



Border Green Infrastructure Forum
University of Arizona, Tucson, AZ
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ECONOMIC STUDIES OF GREEN INFRASTRUCTURE IN TUCSON

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Epiphany – AH HA Moment of Green Infrastructure

2014 BECC/COCEF Forum



Janet Clements
Managing Economist
Stratus Consulting

Triple Bottom Line
Analysis of Philadelphia
CSO Program

2013 ISC Leadership Academy

Adaptive Water Resource Management &
Infrastructure, Philadelphia, PA 2013



Mead Mier
PAG



Sam Credio
COT DOT



Jean McClain
UA WRRC



Evan Canfield
PC RFCD



Irene Ogata
COT OIP





Analyzing Economic Benefits of Green Infrastructure

Managing stormwater infrastructure : At What



Gray Infrastructure:

Escalating needs

- Deferred Maintenance
- Growing communities
- Climate Change





Analyzing Economic Benefits of Green Infrastructure

What We Want to Know





Analyzing Economic Benefits of Green Infrastructure

A Cost-Benefit Analysis





Analyzing Economic Benefits of Green Infrastructure



Does GI Pay For Itself? A Bit Complicated

Function: why do an analysis

- Evaluate alternatives
- Does cost exceed benefits
(Private : Expense + Revenue)
- ☑ *Demonstrate range of benefit*
(Public : Triple Bottom Line | more than cash flow)

Type: methodology

- Consultant
- Stormwater software

Metrics: Universal standards/site specific

- Expense / benefit seeking
- Net present value (NPV) of program
- Net present value to owners
- Net present value to stakeholders / public
- avoided costs
- monetized social & environmental benefits
- life-cycle costs





Analyzing Economic Benefits of Green Infrastructure



Green Infrastructure Benefit

Social

- Reduced flooding
- Greenways
- Human health

Environmental

- Water quality
- Air quality
- Urban heat stress reduction

Economic

- Increase property value
- Green jobs





Economic Benefits of GI : in City of Tucson

The Business Case Evaluations for Tucson Projects

Function: Demonstrate range of net benefits

Method: AutoCASE™ | Business Case Evaluator

Metrics: Monetizing values, life-cycle calibrated to local weather, regional economy, demographics

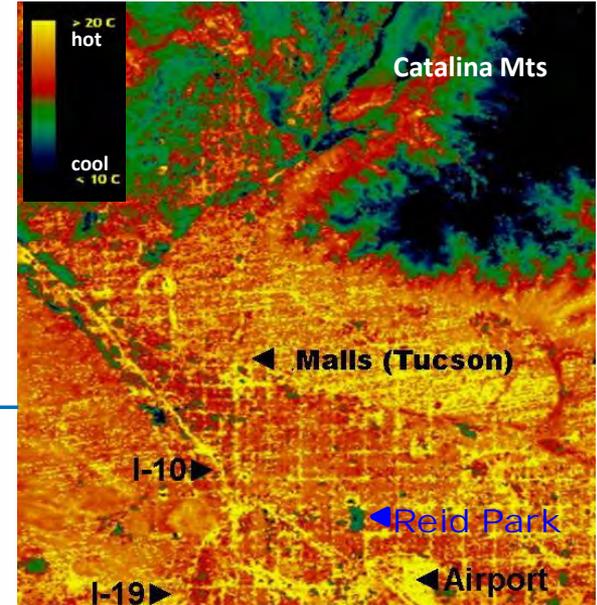
Tucson Projects

Elements: Low Impact/Green Infrastructure Manual

Road: Silverbell Road

Road: Scott Avenue

Garden: Blue Moon



Tucson Basin | 2005 | Kinetic Surface Temperature



Economic Benefits of GI : in City of Tucson

① LID/GI Guidance Manual

- Water Harvesting Basins / Infiltration Basin
- Bio Retention Basins
- Xeriscape
- Swale/Pervious Pavers / Porous Pavement
- Cistern
- Bioretention
- Curb Extensions

Function: Evaluate for Triple Bottom Line

Method: AutoCASE™

Low Impact Development and Green Infrastructure Guidance Manual

Sept 2013 (Draft)





Economic Benefits of GI : in City of Tucson

① LID/GI Guidance Manual

	<u>Water Harvesting Basin</u>								
		CapEx Cost	O&M	Flood Risk	Property Value	Heat Mortality	CO2 Emissions	F-NPV	S-NPV
Percentile	10%	\$ 13,012	-\$ 9	\$ 137	\$ 16	\$ 380	\$ 1,308	\$ 13,007	\$ 15,091
	50%	\$ 13,198	-\$ 7	\$ 350	\$ 53	\$ 503	\$ 1,345	\$ 13,192	\$ 15,479
	90%	\$ 13,368	-\$ 5	\$ 1,132	\$ 90	\$ 652	\$ 1,379	\$ 13,361	\$ 16,268

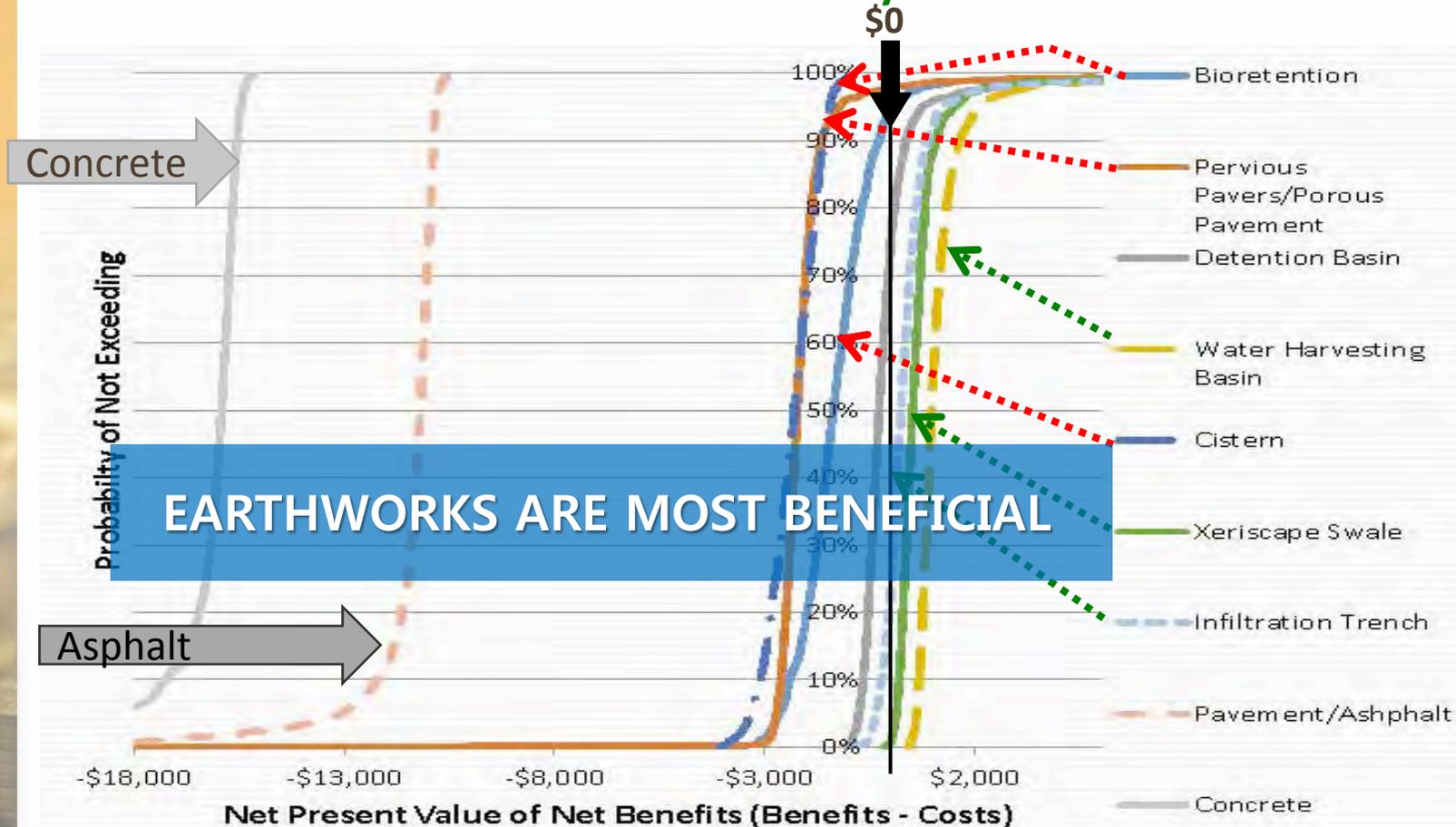
**Per thousand square feet, relative to grey option (concrete)*

- Use of universal values
- Monetized social and environmental values (some localized values included)





Economic Benefits of GI : in City of Tucson

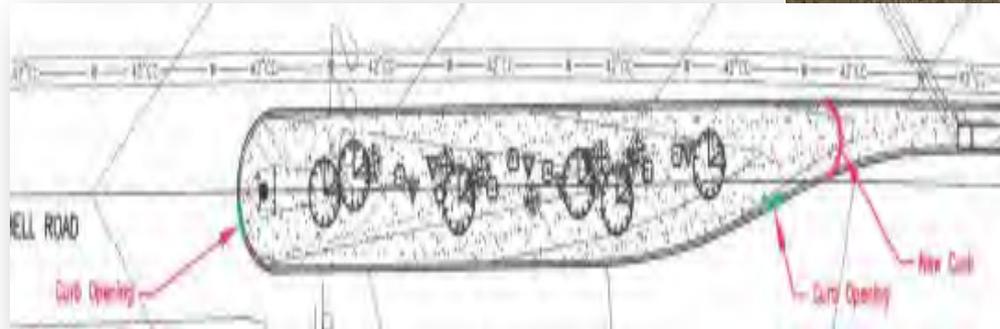




Economic Benefits of GI : in City of Tucson

② Silverbell Re-Design

- Bioretention
- Water harvesting basins
- Trees
- Traffic calming



Function: Evaluate Triple Bottom Line

Method: AutoCASE™





Economic Benefits of GI : in City of Tucson

② Silverbell SROI

Traffic calming:

- Avoidance of loss of life

Cost of Water:

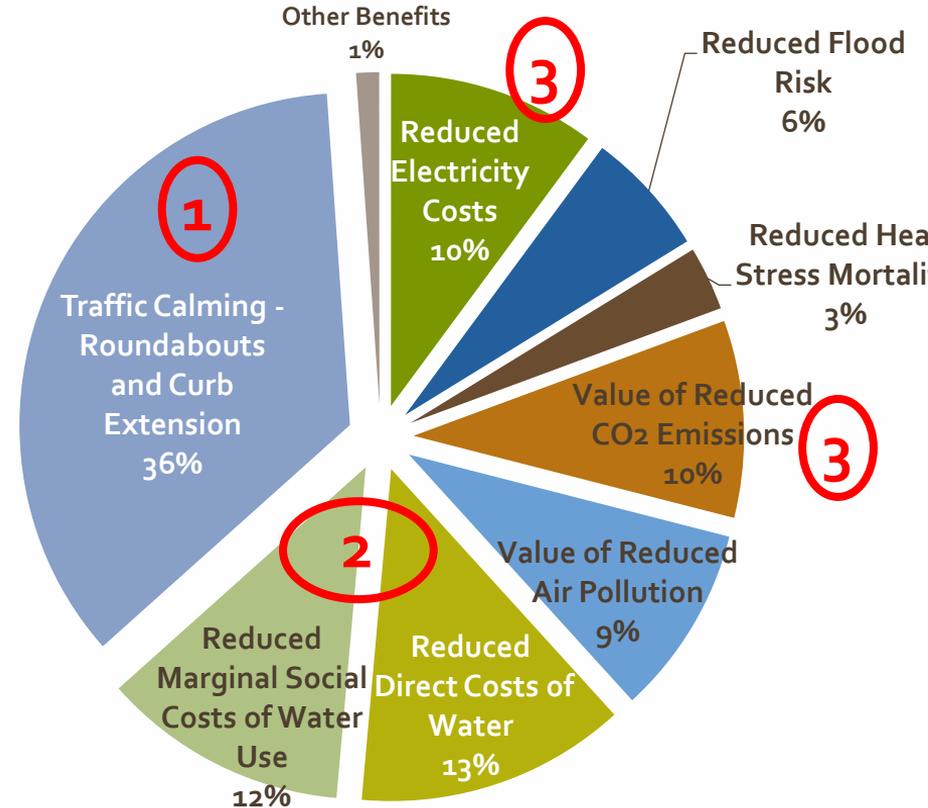
- Social +
- Direct

Energy savings:

- Reduced Electricity

Air Quality + Climate Change:

- Reduced CO₂





Economic Benefits of GI : in City of Tucson

② Silverbell Stakeholders' Benefit

Community:

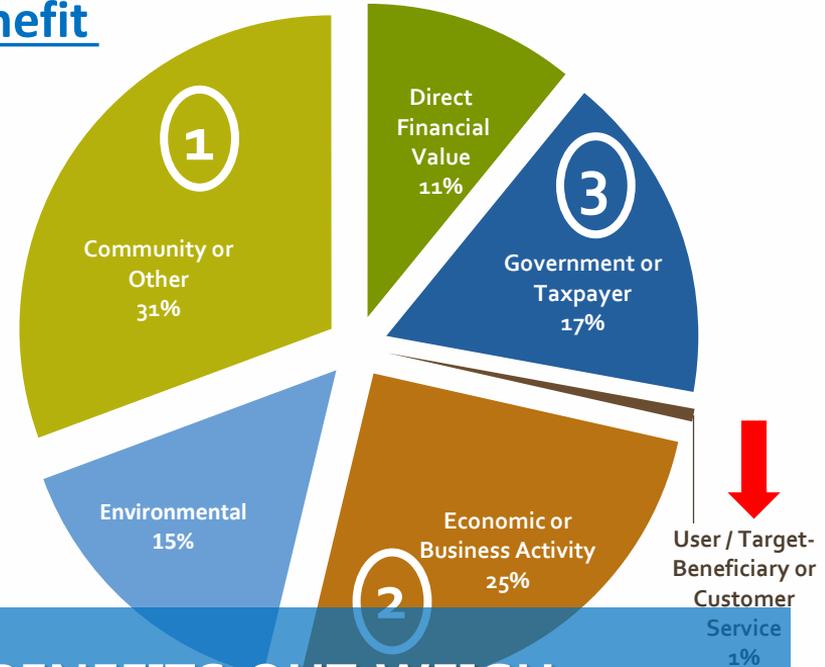
- Reduced traffic mortality
- Social cost of water; security

Economic

- Reduced accidents
- Reduced social cost of water

Government/Taxpayer

- Decreased traffic accidents
- Decreased flooding risk;
- Reduced carbon + air pollution



**THE COMMUNITY BENEFITS OUT WEIGH
INDIVIDUAL DRIVER**



Economic Benefits of GI : in City of Tucson

③ Scott Avenue Re-Design

- Bioretention
- Water harvesting basins
- Trees
- [*Traffic calming : road diet*]



Function: Demonstrate range of net benefits = Triple Bottom Line

Method: Business Case Evaluator





Economic Benefits of GI : in City of Tucson

③ Scott Avenue Re-Design

Social

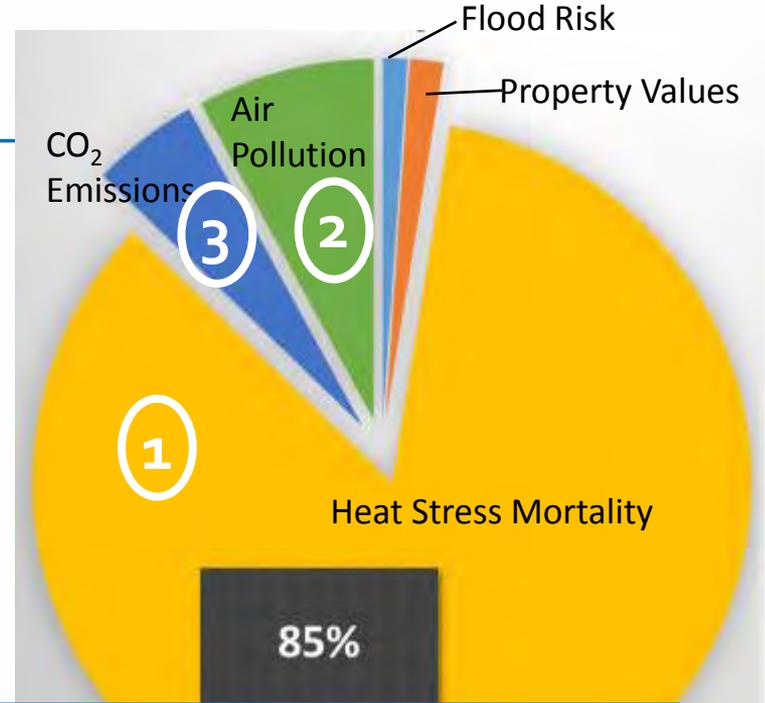
- Heat Stress Mortality ✓

Environmental

- Air Pollution ✓
- CO₂ Emissions ✓
- Flood risk

Economic

- Property ✓



TREES ADDED TO GREEN INFRASTRUCTURE HAS COMMUNITY BENEFIT





Economic Benefits of GI : in City of Tucson

④ Blue Moon Community Gardens

- Cistern
- Water harvesting basins



Function: Demonstrate range of net benefits

Method: Business Case Evaluator





Economic Benefits of GI : in City of Tucson

④ Blue Moon Community Gardens

- Residents of Tucson House
- Actively involved in design

Before : 2011



After : 2012





Economic Benefits of GI : in City of Tucson

④ Blue Moon Community Gardens

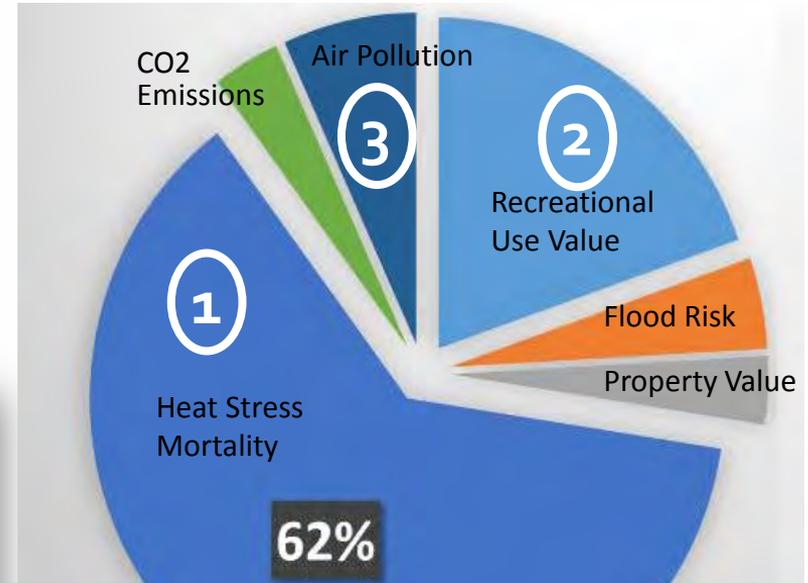
Social

- Heat Stress Mortality
- Recreation

Environment

- Air Pollution

Economic



**GI ECONOMIC ANALYSIS REQUIRES RE-EVALUATION
BASED ON UNIQUE SITUATIONS**

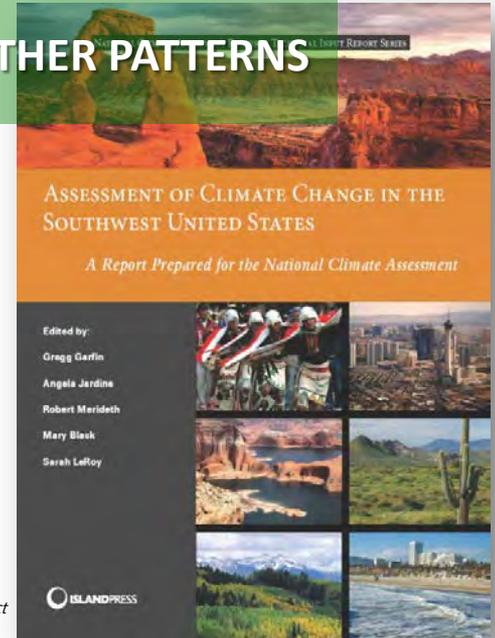
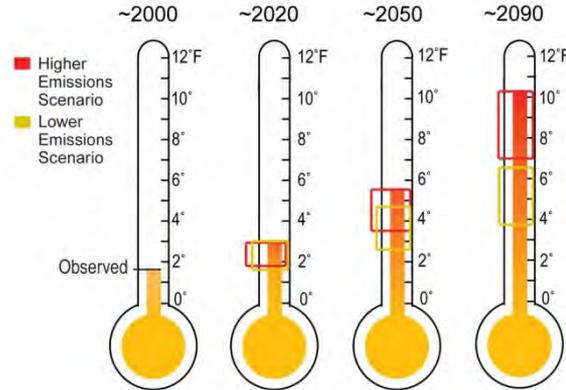




Economic Benefits of Green Infrastructure

A Few Considerations

CLIMATE CHANGE HAS ALTERED WEATHER PATTERNS



Garfin, G., G.Franco, H. Blanco, A.Comrie, P.Gonzalez, T.Piechota, R.Smyth, and R.Waskom, 2014: Ch. 20: Southwest. *Climate Change Impacts in the United States: The Third National Climate Assessment*, J.M.Melillo, Terese (T.C.) Richmond, and G.W.Yohe, Eds, U.S. Global Change Research Programs .



Economic Benefits of Green Infrastructure

A Few Considerations

CLIMATE CHANGE HAS ALTERED WEATHER PATTERNS

STORMWATER INFRASTRUCTURE STANDARDS CHANGING

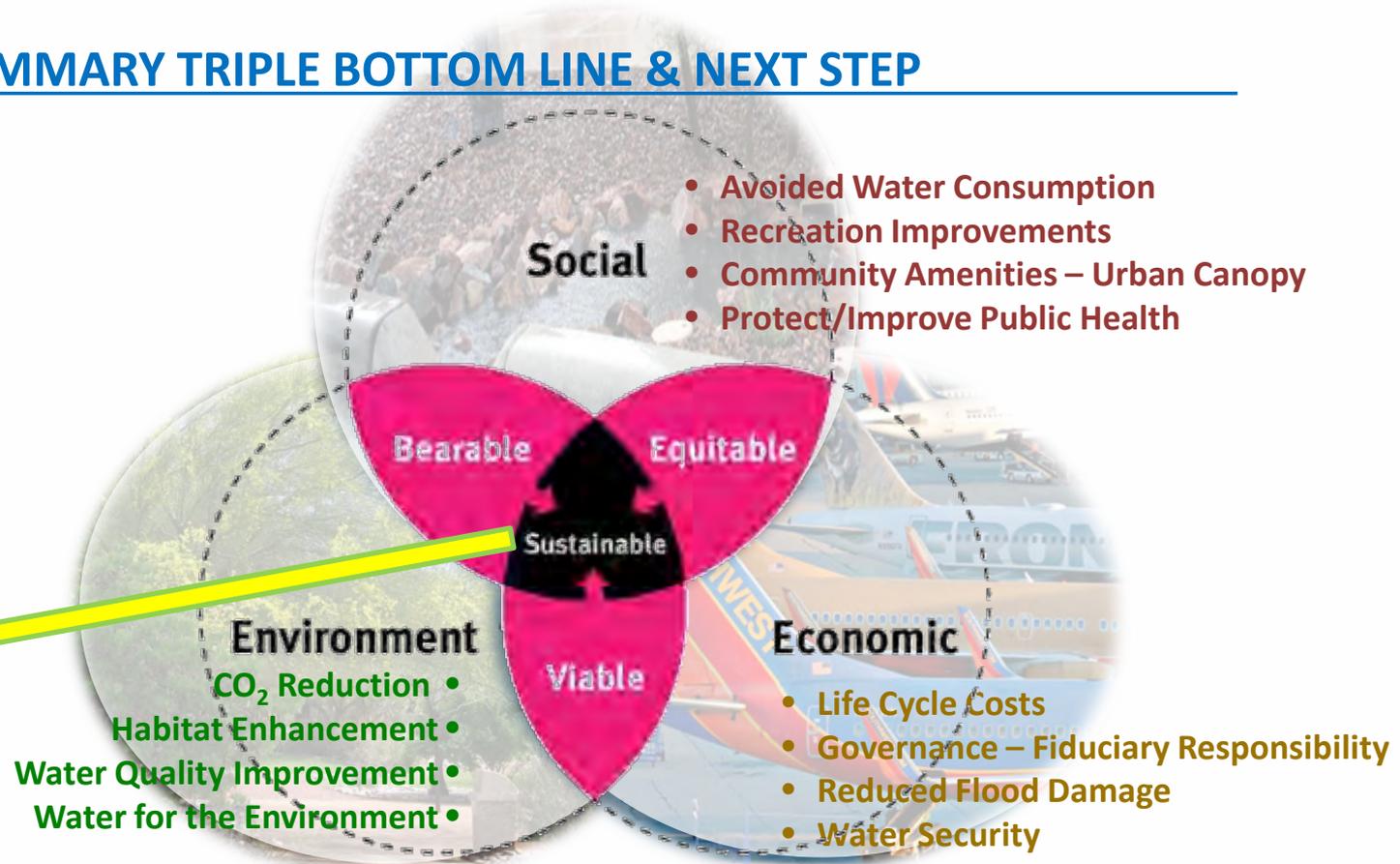
ECONOMIC ANALYSIS PART OF INFORMED
DECISION-MAKING PROCESS





Economic Benefits of Green Infrastructure

SUMMARY TRIPLE BOTTOM LINE & NEXT STEP





Economic Benefits of Green Infrastructure

NEXT STEP



Downtown Links



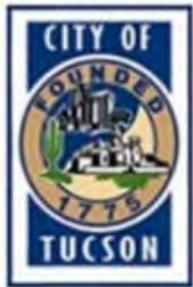
Houghton Road

FUNCTION : EVALUATE ALTERNATIVES





Acknowledgements



- Office of Integrated Planning
- Tucson Water
- DOT





Resources



Pima County LID Working Group Website:

<http://webcms.pima.gov/cms/one.aspx?portalId=169&pageId=65263>

AutoCASE™ Beta Testing Project: Evaluation of GI/LID Benefits in the Pima County Environment:

[Same as above](#)

Business Case Evaluator for Stormwater Management Website:

<http://impactinfrastructurellc.com/blog/?p=233>

Contact: irene.ogata@tucsonaz.gov

