FORGING THE LINK

Linking the Economic Benefits
of Low Impact Development
and Community Decisions

Economics and LID Practices

FTL Guiding Principles

- **The purpose of FTL is to provide information on the economics of LID**
- **The environmental and water quality benefits of LID are well established,**
- **However considerable economic, infrastructure, and adaptation planning benefits are also being realized through the incorporation of LID-based strategies.**

In the vast majority of cases, the EPA has found that implementing well-chosen LID practices saves money for developers, property owners, and communities while also protecting and restoring water quality.

- **Green infrastructure elements may add expense to a project, however cost savings are often realized on an overall project basis as the need for conventional stormwater infrastructure such as curbing, catch-basins, piping, ponds, and other controls are reduced.**
- **Of course, cost savings are not observed when compared with no stormwater management.**
- **With new state and federal permitting requirements addressing volume and pollutant reduction, new construction and redevelopment projects requiring no stormwater controls are increasingly rare.**

Residential— Boulder Hills

Commercial---Greenland Meadows

LID Retrofit--- UNH Parking Lot

COMMERICIAL AND RESIDENTIAL ECONOMIC CASE STUDIES FOR LID PRACTICES

Boulder Hills, Pelham, NH

- **2009 Installation of 900’ of first PA private residential road in Northeast**
- **Site will be nearly Zero discharge**
- **LID subdivision 55+ Active Adult Community**
- **Large sand deposit**
- **Cost 25% greater per ton installed**


POROUS PAVEMENT
DWELLING CLUSTERS
DRAINAGE INFRASTRUCTURE
Winterberry Road
CATCH BASINS


STORMWATER POND
STORMWATER POND
CONVENTIONAL PAVEMENT
DWELLING CLUSTERS
DRAINAGE INFRASTRUCTURE
BITUMINOUS CURBING
Winterberry Road
CATCH BASINS

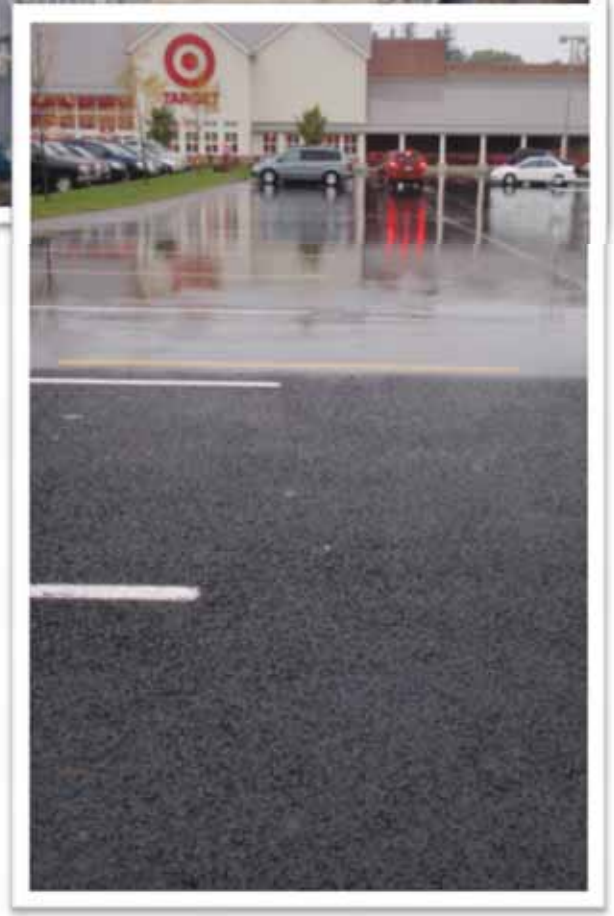
- **Built on 9% grade**
- **Avoided use of 1616’ of curbing, 785’ pipe, 8 catch-basins, 2 detention basins, 2 outlet control structures**
- **1.3 acres less of land clearing**
- **Conventional SWM=$789,500 vs LID SWM=$740,300, $49,000 savings (6.2%)**

Comparison of Unit Costs

Item	Conventional	LID	Difference
SITE PREPARATION	$23,200.00	$18,000.00	–$5,200.00
TEMP. EROSION CONTROL	$5,800.00	$3,800.00	–$2,000.00
DRAINAGE	$92,400.00	$20,100.00	–$72,300.00
ROADWAY	$82,000.00	$128,000.00	$46,000.00
DRIVEWAYS	$19,700.00	$30,100.00	$10,400.00
CURBING	$6,500.00	$0.00	–$6,500.00
PERM. EROSION CONTROL	$70,000.00	$50,600.00	–$19,400.00
ADDITIONAL ITEMS	$489,700.00	$489,700.00	$0.00
BUILDINGS	$3,600,000.00	$3,600,000.00	$0.00
PROJECT TOTAL	$4,389,300.00	$4,340,300.00	–$49,000.00

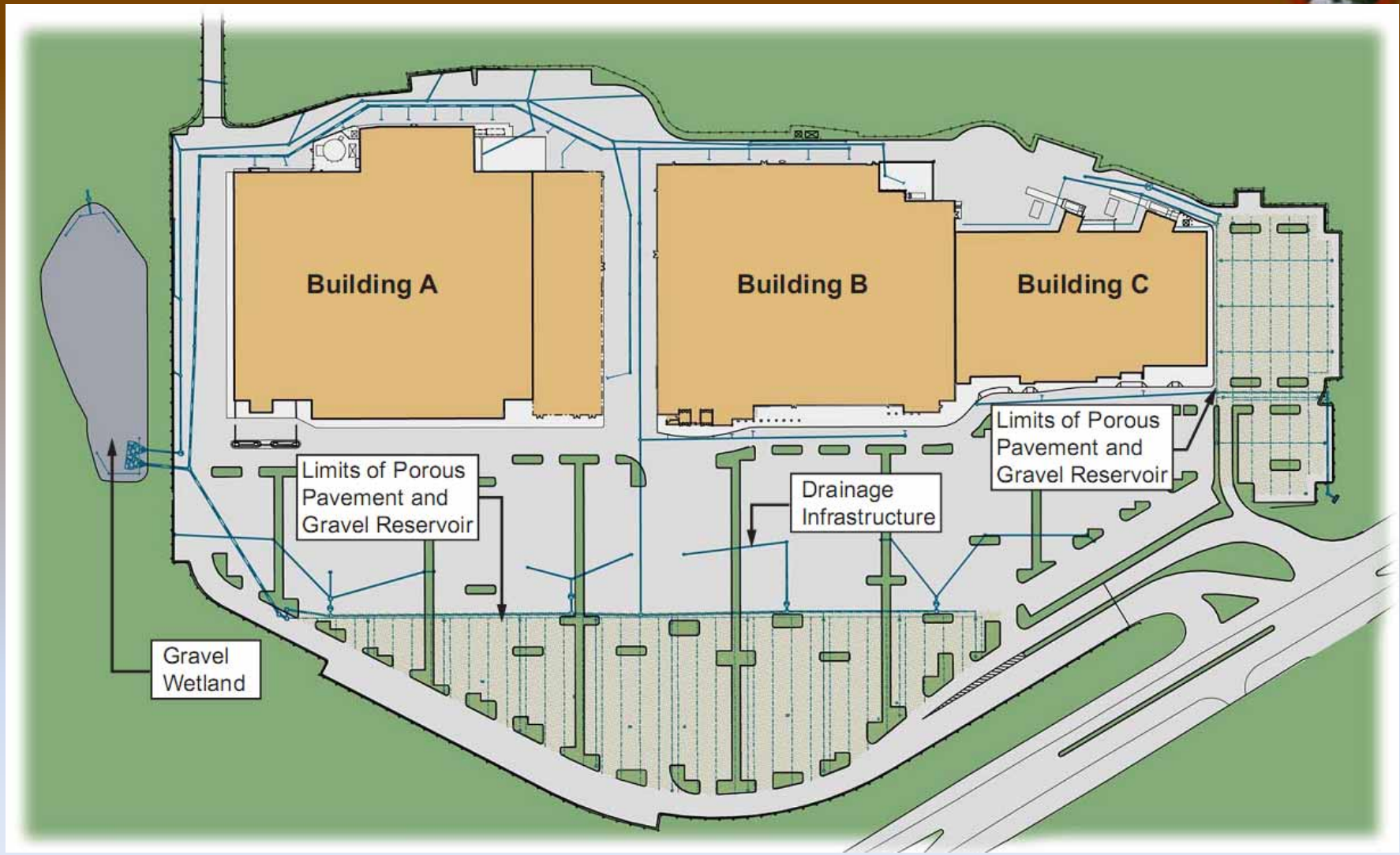
6% savings on total cost of SW infrastructure for a ~zero discharge site

Greenland Meadows Commercial, Greenland, NH



- "Gold-Star" Commercial Development
- Cost of doing business near Impaired Waters/303D
- Saved $900k in SWM on costly piping and advanced SWM proprietary
- Brownfields site, ideal location, 15yrs
- Proposed site >10,000 Average Daily Traffic count on >30 acres

Greenland Meadows



Comparison of Unit Costs

Item	Conventional Option	LID Option	Cost Difference
MOBILIZATION / DEMOLITION	$555,500	$555,500	$0
SITE PREPARATION	$167,000	$167,000	$0
SEDIMENT / EROSION CONTROL	$378,000	$378,000	$0
EARTHWORK	$2,174,500	$2,103,500	–$71,000
PAVING	$1,843,500	$2,727,500	$884,000
STORMWATER MANAGEMENT	$2,751,800	$1,008,800	–$1,743,000
ADDITIONAL WORK-RELATED ACTIVITY (utilities, lighting, water & sanitary sewer service, fencing, landscaping, etc.)	$2,720,000	$2,720,000	$0
PROJECT TOTAL	$10,590,300	$9,660,300	–$930,000

LID Retrofit: UNH Parking Lot Bioretention

- **Simple, used existing infrastructure and median**
- **$14,000/acre retrofit for everything**
- **Labor and install was $8500/ac**
- **Materials and plantings $5500/ac**
- **Model partnership**

Narragansett Bay Commission, Rhode Island

Portland, Oregon

Kansas City, Missouri

Chicago, Illinois

LID PRACTICES FOR CSO MANAGEMENT

Narragansett Bay Commission: a Baseline Gray infrastructure approach to CSO management

- NBC RI has completed construction of six miles of underground storage tunnels at a projected cost of $467 million (1992 dollars).
- Tunnels store the sewage overflows during intense rain events for later treatment
- Tremendous long-term costs for store, pump, treat
- Does not address increased storm size

Portland, Oregon

For the City of Portland, utilizing green streets is the preferred strategy for helping relieve sewer overflow conditions because it is the most cost-effective and eliminates the need for expensive below-ground repairs, which often involve replacing infrastructure.

A National Leader

GOALS OF WWF Control Program

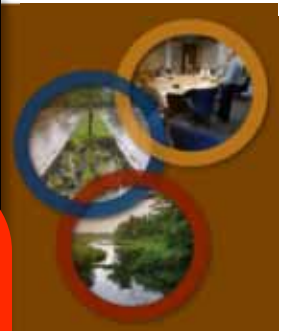
- **Capturing and detaining stormwater runoff as close to the source as possible;**
- **Reducing the volume of stormwater entering the combined sewer system;**
- **Filtering stormwater to remove pollutants before the runoff enters groundwater, streams, or wetlands;**
- **Using and promoting methods that provide multiple environmental benefits; and**
- **Using techniques that are less costly than traditional piped solutions.**

Tabor to the River: Brooklyn Creek Project

- **Program sought to rectify CSO, street and basement flooding**
- **The original cost estimate using gray infrastructure was $144 million (2009 dollars).**
- **Gray-Green design including a total of $11 million allocated for green solutions, the cost estimate for this integrated approach was $81 million, a savings of $63 million for the city**

TABLE 3-7 CSO Control Alternatives Costing for Portland, Oregon.

Project/Program	Effective Imp. Acres Controlled	Est. 3-year Volume Removed (MG)	Capital Cost	Marginal Cost ($/ Gallon)	Cumulative Volume Removed (MG)	Cumulative Capital Cost
Extended Downspout Disconnection Program (can include LID)	284	7.45	$6,633,000	$0.89	7.45	$6,633,000
School Disconnection*	68	1.77	$1,954,000	$1.10	9.22	$8,587,000
Church Disconnection*	32	0.96	$2,031,000	$2.12	10.18	$10,618,000
Beech-Essex Sewer Separation	37	1.40	$3,889,000	$2.78	11.58	$14,507,000
ES Curb Extensions (LID)	349	4.29	$12,323,000	$2.87	15.87	$26,830,000
Tanner Phase 3 Sewer Separation	85	3.10	$10,767,616	$3.47	18.97	$37,598,000
ES Roof & Parking IC (LID)	475	17.64	$72,047,000	$4.08	36.61	$109,645,000
NWN Pre-design – Tanner North Sewer Separation	14	0.22	$1,127,000	$5.12	36.83	$110,772,000
Carolina Stream & Storm Separation	93	1.02	$5,319,000	$5.21	37.85	$116,091,000
NWN Pre-design – Tanner South Sewer Separation	13	0.26	$1,602,000	$6.16	38.11	$117,693,000
NWN Pre-design – Tanner Central Sewer Separation	2	0.04	$269,000	$7.60	38.14	$117,962,000
NWN Pre-design – Nicolai/ Outfall Sewer Separation	34	0.54	$6,321,000	$11.76	38.68	$124,283,000
NWN Pre-design – Nicolai/ Outfall 13 Sewer Separation	52	0.68	$8,217,000	$12.04	39.36	$132,500,000
Green Roof Legacy Project (LID)	20	1.04	$14,179,000	$13.65	40.40	$146,679,000
NWN Pre-design – Nicolai/ Outfall 15 Sewer Separation	24	0.36	$6,546,000	$17.98	40.77	$153,225,000
Holladay Sewer Separation	125	0.69	$14,360,000	$20.94	41.45	$167,585,000
NWN Pre-design – Balch Neighborhood Sewer Separation	8	0.14	$7,664,000	$55.06	41.59	$175,249,000
NWN Pre-design – Balch/ Forest Park Storm Separation	5	0.13	$12,026,000	$93.82	41.72	$187,275,000



LID Avoidance Costs

- **Annual O&M costs avoidance to pump and convey stormwater through the existing combined sewer system. The city measures this by applying a rate of $0.0001 per gallon treated and $0.0001 per gallon pumped. This equates to an annual O&M avoidance cost of $0.0002 per gallon.**
- **The cost-effectiveness point for projects/programs that remove stormwater volume from the CSO system ($4 per gallon) is also considered as the avoidance cost of constructing a larger CSO tunnel.**

Kansas City, Missouri: Gray & Green Infrastructure

- National Demonstration Project EPA
- KC needs to meet EPA CSO requirements.
- Grey infrastructure (separate, store, and treat) cost ~$6 billion.
- Using 100 acre subwatershed as test site.
- $54 million grey infrastructure at $18/gal
- $35 million of green and gray combination.
- Will reduce overflows to 6X per year and eliminate need for storage
- Will provide distributed storage of 3.5 million gallons

Green solutions considered included:

- catch basin retrofits,
- curb extension swales
- pervious pavement
- street trees,
- green roofs
- stormwater planters.

The city estimated that it should be possible to completely replace two CSO storage tanks with distributed green solutions without increasing costs or reducing CSO control performance.

Unit Costs for GI

GREEN SOLUTION	UNIT COST ($/GAL)
Catch Basin Retrofits in Road and Street ROW	$2.28-$7.13 (avg $5.00)
Porous Pavement	$4.62
Street Trees (Residential)	$10.80
Street Trees (Commercial)	$23.36
Curb Extension Swales	$10.86
Replacement of Sidewalks in ROW with porous pavement	$11.62
Conversion of Roof Areas to Green Roofs	$22.68
Stormwater Planters	$26.83

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Questions?