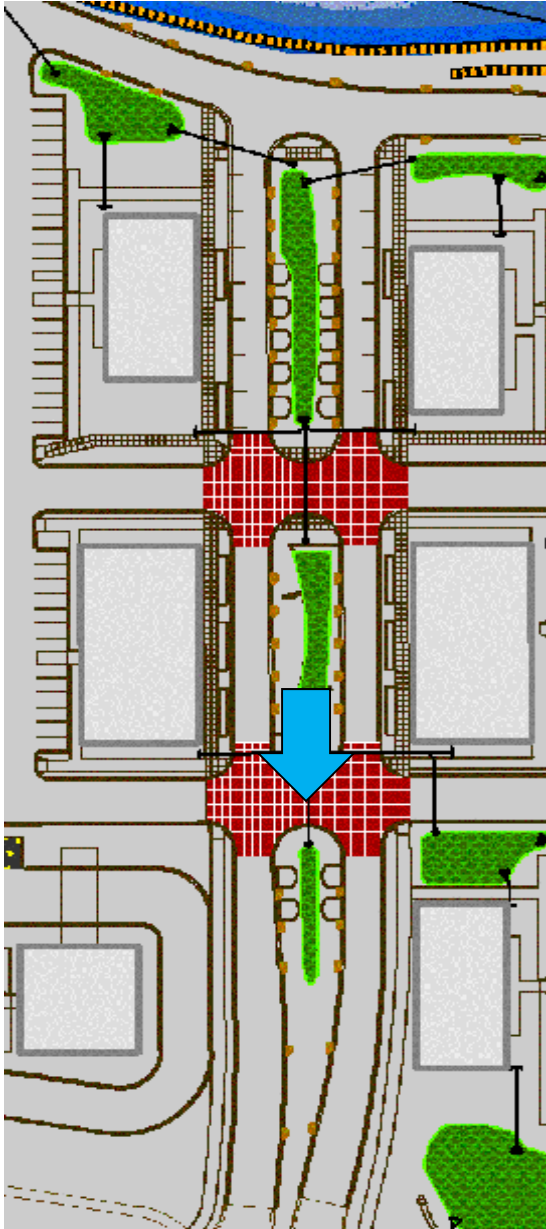
Site Map – Main Street



Site Map – Main Street



Site Map – Main Street



Main Street Raingarden



Main Street Raingarden



Main St. - Porous Paver Section



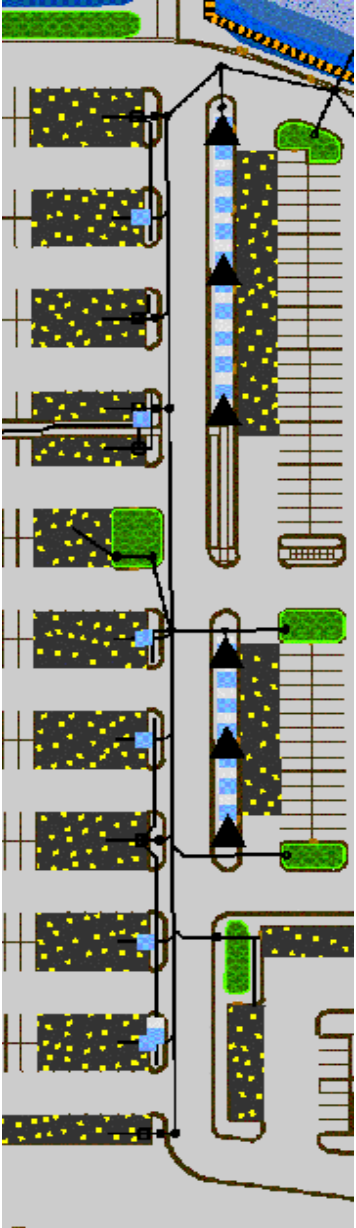
Main St. - Porous Paver Section



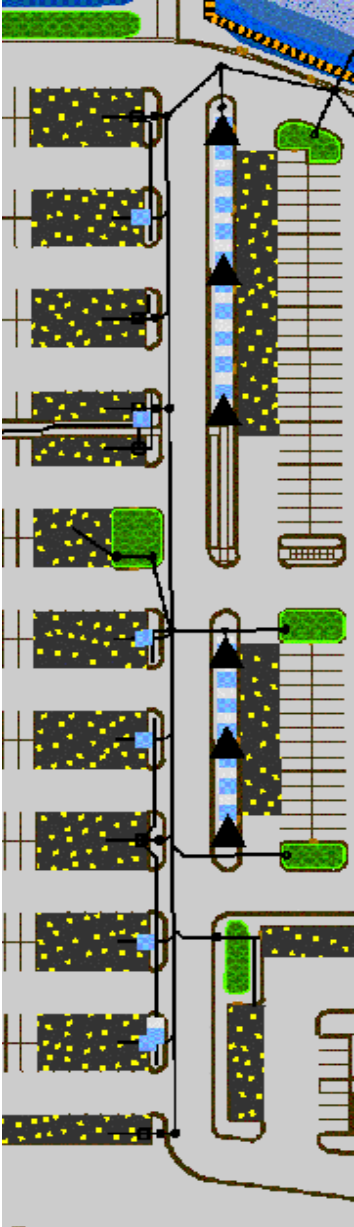
Site Map – Target



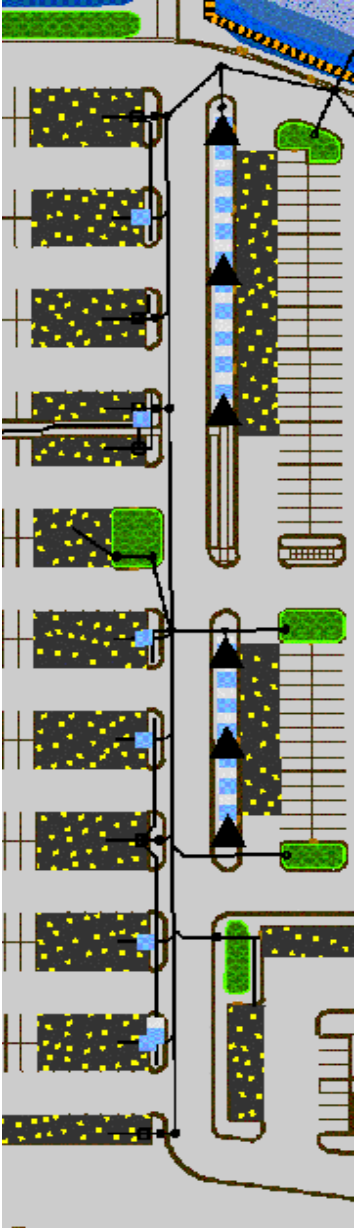
Target Porous Lot



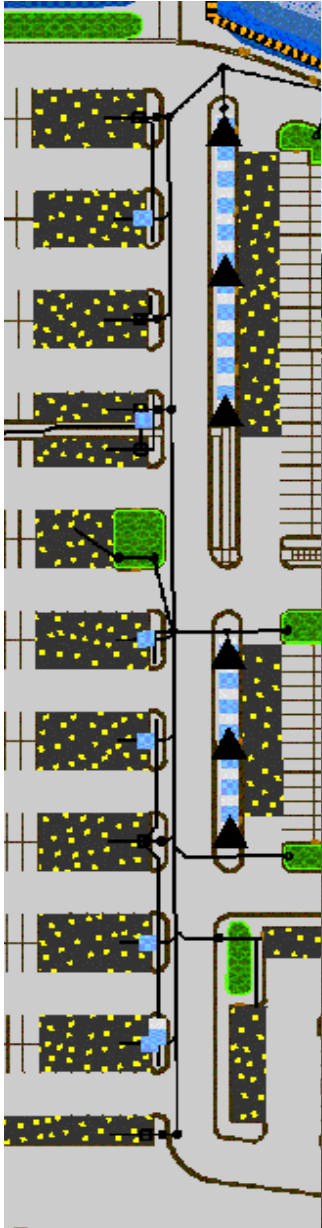
Prior to Paving



Prior to Paving



Prior to Paving



Choker Rock



Porous Paving



Porous Pavement



Curb Cut Design



Zero Runoff: Is it a Realistic Goal in Urban Areas?



Answer: *YES...*

*By Mimicking the Natural
Hydrology*



Acknowledgements



City of Inver Grove Heights, MN

- Council
- Staff – Planning, Engineering

NWA Land Use Plan & Zoning

- Hoisington-Koegler Group Inc.

Argenta Hills Project Owners

- McGough
- Enebak Construction
- Herb Pilhofer, Landowner



Questions?



“Lessons Learned”

- **Sketch Plan is Key**
- **Flexibility with Regional Basins & Open Space (cluster, width, connectedness)**
- **Internalized Costs- Extra Design/Construction Costs**
- **Designers’ Lack of Familiarity**
- **Soils Data – Construction Phase**

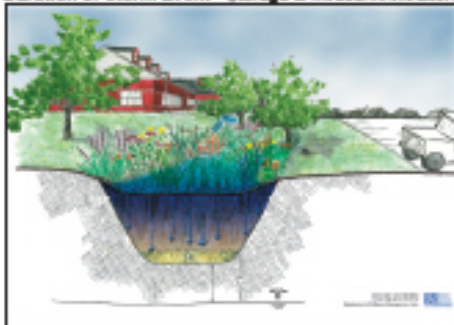
Stormwater Manual

STORM SEQUENCE

Start of Storm Event - Initial runoff & storage



Duration of Storm Event - Storage & filtration/infiltration



Following Storm Event - Remaining storage draw-down



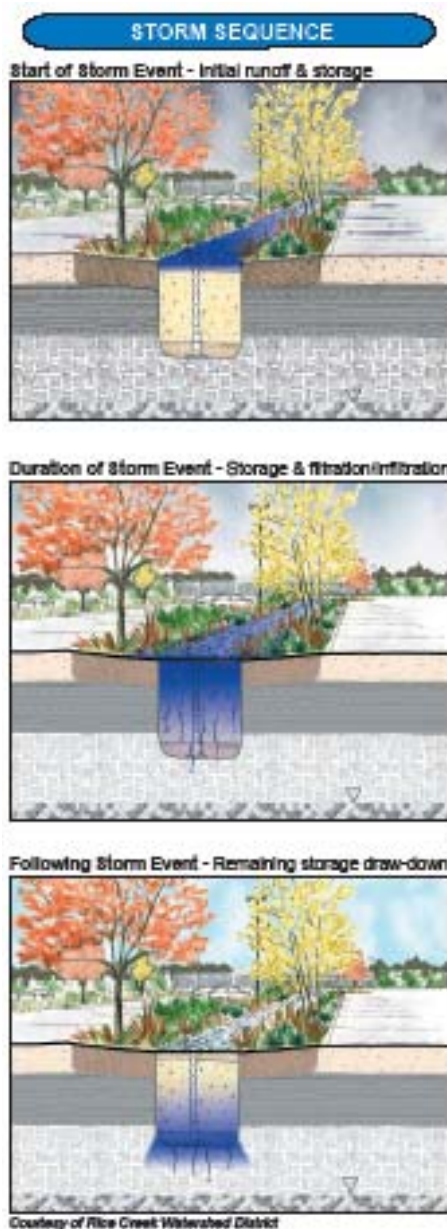
Graphics Courtesy of Rice Creek Watershed District



Bioretention

- Rain Gardens
- Depressed Islands
- Depressed Cul-de-sacs

Stormwater Manual



Infiltration

- Trenches
- Basins
- Dry Wells
- Subsurface Facilities

Stormwater Manual

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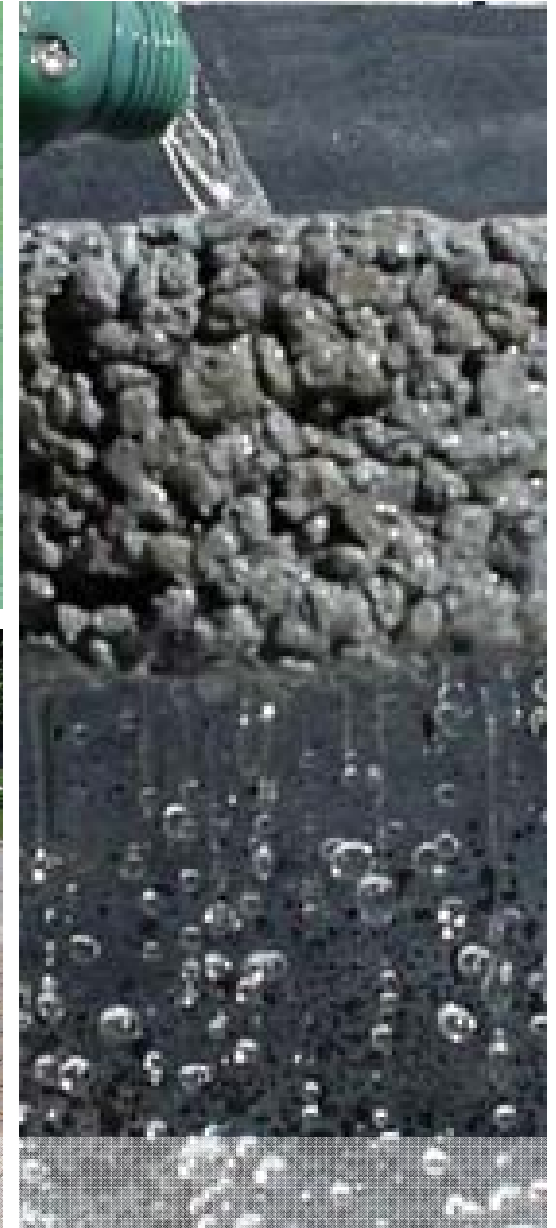
Following Storm Event - Remaining storage draw-down



Courtesy of Rice Creek Watershed District



Pervious Pavements



Soil Amendments



Stormwater Manual

Green Roofs

