II Foro Fronterizo de Infraestructura Verde

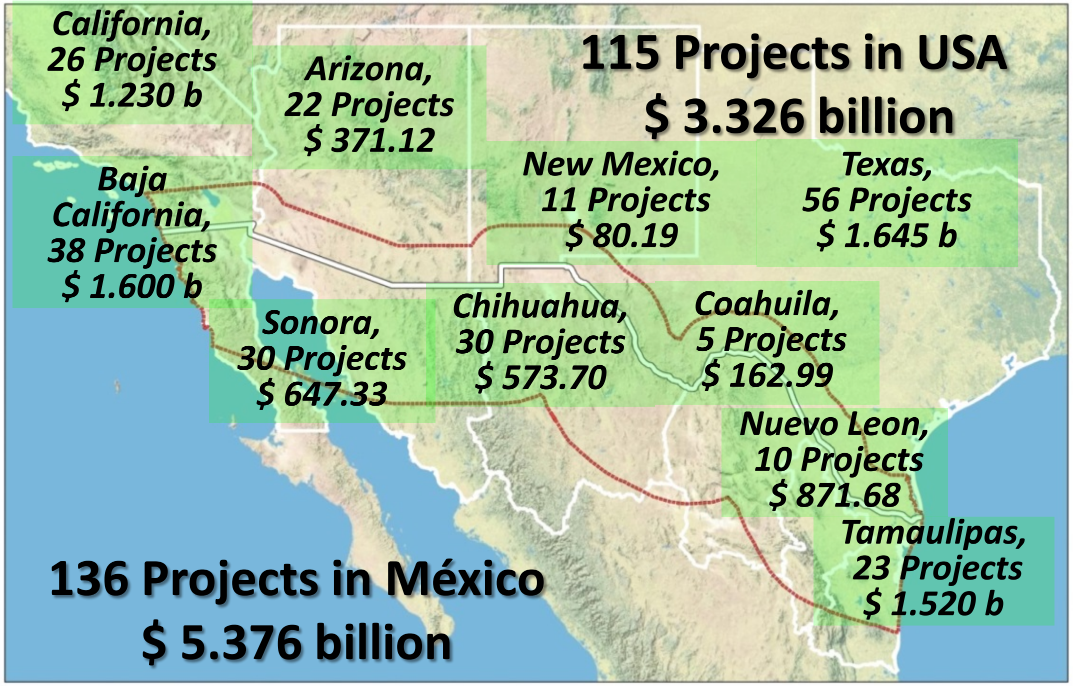
Resiliencia y competitividad para ciudades de la frontera México-Estados Unidos

SEMARNAT
SECRETARÍA DE MEDIO AMBIENTE Y RECURSOS NATURALES

Comisión de Cooperación Ecológica Fronteriza

Border Environment Cooperation Commission

Certified Projects and Technical Assistance



Certified projects	**251**
Total investment (billion dollars)	**$8.702**
NADB financing* (billion dollars)	**$2.249**
Benefited population (million)	**17.5**
Projects financed by NADB*	**197**

*Only active contracts, including grants

BECC Technical Assistance

(million dollars)

- **72** Communities in Mexico **$16.50**
- **93** Communities in USA **$29.62**
- PDAP/BECC Tech. Assistance from 1995 to 2015= **$46.12**
- Approx. **85%** of these funding have resulted in implemented or in-progress projects.

Border 2012 and 2020 Programs

(million dollars)

- 2005-2015: **$10.80**

NADB Technical Assistance

(million dollars)

- **$21.70** for **222** studies in **102** communities

Beneficios Sociales y Ambientales

141 Proyectos de Agua y Aguas Residuales

Mejor tratamiento y distribución de agua potable y recolección y tratamiento de aguas residuales para el beneficio de más de **12.9 millones de residentes** fronterizos; **20.5 m^3/segundo** de aguas residuales reciben tratamiento.

23 Proyectos de Manejo de Residuos Sólidos

2.9 millones de residentes fronterizos con mejores servicios de recolección y disposición de residuos y menores riesgos a la salud; **1,550 ton/día** se disponen correctamente.

.

12 Proyectos de Calidad del Aire

7.5 millones de residentes con menor exposición al aire contaminado por tráfico vehicular y calles sin pavimentar. Eliminación de **170,000 toneladas anuales de PM_{10}**.

26 Proyectos de Conservación de Agua

Ahorros estimados de **456 millones de m^3/año**, equivalentes a la dotación de **4 millones de personas**.

27 Proyectos de Energía

Eliminación de **2.47 millones de toneladas de CO_2-e por año** por reducción de GEI y sustitución de combustibles fósiles. Generación anual de **4,504 GW-hora** de energía de fuentes renovables con **1,562 MW** instalados.

Resultados

INVERSION

NECESIDAD

21 Plantas potabilizadoras y **41** Sistemas de distribución de agua potable

62 Plantas de tratamiento de aguas residuales y **99** Sistemas de drenaje

16 Rellenos sanitarios construidos o ampliados y **12** Tiraderos clausurados

9.0 millones de metros cuadrados pavimentados

1,562 MW_{AC} de capacidad en energías renovables. Emisiones de CO_2 evitadas, equivalentes al retiro de **517,000** automóviles.

RESULTADOS

Ejemplos

Antes

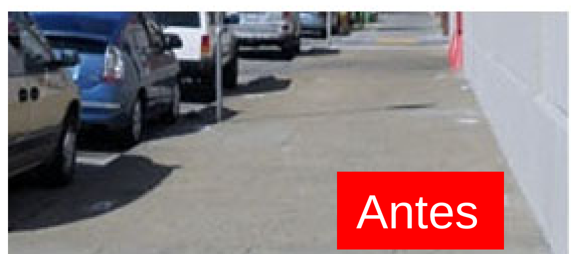
Después

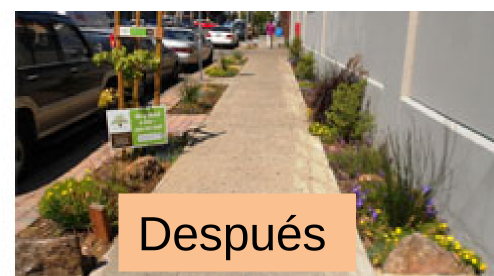
Watershed Management Group

http://www.construccion-y-reformas.vilssa.com/articulos/tipos-de-pavimentos-ecologicos

Barcelona

San Francisco





Problemas que Atiende – Agua Pluvial

Rubén Villalpando y cortesía de la Secretaría de Seguridad Pública Municipal, 6 Agosto 2006
http://www.jornada.unam.mx/2006/08/06/index.php?section=politica&article=035n1est

Ernesto Rodríguez, El Diario de Juárez, 25 Sept. 2013, calle Ejercito Nacional
http://diario.mx/Local/2013-07-25_2c63e372/cierran-por-inundacion-un-tramo-de-la-ejercito-nacional/

Problemas que Atiende – Aire

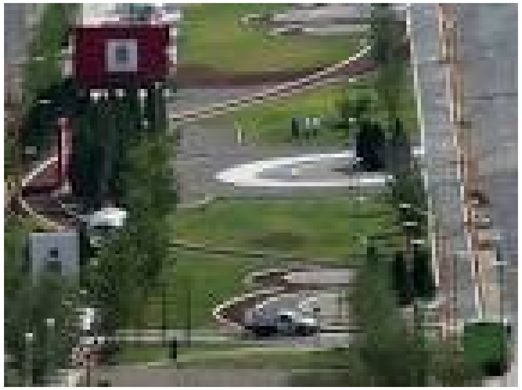
Visibilidad casi nula para conductores y mala calidad de aire para Ciudad Juárez. Foto: El Mexicano, 14 de abril de 2012, http://www.oem.com.mx/elmexicano/notas/n2505355.htm

Juan Antonio Castillo / José Luis González, sábado, 14 de abril de 2012, http://www.nortedigital.mx/article.php?id=9034

Foto: Lucio Soria, 19 Diciembre 2012, http://diario.mx/Local/2012-12-19_220dafd8/juarez-bajo-tiera

Problemas que Atiende – Salud Pública

Desarrollo Económico



Línea Verde del Municipio de Aguascalientes

Thoughts on Green Infrastructure: An Invitation to Growing Oases

by Brad Lancaster

www.HarvestingRainwater.com

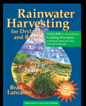
www.DesertHarvesters.org

Have you ever experienced
a true *living* oasis?

What was it like for you?

What did it enable?

Did you have a role in it?



Oasis

Oasis

Photo credit: Kevin Schraer

Oasis

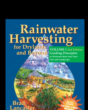
The Ancient Oasis

4,000 Years of Agriculture and Irrigation in Tucson

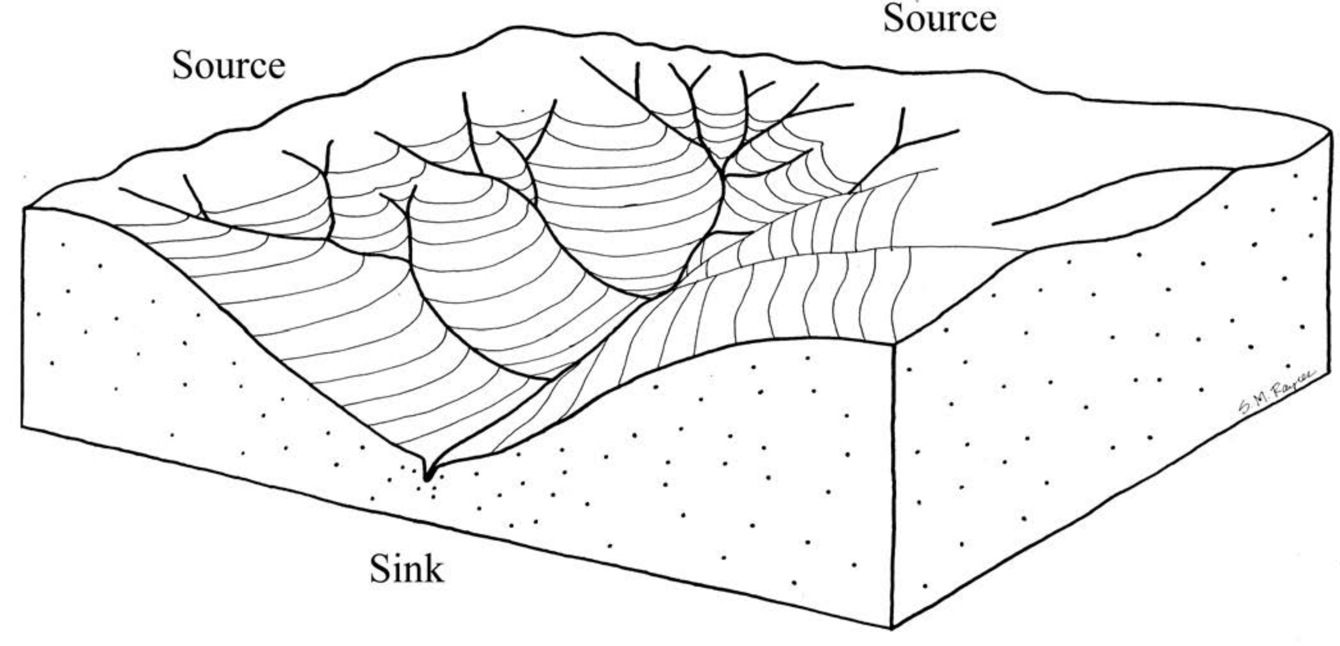
Hohokam farmers, circa A.D. 1000

Tucson's fields, circa 1915

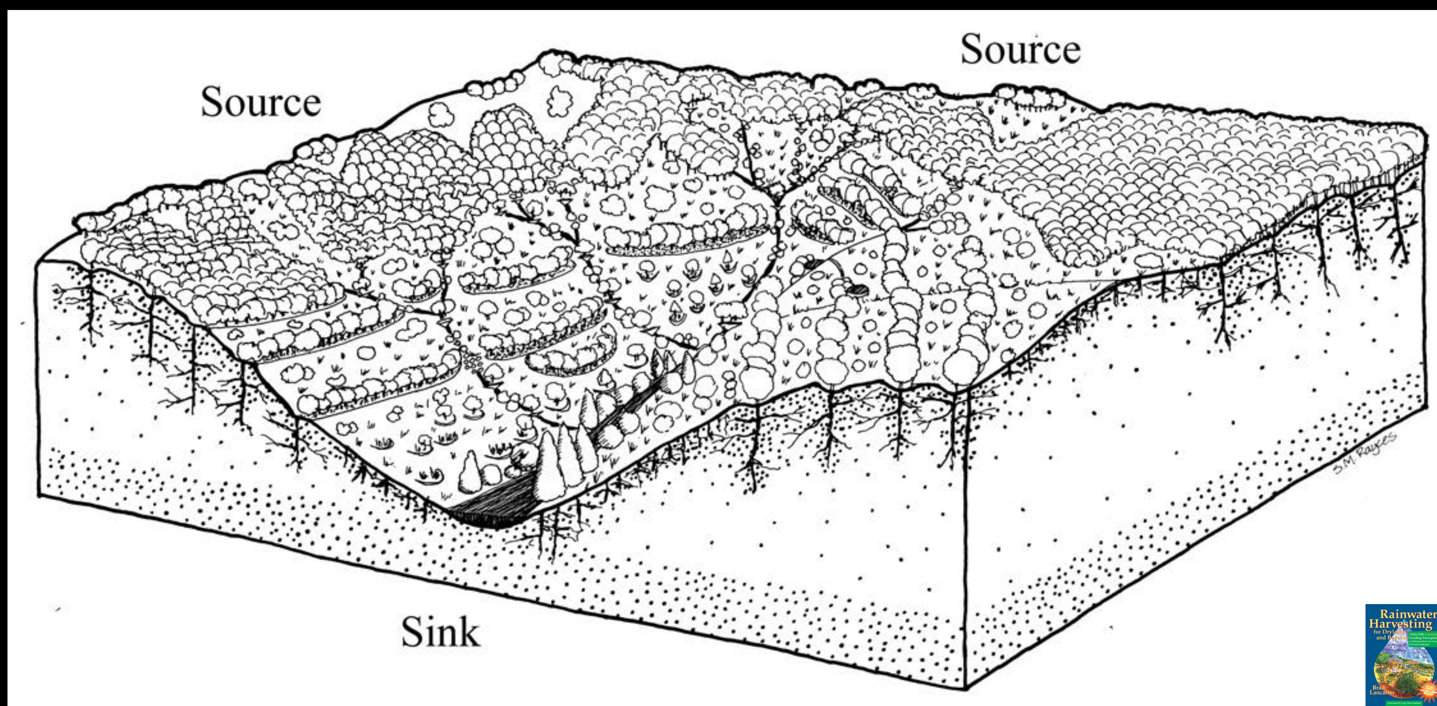
Jonathan Mabry
Tucson Historic Preservation Office



Mirage



Drain /
Dying mirage



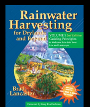
Net /
Sponge/
Oasis

What is Green Infrastructure?

Green infrastructure is *living* infrastructure.
Living systems of vegetation, soil life, and infiltrated stormwaters are key to its function and effectiveness.
It strives to align design principles and ecological-systems understanding. Thus it works *with* and demonstrates natural processes within our built environment.

Why Green Infrastructure?

To improve and inform the design of living urban infrastructure so it contributes to larger, interconnected living systems in a way that enhances the health and wealth of communities, their environments, and the larger shared watershed.



Dead *drainage*way to living *infiltration*way

U of A Architecture and Landscape Architecture Building, Tucson, AZ

CALA landscape tour www.cala.arizona.edu

Mirage

Oasis

Mirage
– fertility extraction

Oasis
– fertility reinvestment

1996

2007

2013

2013

• Food-bearing native trees (*Prosopis velutina*) associated with mulched street runoff-harvesting earthworks did NOT uptake heavy metals into edible plant tissue.

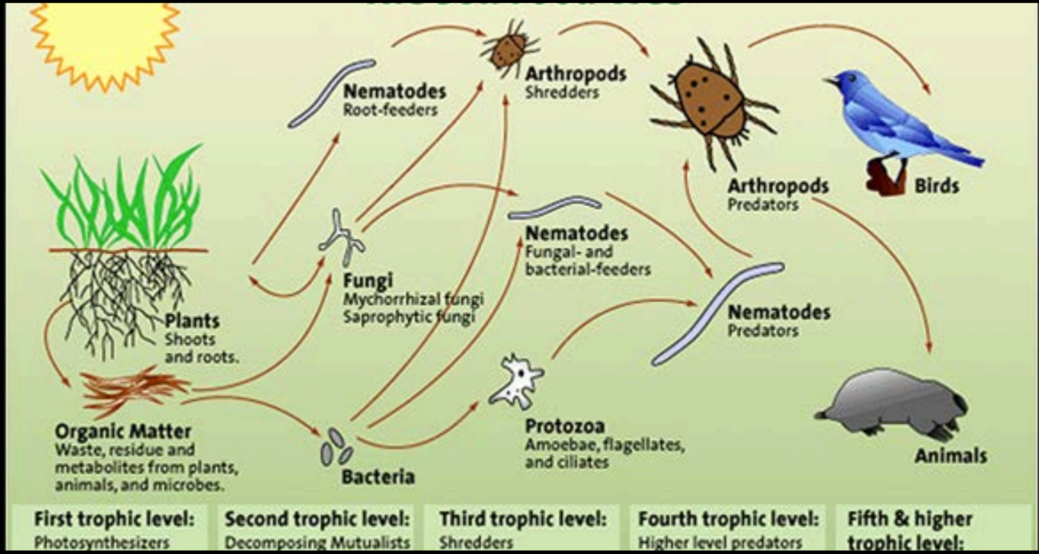
• Trees associated with mulched water-harvesting earthworks are able to grow 33% larger than those without.

This more than doubles the trees' potential sequestration of atmospheric carbon, passive cooling, and food production

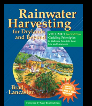
• The presence of more organic matter in the soil enables the soil itself to sequester additional carbon

• The natural pollutant-filtering/ bioremediation ability of the soil mulched with organic material was ***ten times greater*** than that of rock- or gravel-mulched soil

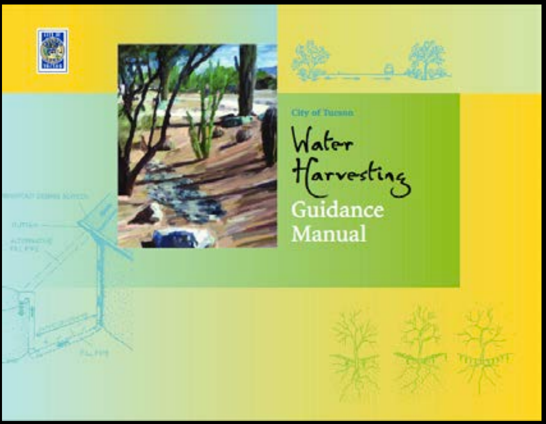
GENERATE AND SHARE REPUTABLE DATA THAT CAN EVOLVE PRACTICES AND POLICY

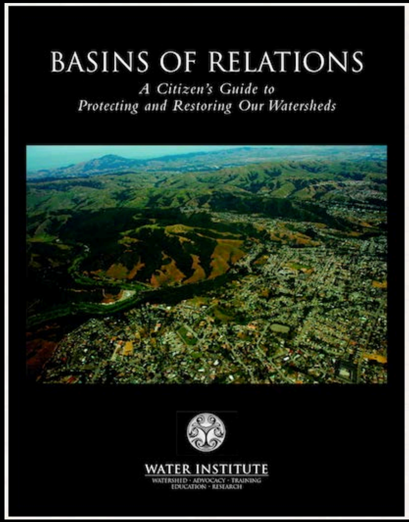


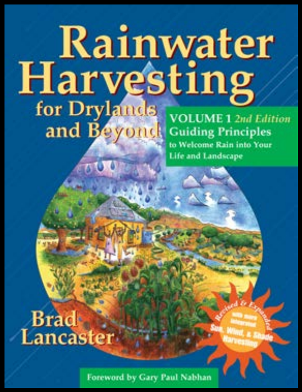
Mitchell Pavao-Zuckerman, PhD
Biosphere 2 & School of Natural Resources and Environment
University of Arizona mzuckerman@arizona.edu

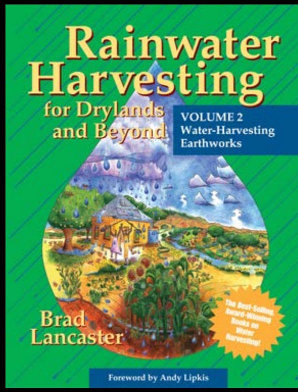


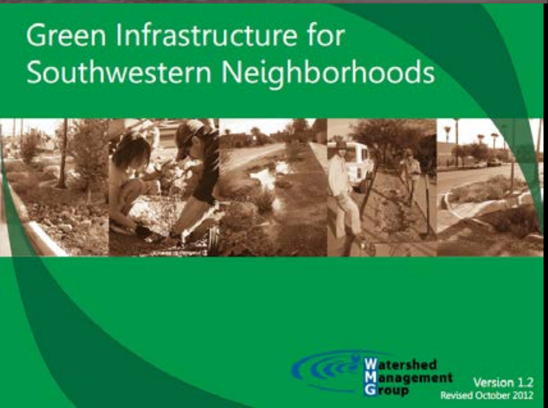
INCREASE AWARENESS OF GREEN INFRASTRUCTURE'S VALUE & POTENTIAL

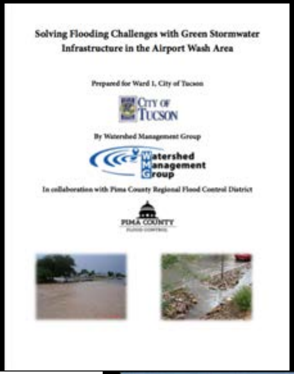


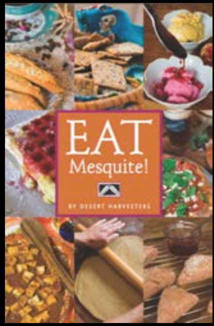


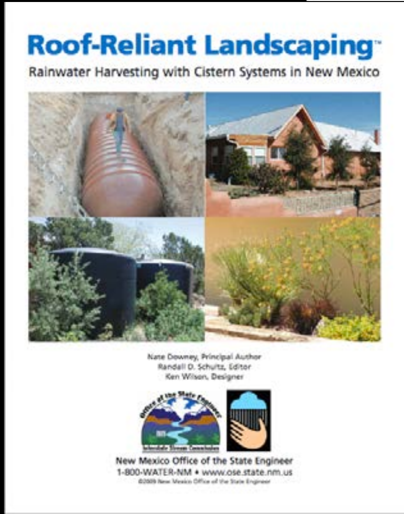


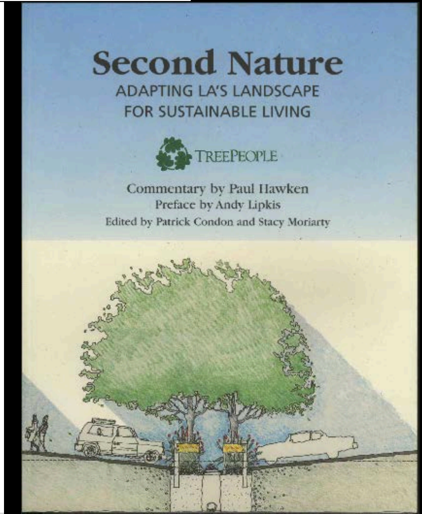


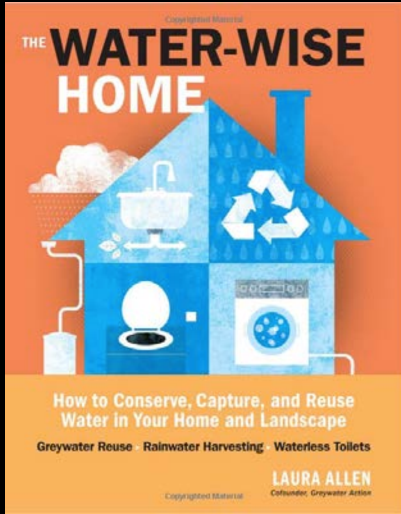








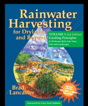




DEVELOP IMPLEMENTATION CAPABILITY AND HANDS-ON EXPERIENCE

La Paz, Baja, México, 2013

La Paz, Baja, México, 2013



INSPIRE AND GROW POLITICAL WILL

FOSTER A MARKET / ECONOMIC VIABILITY AROUND THE PRACTICE WITH INCENTIVES

• Legalize the practice

• Promote the practice

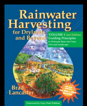
• Rebates

Rebates can create a financial carrot to encourage new practices. Rebates with requirements and education can enhance the quality of the rebated practice.

• Stormwater utility fees or Green Infrastructure Fund

Makes more clear the community costs and benefits of certain practices.

If a property helps reduce, rather than increase, downstream flooding, then the fee is less.



CHANGE PRACTICES, LAWS, AND POLICIES TO INCENTIVIZE RATHER THAN DISINCENTIVIZE BEST PRACTICES

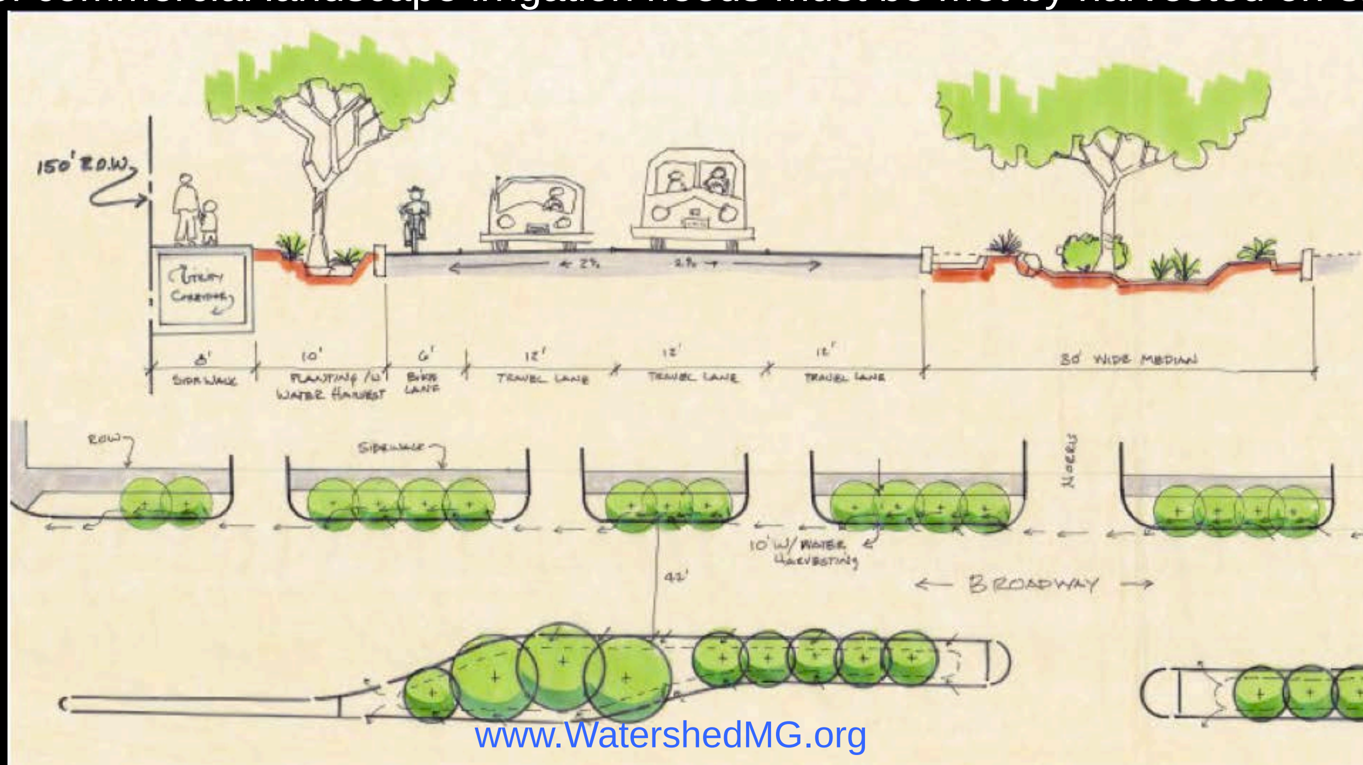
Green Streets Policy in Tucson, AZ

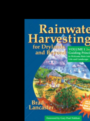
Minimum ½ -inch rainfall to be harvested in roadway or adjoining right-of-way

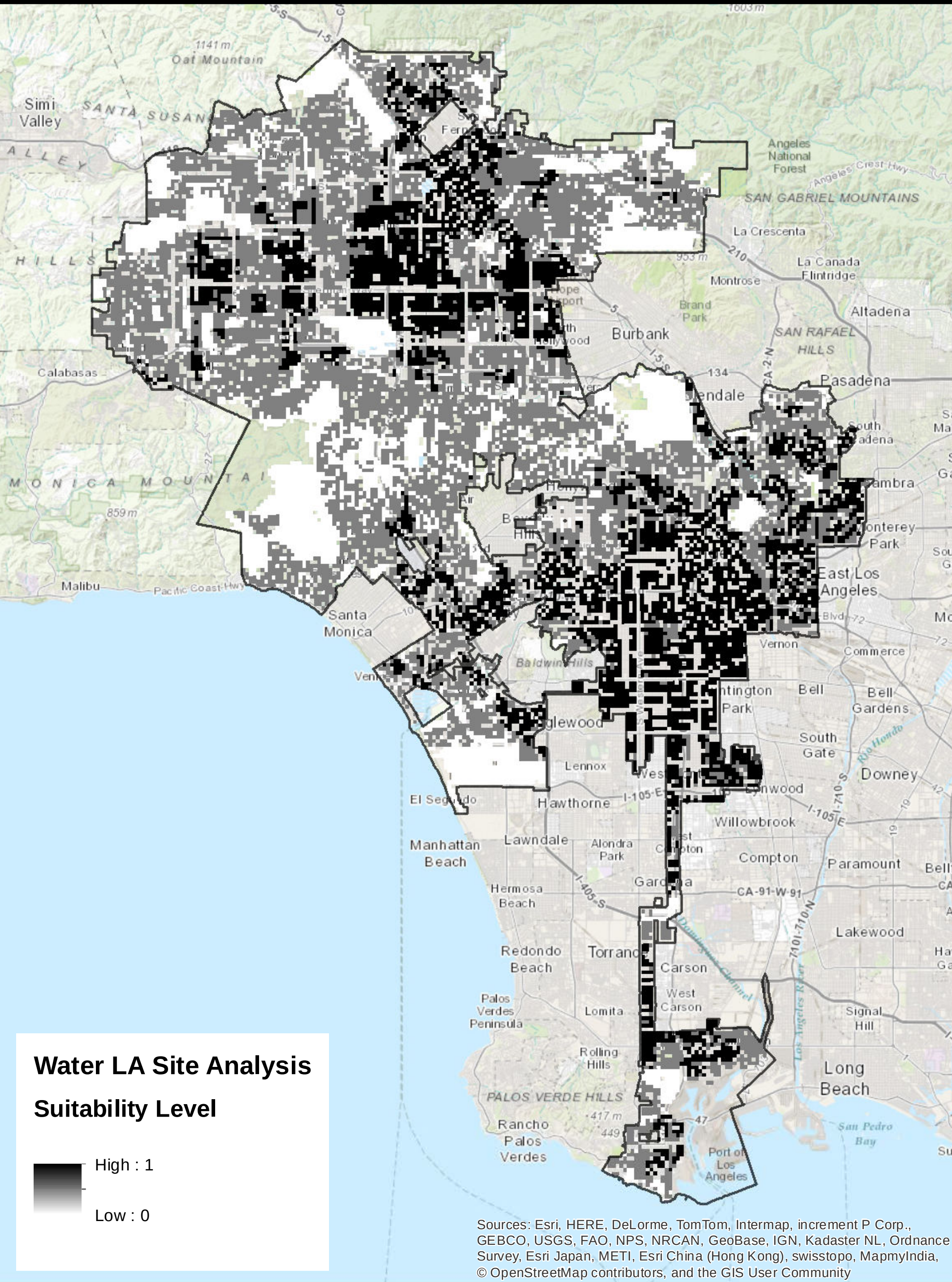
http://www.mayorrothschild.com/2013/05/29/tucson-to-capture-stormwater-for-irrigation-of-roadway-vegetation/

Commercial landscape policy

At least 50% of commercial landscape irrigation needs must be met by harvested on-site rainwater

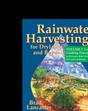


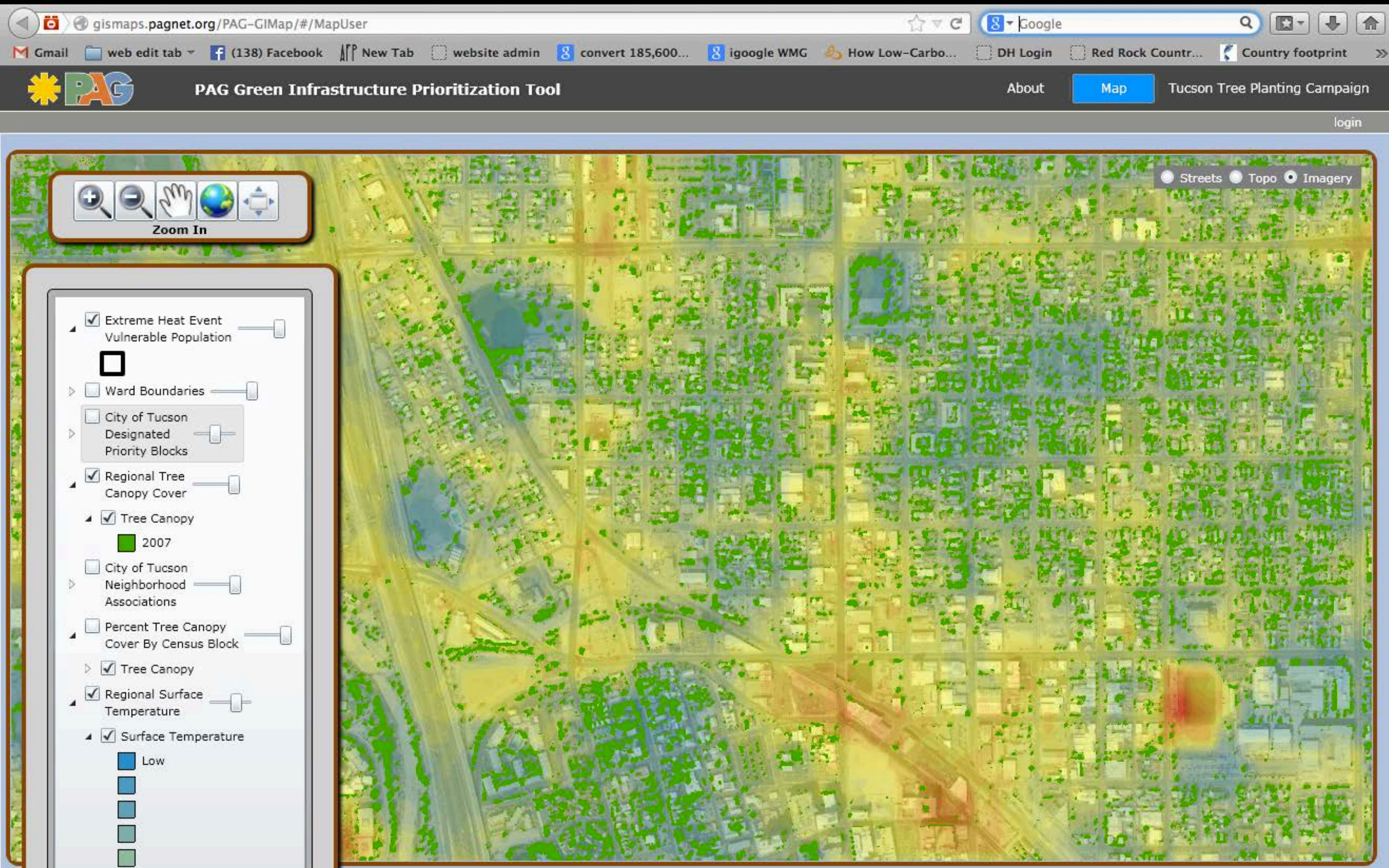




GENERATE SITE ASSESSMENT PROTOCOL TO PLACE BEST PRACTICE IN BEST SITE

Soil percolation/infiltration
Local patterns of flooding
Slopes
Parkway width
Existing tree canopy
Volumes of street-side water flow
Climate vulnerability

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New Tab
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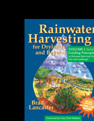
How Low-Carbo...
DH Login
Red Rock Countr...
Country footprint
PAG
PAG Green Infrastructure Prioritization Tool
About
Map
Tucson Tree Planting Campaign
login
Zoom In
Streets
Topo
Imagery
Extreme Heat Event Vulnerable Population
Ward Boundaries
City of Tucson Designated Priority Blocks
Regional Tree Canopy Cover
Tree Canopy
2007
City of Tucson Neighborhood Associations
Percent Tree Canopy Cover By Census Block
Tree Canopy
Regional Surface Temperature
Surface Temperature
Low


Rainwater Harvesting

Dunbar/Spring neighborhood surface area is:

43% impervious cover (rooftops and pavement) + 17.8% bare earth = 60.8% of the neighborhood

Currently just 12% is under tree canopy

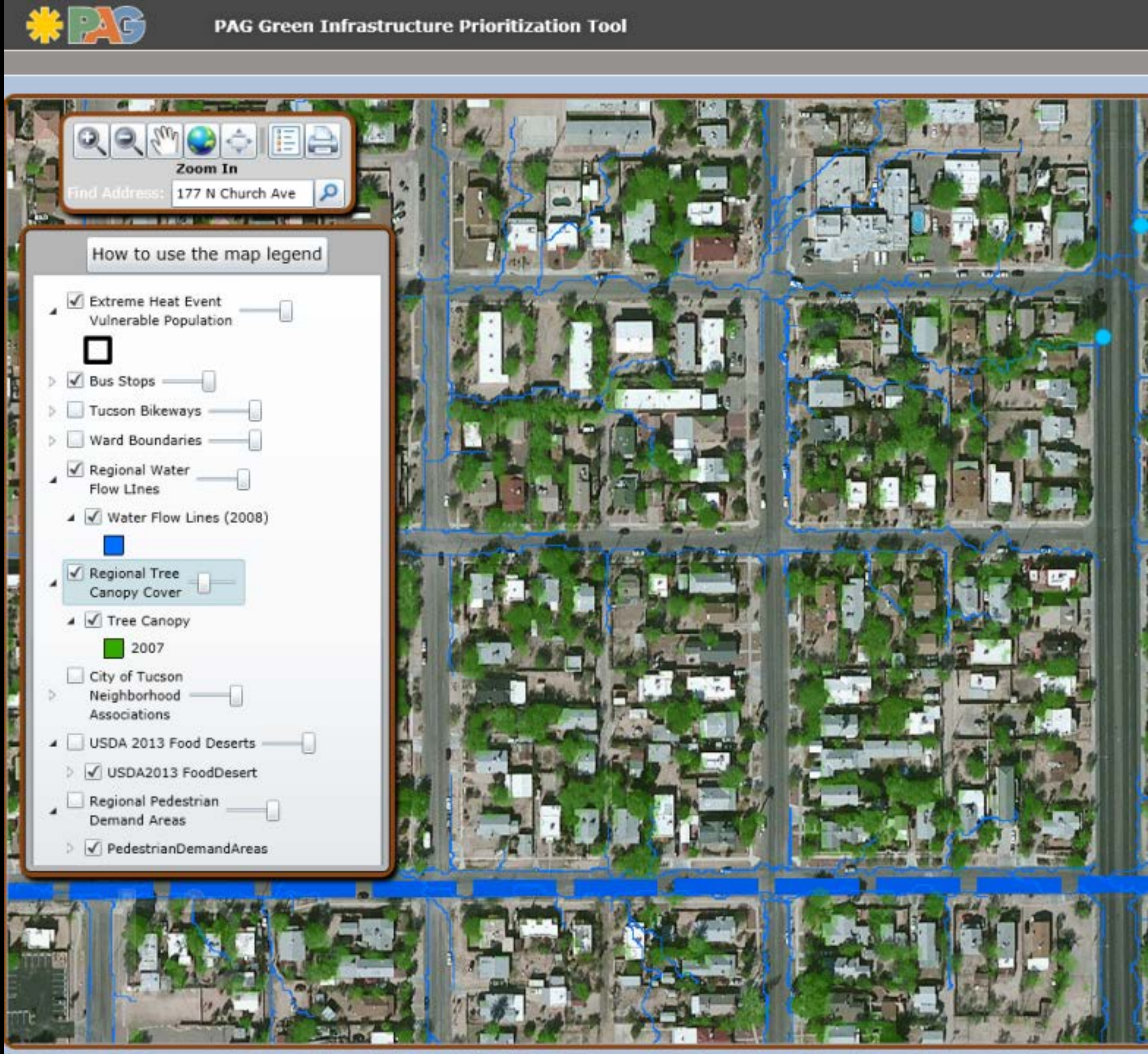
2011 data from PAG & RFCD

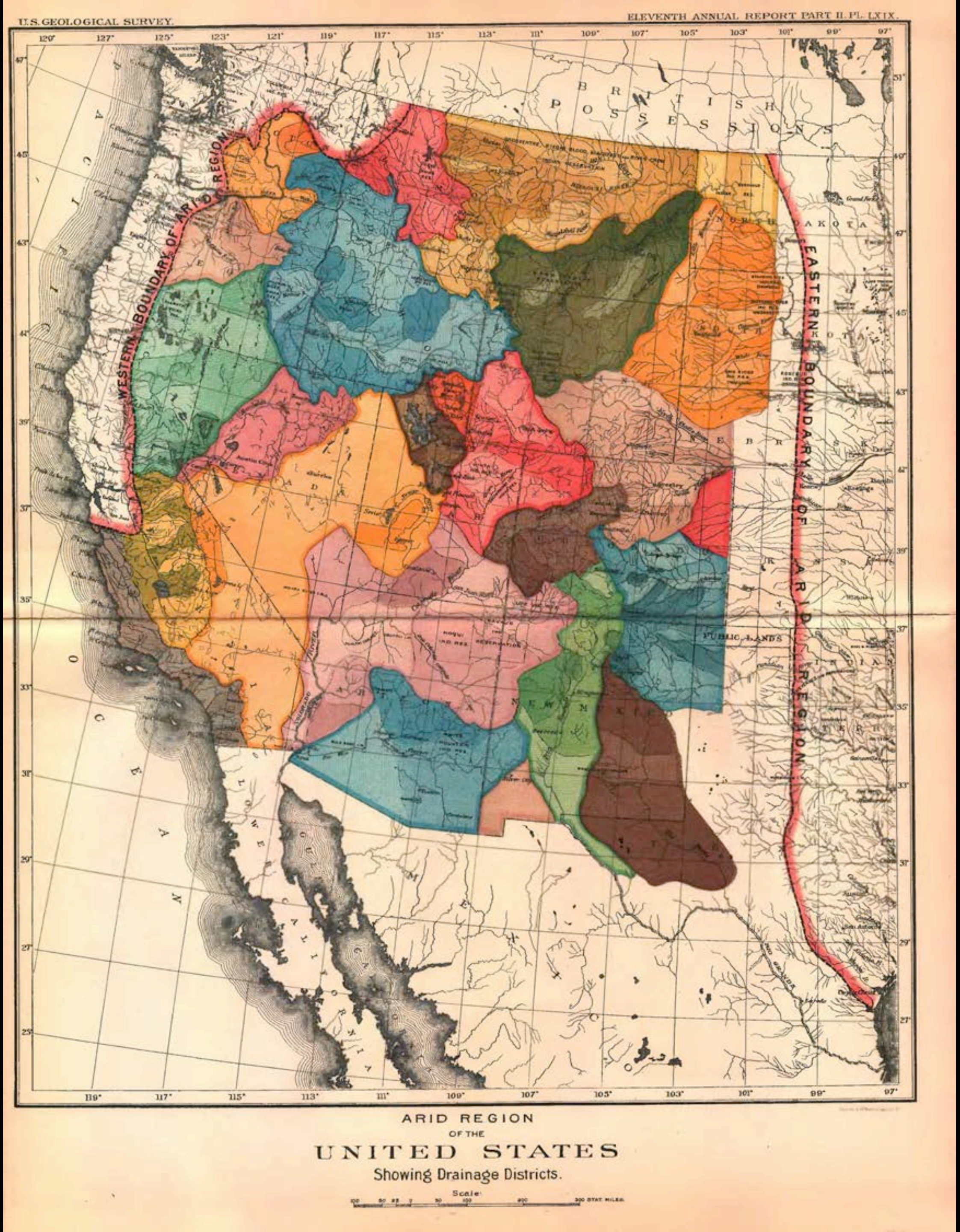
Storm water Flow Paths

Important water source to reduce irrigation

Aid planning efforts and implementation,

Plan which side of street or traffic circle



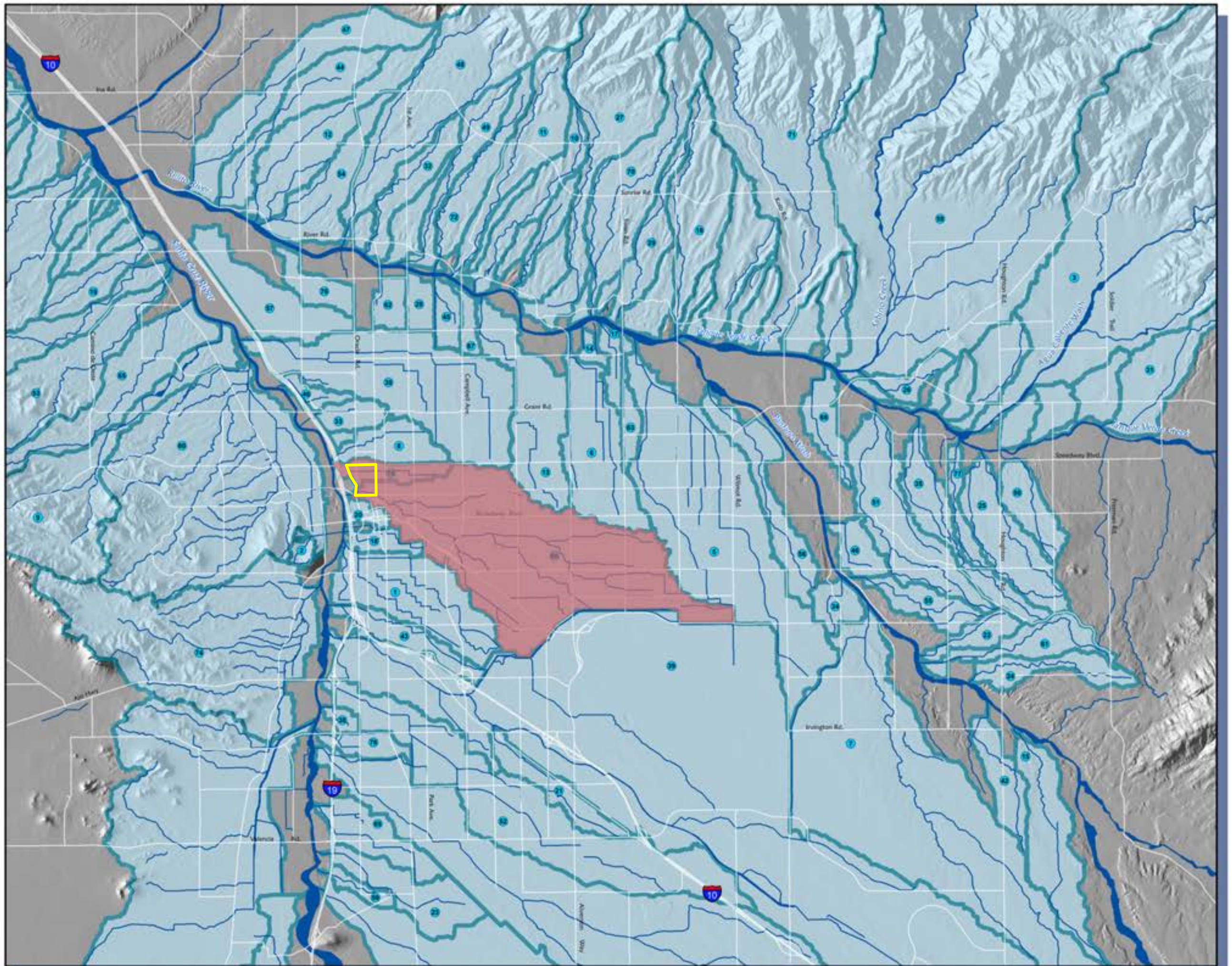


PRODUCE / PROMOTE EVOLVING BEST MANAGEMENT PRACTICES

Western United States delineated by their *watershed* boundaries as proposed by John Wesley Powell

SHOW THE FLOW

The Dunbar/Spring Neighborhood Washes & Their Watersheds*

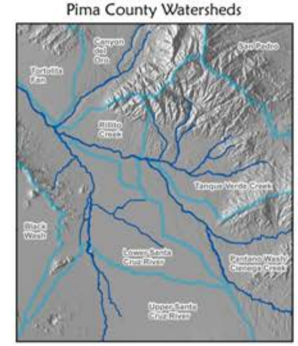


*shaded red on map & in list

Named Tucson Basin Watersheds

1. 18th Street Wash
2. A Mtn Detention
3. Agua Caliente
4. Airport Wash
5. Alamo Wash
6. Alvernon Wash
7. Atterbury Wash
8. Bronx Wash
9. Camino de Oeste Wash
10. Camino Real Wash
11. Campbell Wash
12. Casas Adobes Wash
13. Christmas Wash
14. Christopher City Wash
15. Civano Wash
16. Craycroft Wash
17. Creekside Wash
18. Cushing Street Wash
19. Del Cerro Wash
20. Downtown Watershed
21. Earp Wash
22. Eastview Wash
23. El Vado Wash
24. Escalante Wash
25. Este Wash
26. Fahringer Wash
27. Finger Rock Wash
28. First Avenue Wash
29. Fletcha Caida Wash
30. Flowing Wells Wash
31. Fortyniners Wash
32. Friendly Village Wash
33. Grant Road Wash
34. Guillermo Wash
35. Hidden Hills Wash
36. Hughes Wash
37. Idle Hour Wash
38. Irvington (Michigan) Wash
39. Julian Wash
40. Kreuger Wash
41. Los Reales Diversion Channel
42. Mesqute Ranch Wash
43. Mission View Wash
44. Nanini Wash
45. North Mountain Ave. Wash
46. Owen Park Wash
47. Pegler Wash
48. Pima Wash
49. Race Track Wash
50. Reyes Wash
51. Robb Wash
52. Rodeo Wash
53. Roger Wash
54. Roller Coaster Wash
55. Rolling Hills Wash
56. Rose Hill Wash
57. Ruthrauff Wash
58. Sabino Creek
59. Santa Clara Wash
60. Silvercroft Wash
61. Spanish Trail Wash
62. Stone Avenue Wash
63. Swan Road Wash
64. Sweetwater Wash
65. Trails End Wash
66. Tucson Arroyo
67. Tucson General Wash
68. Udall Park Wash
69. Valencia Wash
70. Valley View Wash
71. Ventana Canyon Wash
72. Villa Entrada Wash
73. WBSCR Diversion Channel
74. West Branch Santa Cruz River
75. West University Wash
76. Wetmore Wash
77. Wrightstown Wash
78. Wyoming Wash

Pima County Watersheds



Arizona Watersheds

TerraSystems Southwest and the Watershed Management Group, Inc. would like to thank Pima County Department of Transportation Geographic Information Services Division and the City of Tucson Department of Transportation for graciously providing the datasets displayed on this map. The Hydrologic Unit Code (HUC) data, aggregated to subregions, was provided by the USDA-NRCS National Cartography and Geospatial Center. All data is accepted as-is, with all known and unknown inaccuracies and/or errors, and without warranty of any kind.

N

0 0.5 1 2 3 4 Miles

Major Streets

Named Washes

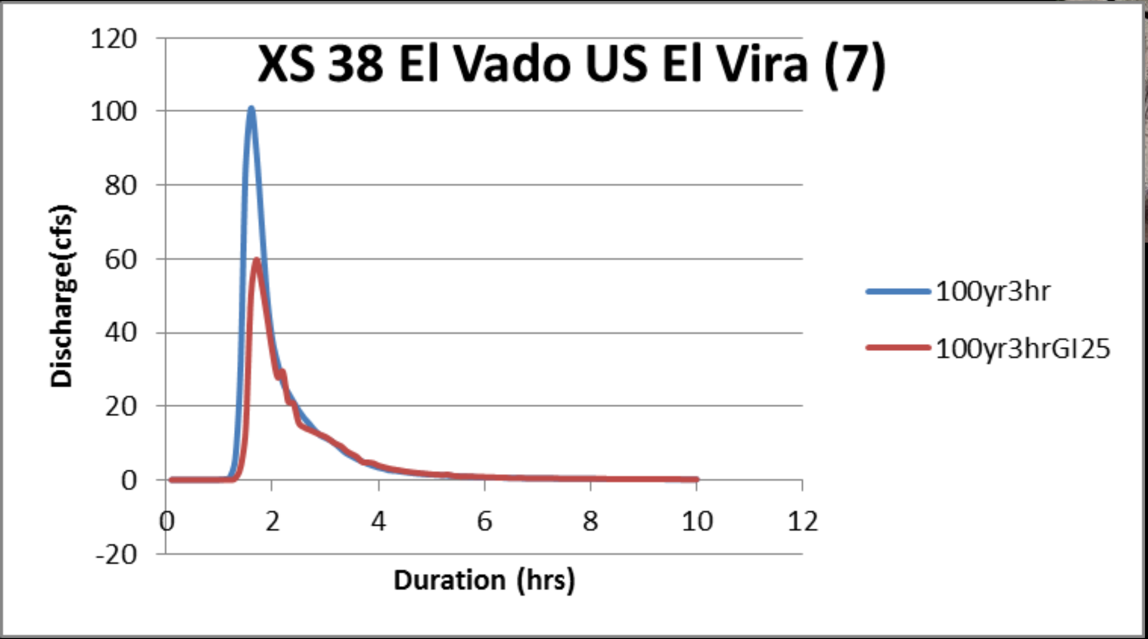
Major Watersheds

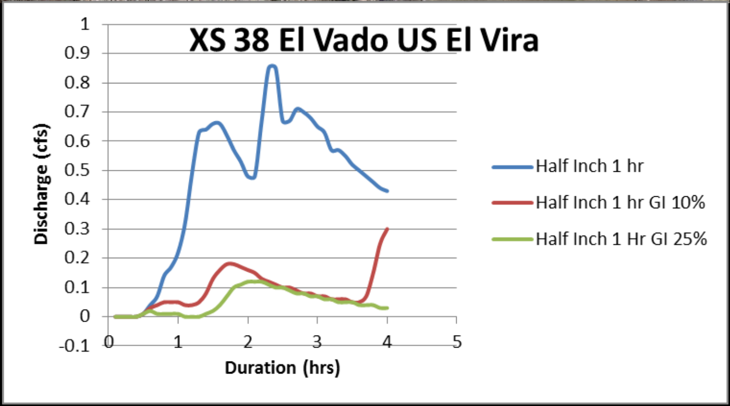
Map Date: March 23, 2009

El Vado
subwatershed

Drainage Area:

30 acres





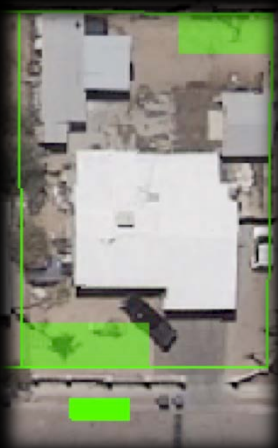
http://watershedmg.org/green-streets/resources#airport-wash

PIMA COUNTY FLOOD CONTROL

CITY OF TUCSON

WMG

Residential Rain Garden & Street Harvesting Benefit/Cost Ratio Initial Results



	Rain Garden	Street Harvesting
Benefit/Cost Ratio:	**$4.4 / $1**	**$2.9 / $1**
Direct benefits only:	**$3.1 / $1**	**$1.9 / $1**

PIMA COUNTY FLOOD CONTROL

CITY OF TUCSON

WMG

Green Streets
Benefit/Cost Ratio Initial Results

Model representation

Benefit/Cost Ratio: **$2.1 / $1**

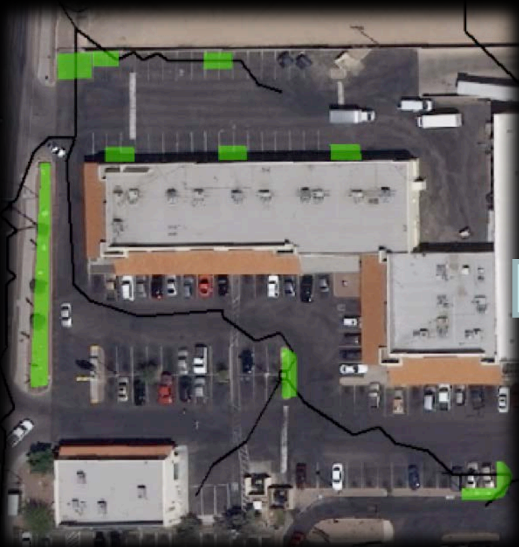
Direct Value Only: **$1.5 / $1**

PIMA COUNTY FLOOD CONTROL

CITY OF TUCSON

WMG

Parking Lots and In-Street Features: Bustin' Up Asphalt



Model representation

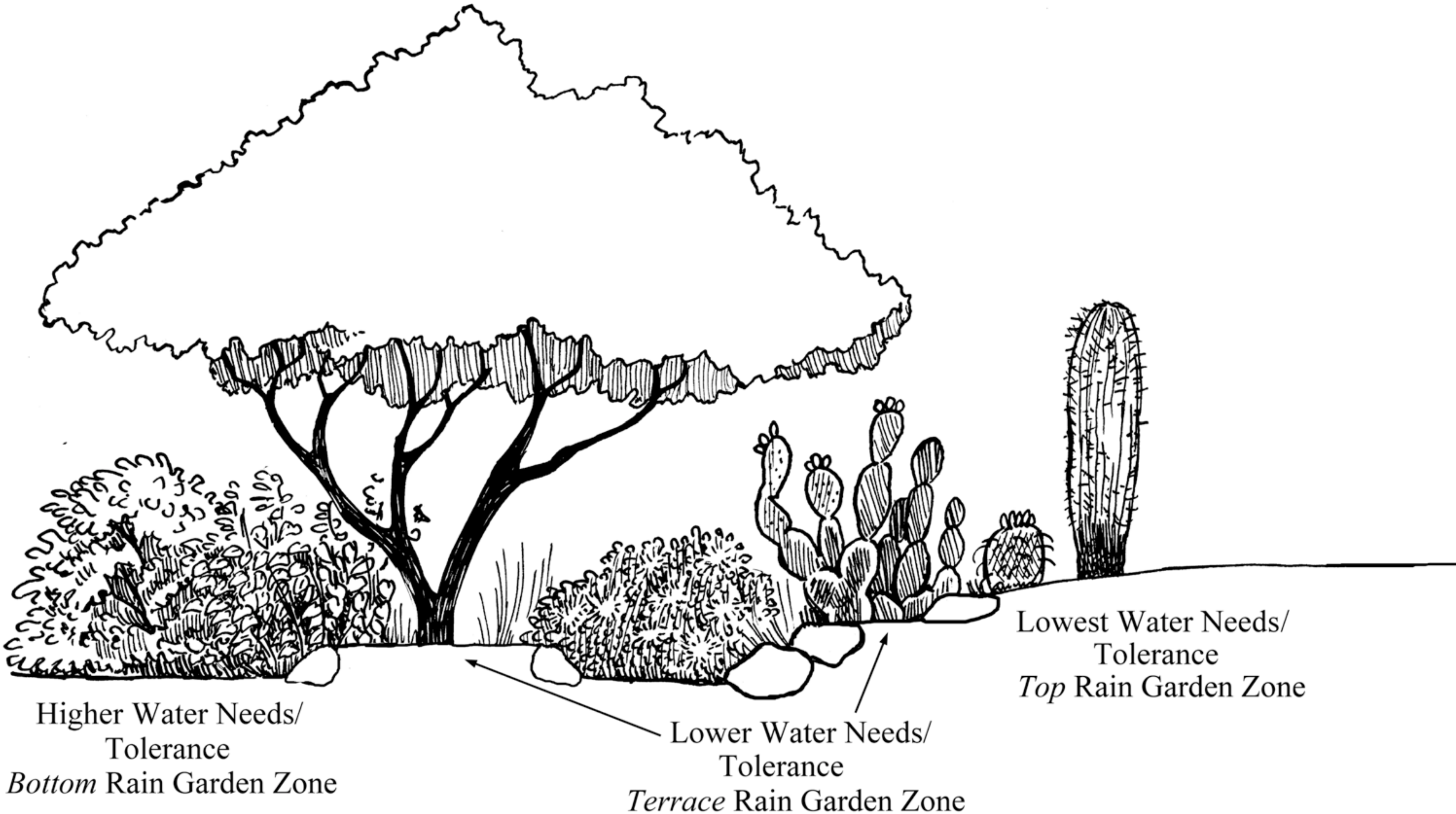
Benefit/Cost Ratio: **$0.5 / $1**

PIMA COUNTY FLOOD CONTROL

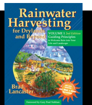
CITY OF TUCSON

WMG

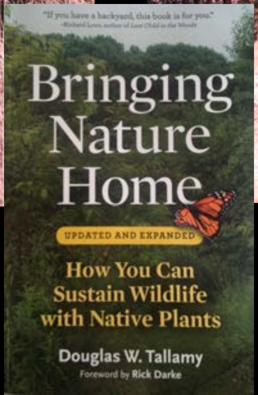
GATHER / CREATE RELIABLE SOURCES OF PLANTS & GUIDANCE ON HOW TO IRRIGATE THEM WITH HARVESTED ON-SITE WATER



Rain Garden Zones



Non-native mirage



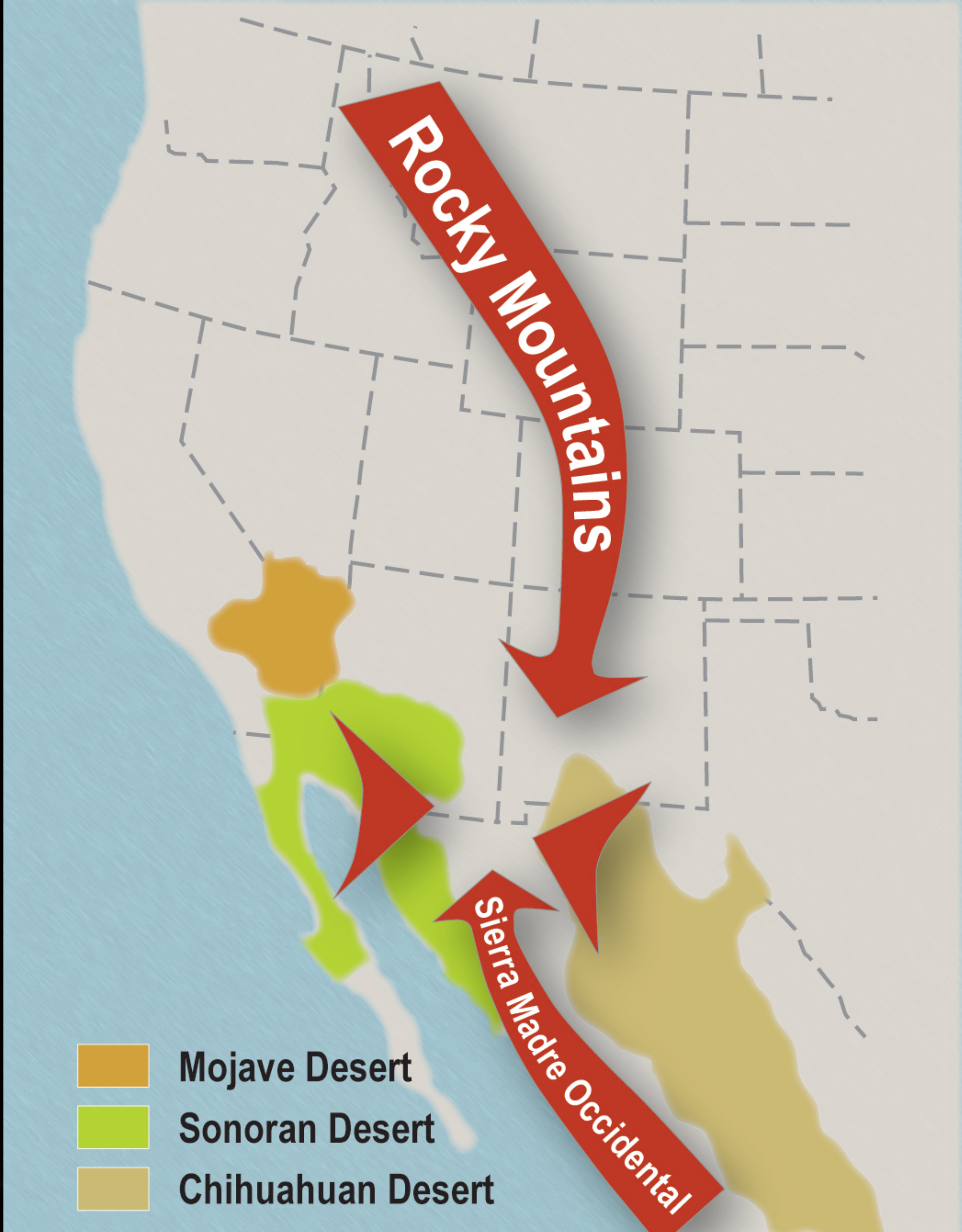
Native oasis


Rainwater Harvesting
for Drylands
and Beyond
VOLUME 1 2nd Edition
Guiding Principles
to Welcome Rain into Your Life and Landscape
Brad
Lancaster
Foreword by Gary Paul Nabhan

Watchable wildlife activities generate $1.4 billion in economic activity per year to Arizona

Native plants support native wildlife, because they have coevolved

along with the region's climate (and its cyclical droughts and floods)



CONTINUALLY EVOLVE IRRIGATION PRACTICES

Drip irrigation bucket

NSPIRE A CONTINUALLY EVOLVING CULTURE AND PRACTICE OF STEWARDSHIP MAINTENANCE

Bad “maintenance”
tree cut down
Photo credit: Sky Jacobs

Bad “maintenance”
all vegetation
clear cut
Photo credit: Sky Jacobs

Good maintenance
prunings reused on
site as mulch

SHOW THE FLOW

Phto credit: Francisco Zamora, Sonoran Institute, Colorado River Delta Legacy Program

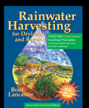
BRING BACK THE FLOW

Colorado River reunited with the Sea of Cortez for the first time in 16 years on May 15, 2014

Where do you want to live
—in a mirage or a true oasis?

What will that choice enable in you, your community, and our shared watershed & world?

What will be your role in that choice?



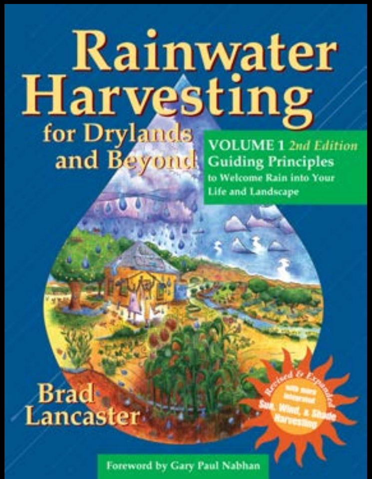
For a downloadable

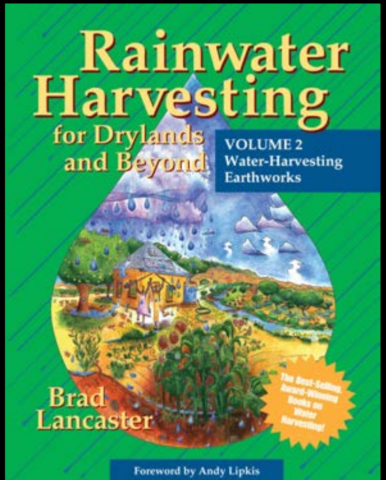
Evolving Checklist of Strategies to Build a Successful Green Infrastructure Program

- including links to resources, research, standards, and programs

see the webpage for the 2015 Border Green Infrastructure Forum

or the Drops in a Bucket blog at www.HarvestingRainwater.com





Infrastructure Builds Community
Community Improves Infrastructure

Highland Vista Neighborhood

A case study in midtown

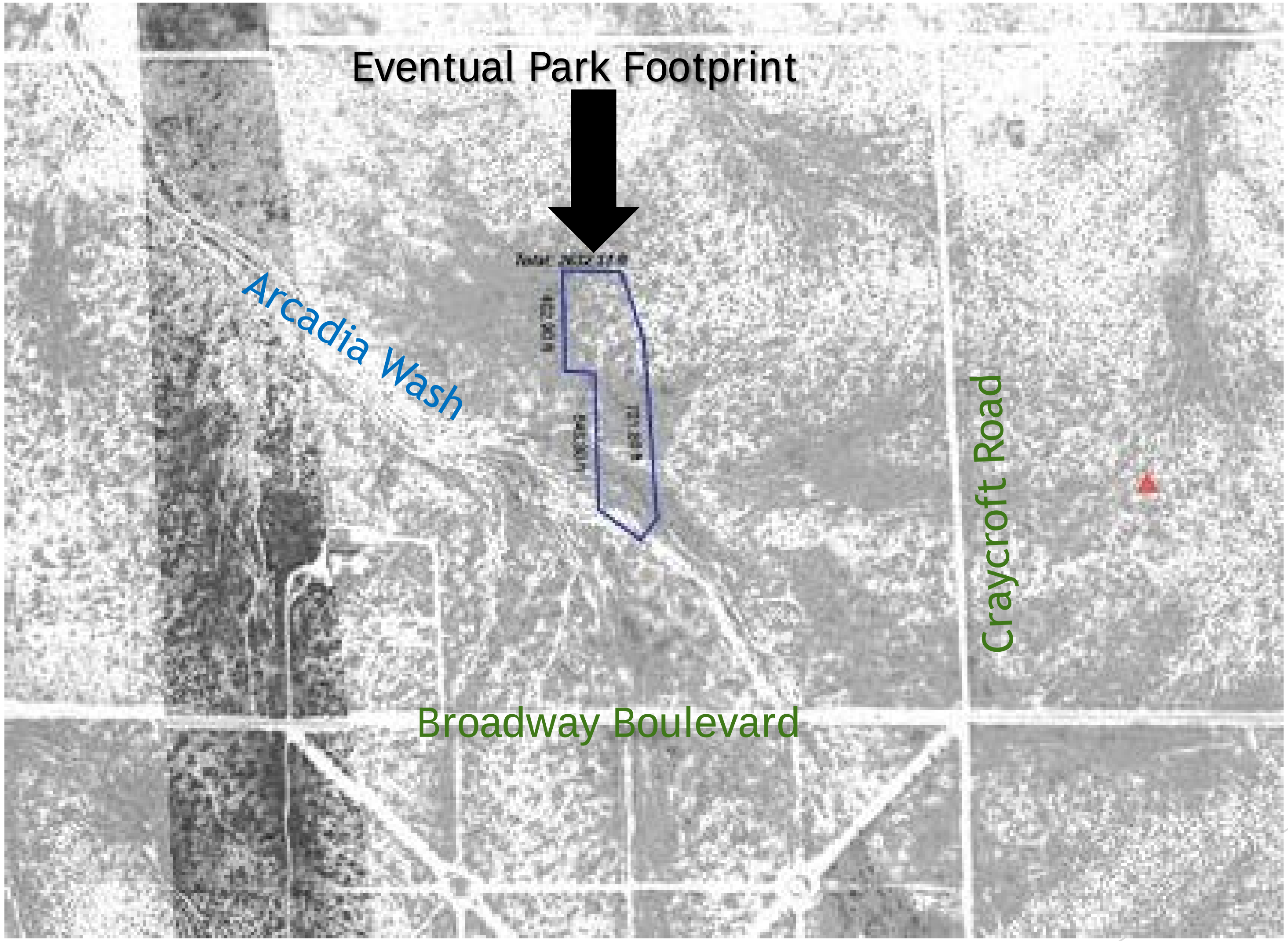
Tucson, Arizona, USA

HIGHLAND VISTA NEIGHBORHOOD AND PARK

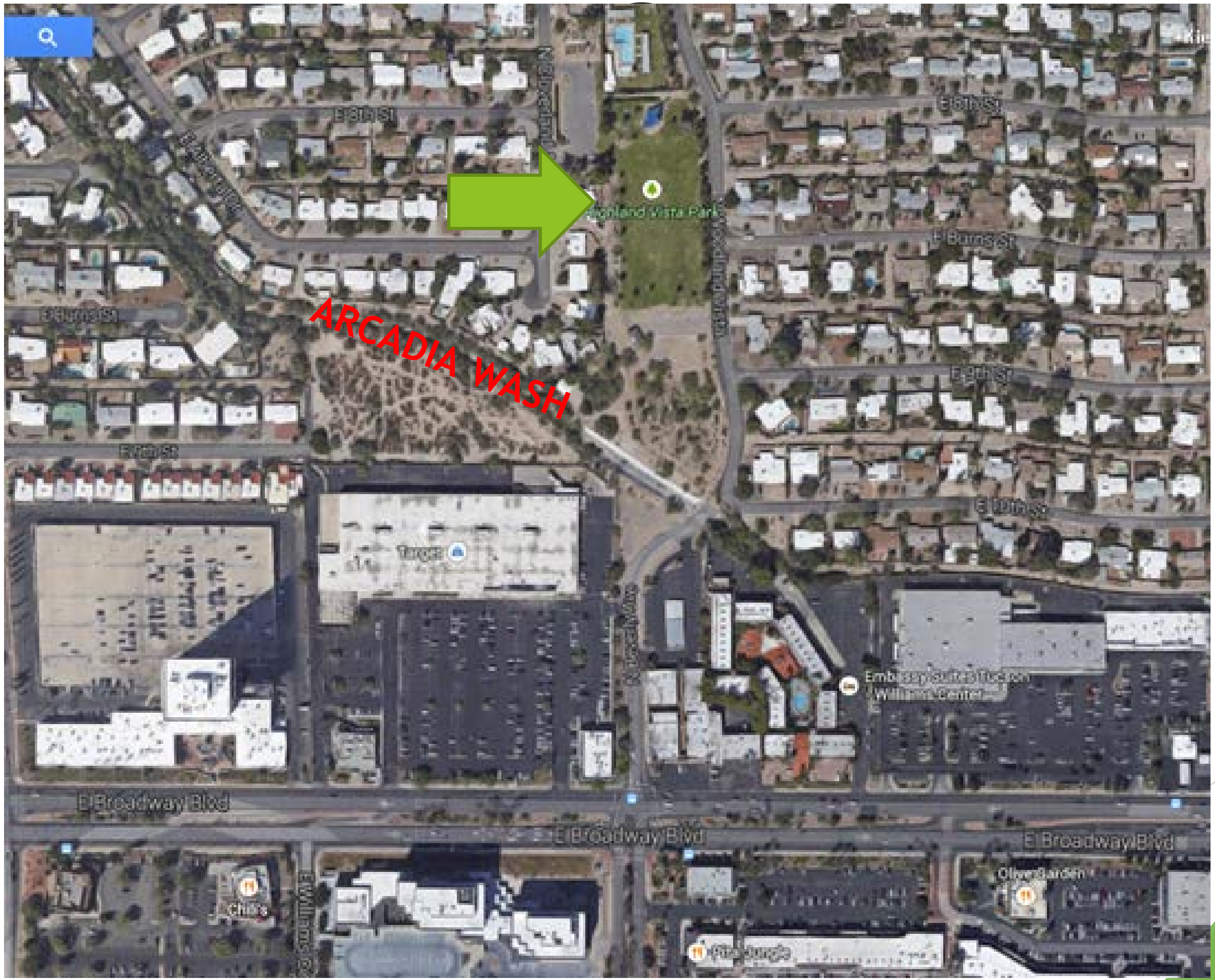
- Located in Central Tucson
- Bounded by Broadway, Craycroft, E. 5th Street and Rosemont
- Initially developed in mid-1950's
- Housing emphasized use of adobe brick with open design
- Neighborhood Park on North bank of Arcadia Wash

Highland Vista Watershed

Highland Vista- pre-development 1941



Highland Vista Park Today



Infrastructure / Community

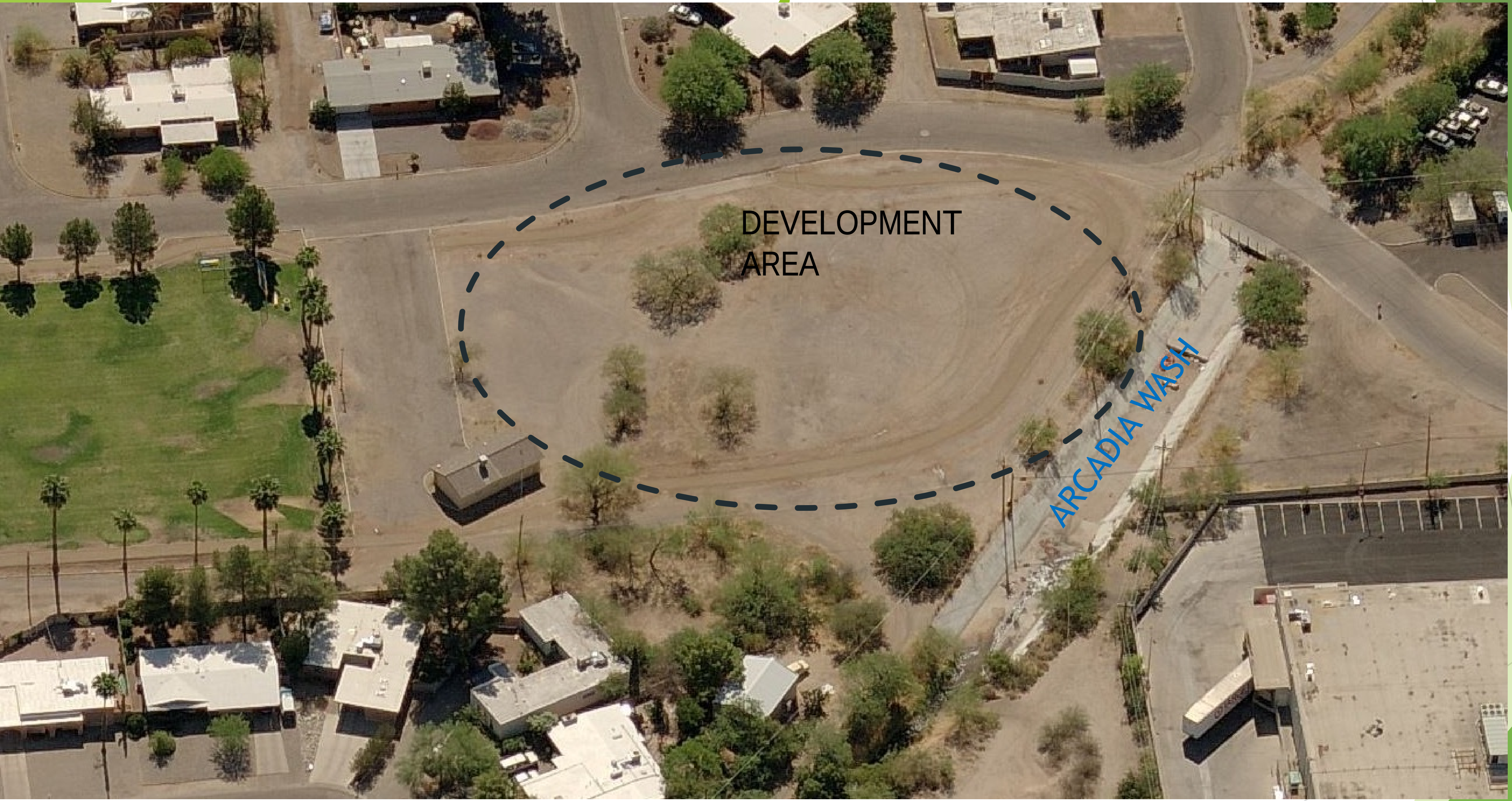
- Initial:
- Community Park
- Swimming Pool
- Playground
- Picnic Tables
- Athletic Field
- Office for 20-30 Club (supports youth programs)

- Neighborhood 346 households
- Each household is stockholder in neighborhood pool
- Swim Team
- Youth Soccer Team
- Community Gatherings:
  - Memorial Day, Independence Day, Labor Day+ special parties
  - Rummage sales, movie nights
  - Bar-B-Q’s

Community added Infrastructure

- Shade Structure over playground (with Tucson Parks Foundation)
- Walking Path (with City of Tucson, Ward 6, Back to Basics Grant)
- Initial harvesting of street water for Native Plant Oasis (With Pima County Neighborhood Reinvestment Program, City (Tucson) Parks and Recreation, plus Brad Lancaster, Consultant Designer & Wheat Sharf Architects) 2008
- Little Free Library (neighbors)
- Neighborhood Community Garden Plots (with Community Gardens of Tucson)
- Neighborhood Watch Programs (with City of Tucson Police)
- Adopt-A-Wash Program (with Tucson Clean and Beautiful)
- Proposed: Broadening use of water harvesting for Native Plants, increased retention, reduced flooding, additional decrease in runoff to Arcadia Wash (with Conserve 2 Enhance Program)

Pre-Project - 2006



Water Harvesting Project Development

WATER HARVESTING GOALS & HOW THEY PERTAIN TO HV PARK

- **Taking a problem and making it an asset**
- **Problematic stormwater drainage situation = opportunity for aesthetic improvement and interest**
- **Reduce erosion, runoff and sedimentation downstream**
- **Direct water where it will do the most good**
- **Enhance existing, groundcover areas**
- **Provide the local Highland Vista Neighborhood educational opportunities**
- **Eliminate standing water to reduce mosquito pressure**
- **Reduce pollutants flowing into the washes**

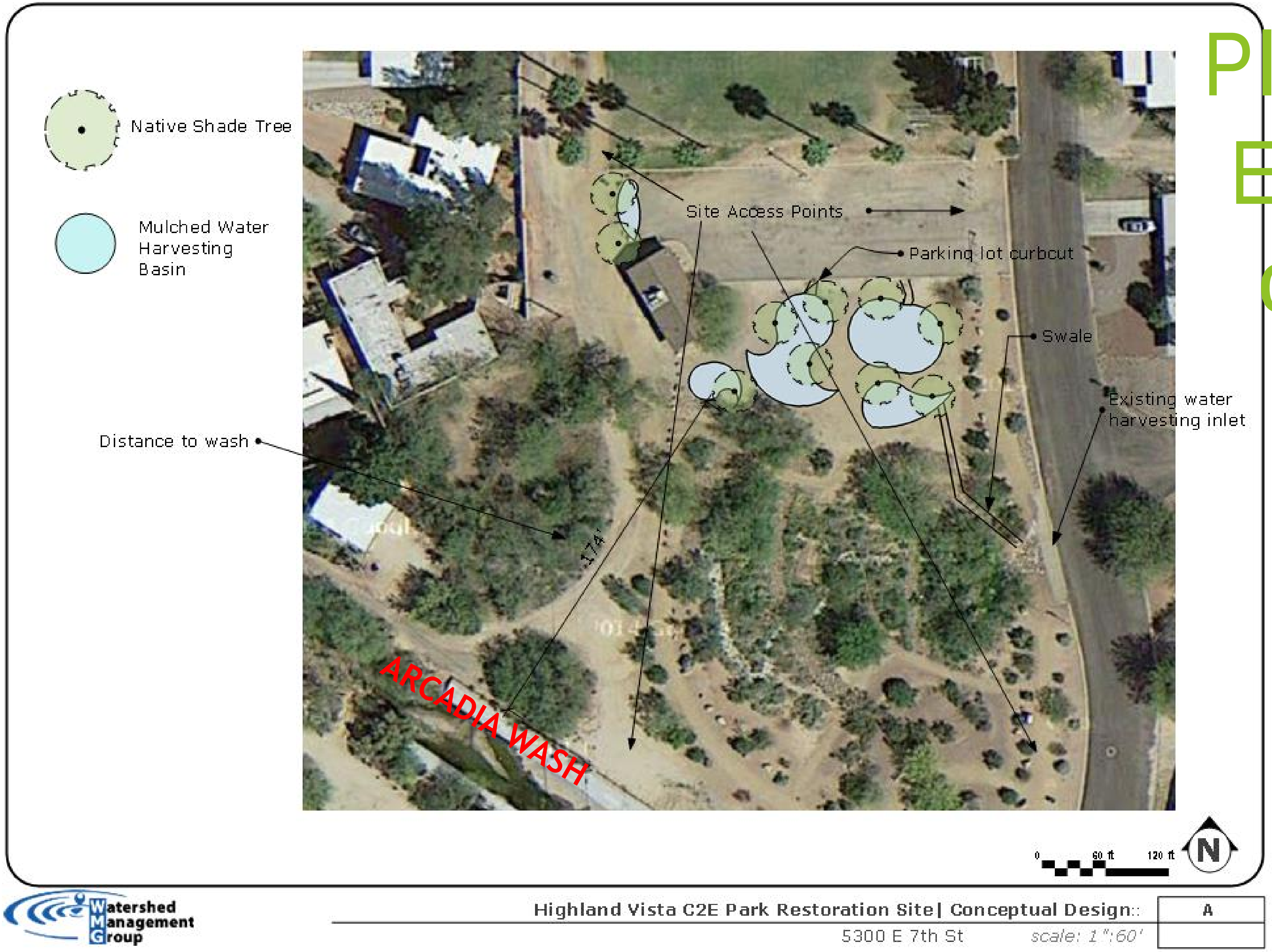
Source: Wheat Sharf Architects 2007

Project-Under Constuction-2008

Native Plant Oasis- 2010

Current Project Site -2014

Planned Expansion of Oasis 2016



END/FIN

James J. Riley*, Associate Professor, Retired

Soil, Water and Environmental Science Department

The University of Arizona

jrjayjay2@gmail.com

*Resident of HV and Board Member

May 20 and 21, 2015

With appreciation for the assistance of Eric Shepp, Irene Ogata, and Kieran Sikdar

BORDER GREEN INFRASTRUCTURE FORUM

NOAA’s Experience with Green Infrastructure and Flood Impact Reduction: Assessing Green Infrastructure Costs and Benefits

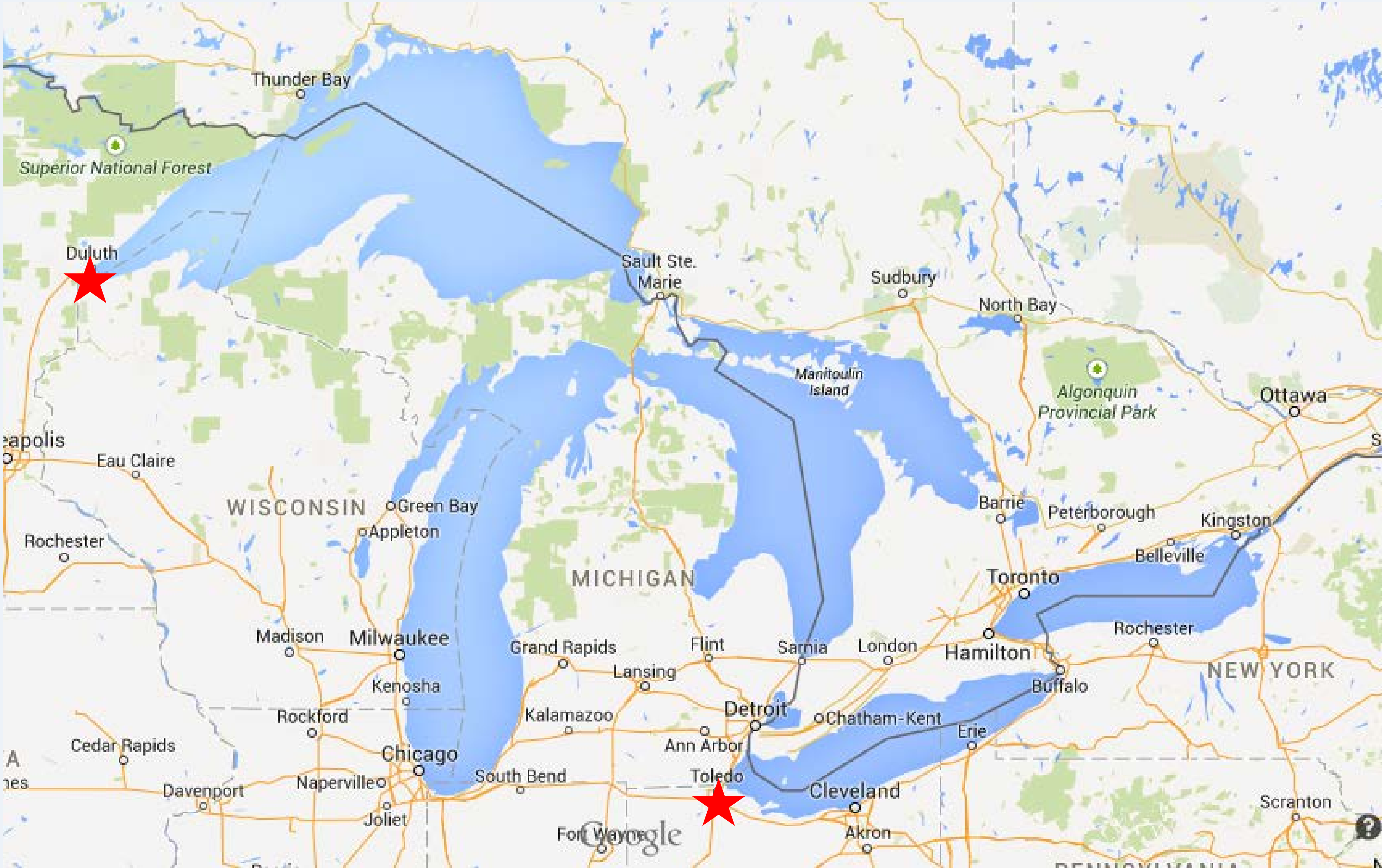
Lori Cary-Kothera

NOAA’s Office for Coastal Management

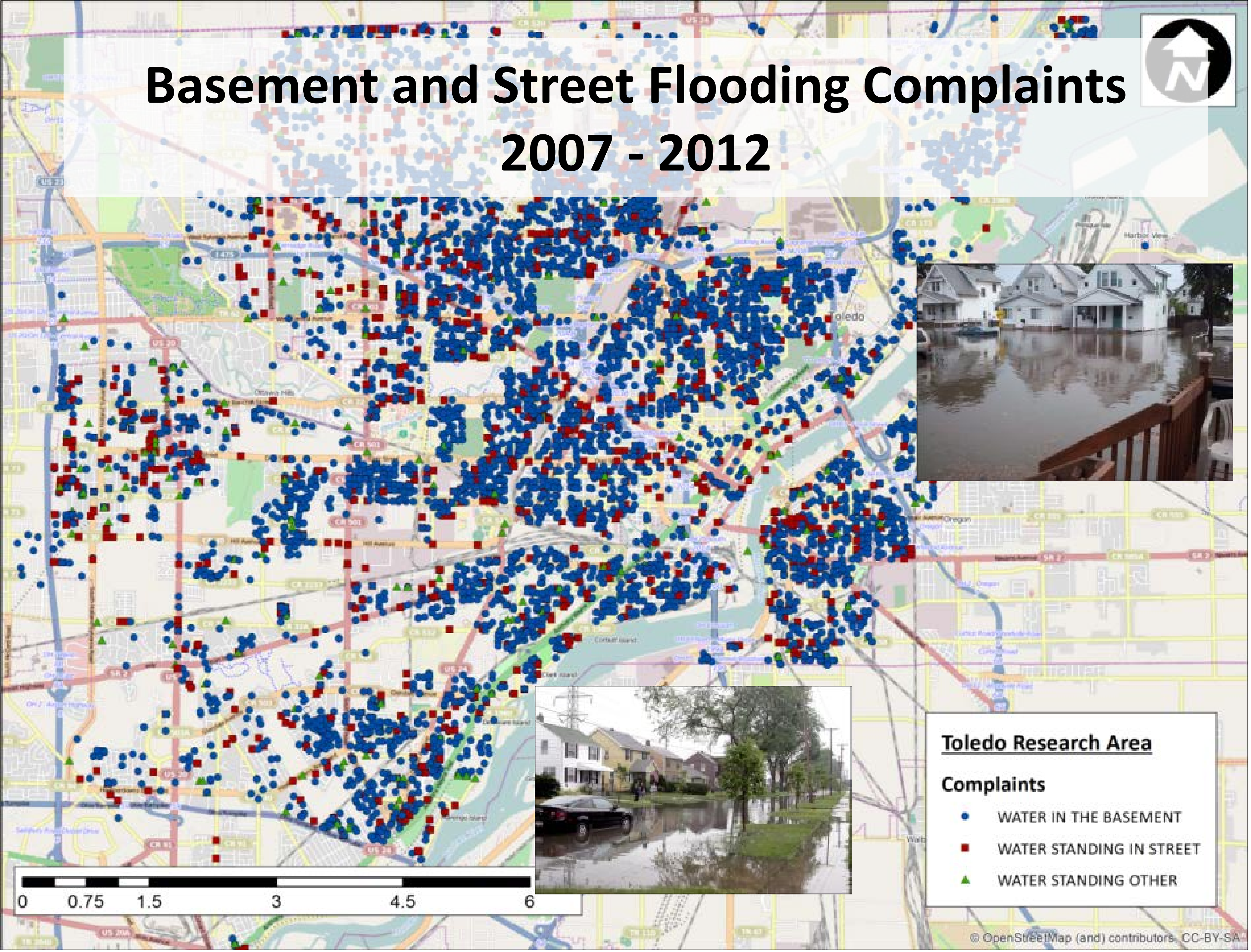

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

Think Nationally, Act Locally

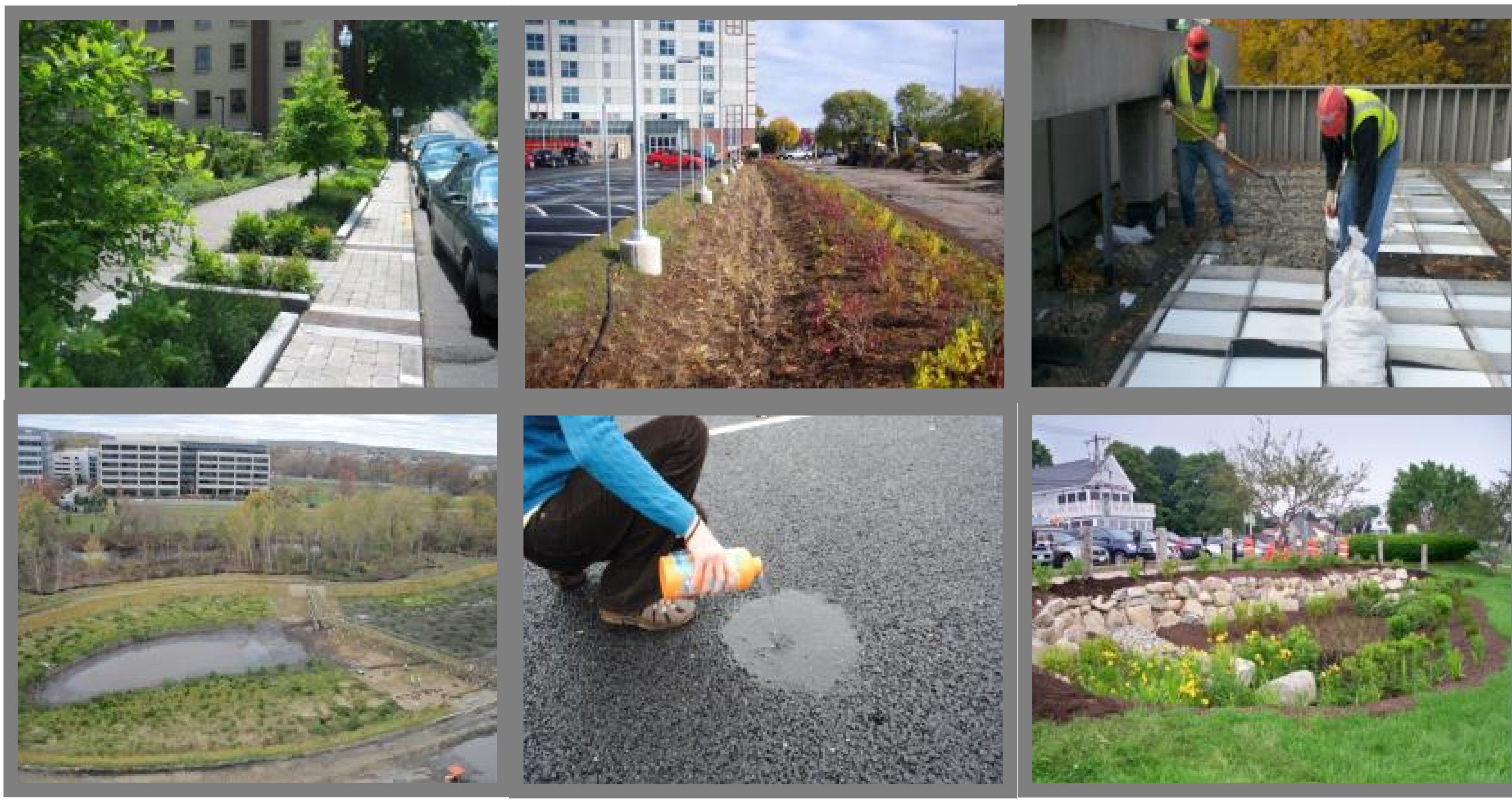
Great Lakes Study Sites



Basement and Street Flooding Complaints 2007 - 2012



Need: Help with long-term planning green infrastructure



But where do we start?

My options
Benefits
Costs
Data
Tell us...

So we worked with…

- Minnesota Sea Grant
- City of Toledo
- U.S. Army Corps of Engineers
- Association of State Floodplain Managers
- Eastern Research Group, Inc.
- American Rivers
- Old Woman Creek NERR

Economic Assessment

1. Define flood problem
2. Assess current and future flooding
3. Identify flood reduction options using GI
4. Assess flood scenarios with GI options
5. Compare benefits and costs

Step 1: Define flood problem

Scale of Study

Pilot Communities

Duluth, Minnesota

Toledo, Ohio

Step 2. Assess current and future flooding

Flood Impact Scenarios

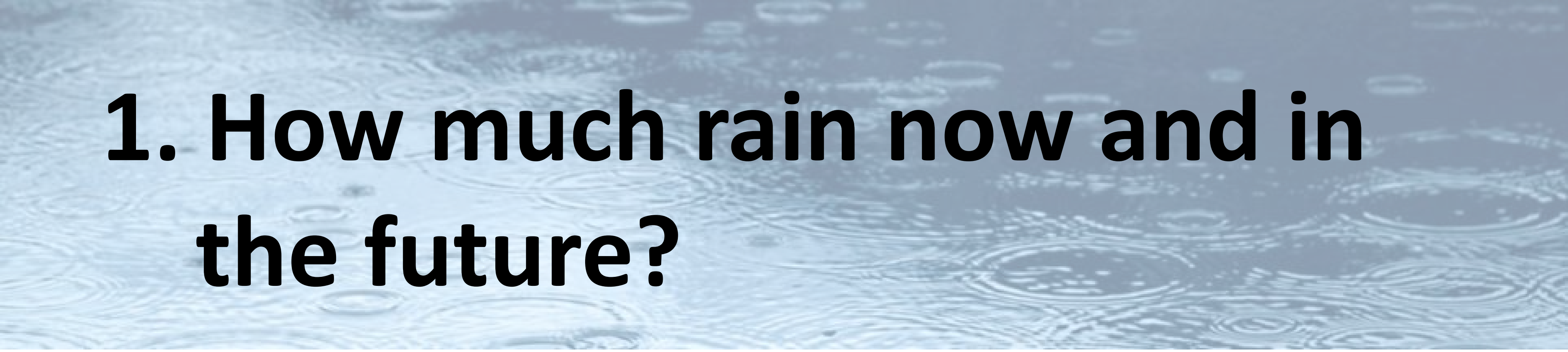
1. Current precipitation and current land use

2. Future precipitation (2035) and future land use

Flood Reduction Scenarios

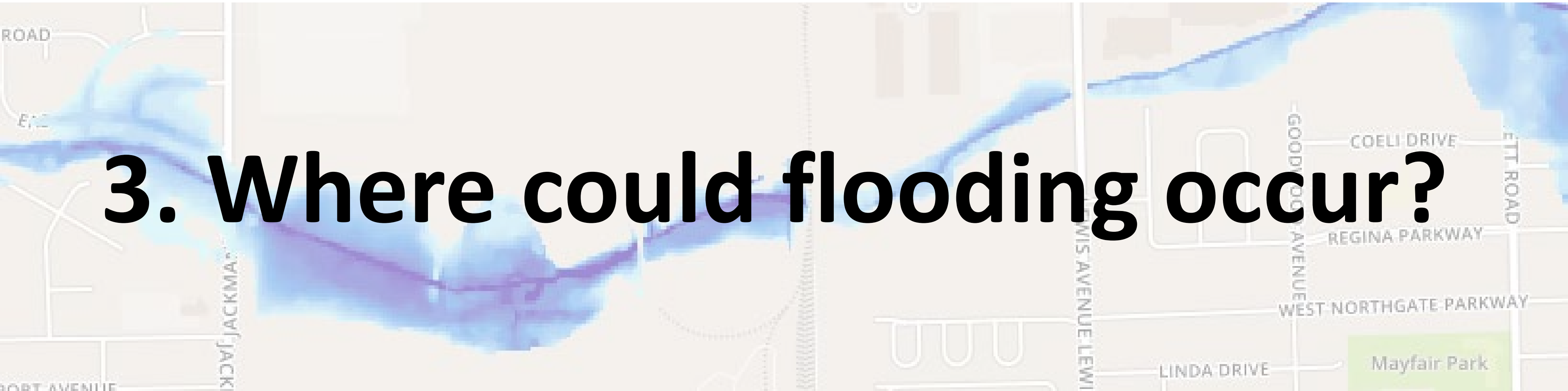
3. Current precipitation and current land use using GI

4. Future precipitation (2035) and future land use using GI



1. How much rain now and in the future?

2. How much water could cause flooding?

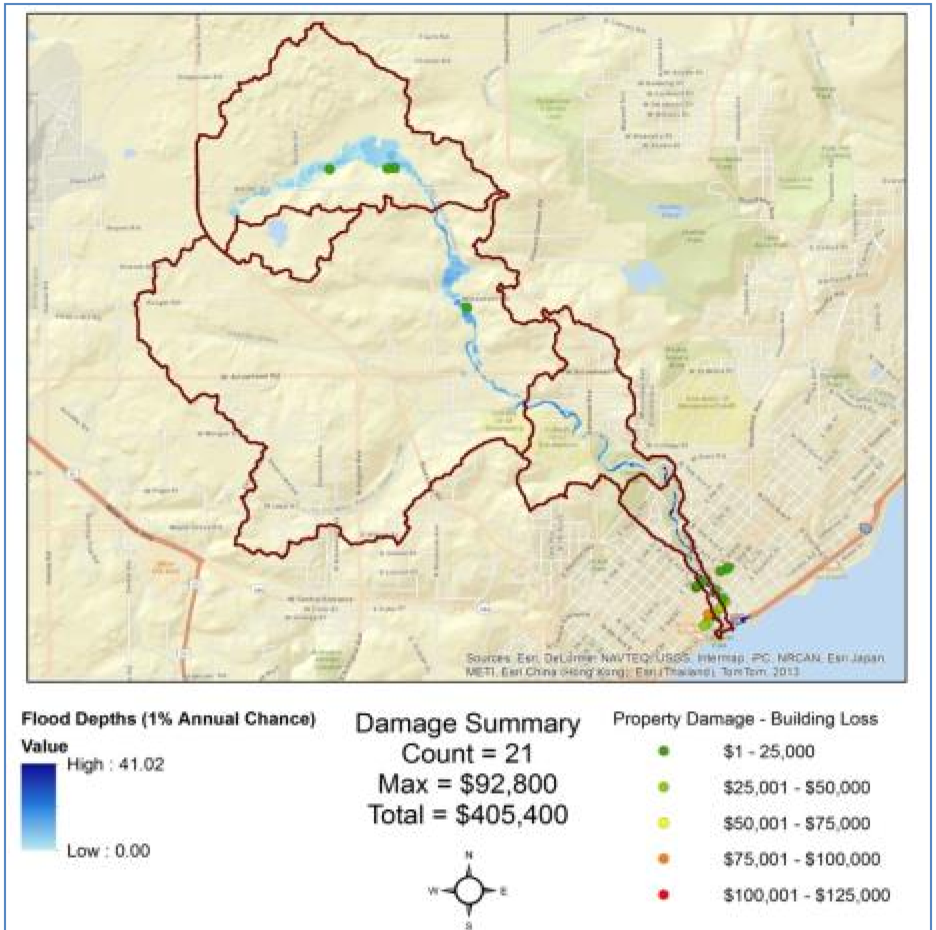


3. Where could flooding occur?

Toledo Flood Damage Costs

Flood damage to buildings = $740K

Duluth Flood Damage Costs

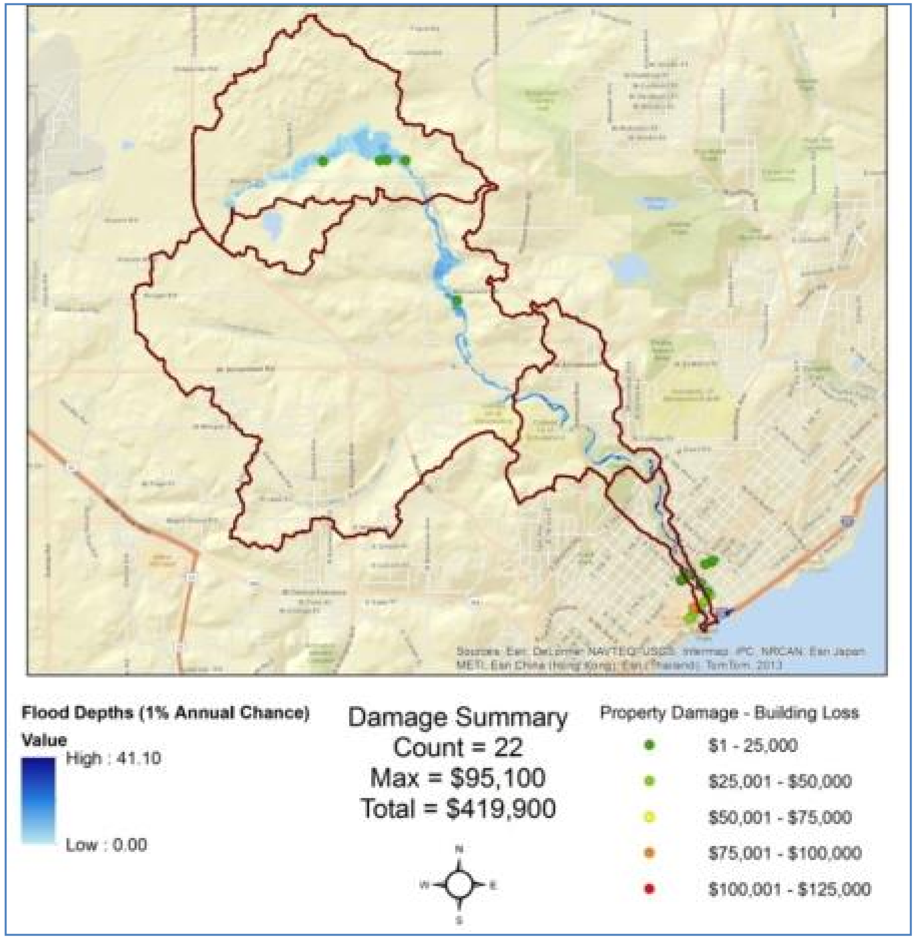


Flood damage to buildings = $400K

Toledo Flood Damage Costs

Flood damage to buildings = $930K

Duluth Flood Damage Costs



Flood damage to buildings = $420K

Step 3. Identify Flood Reduction GI Options

Many Options






Target: reduce peak discharge by

DULUTH

20%

TOLEDO

10%

How much green infrastructure storage is needed to reach this target?

DULUTH

76 acre-feet
(current conditions)

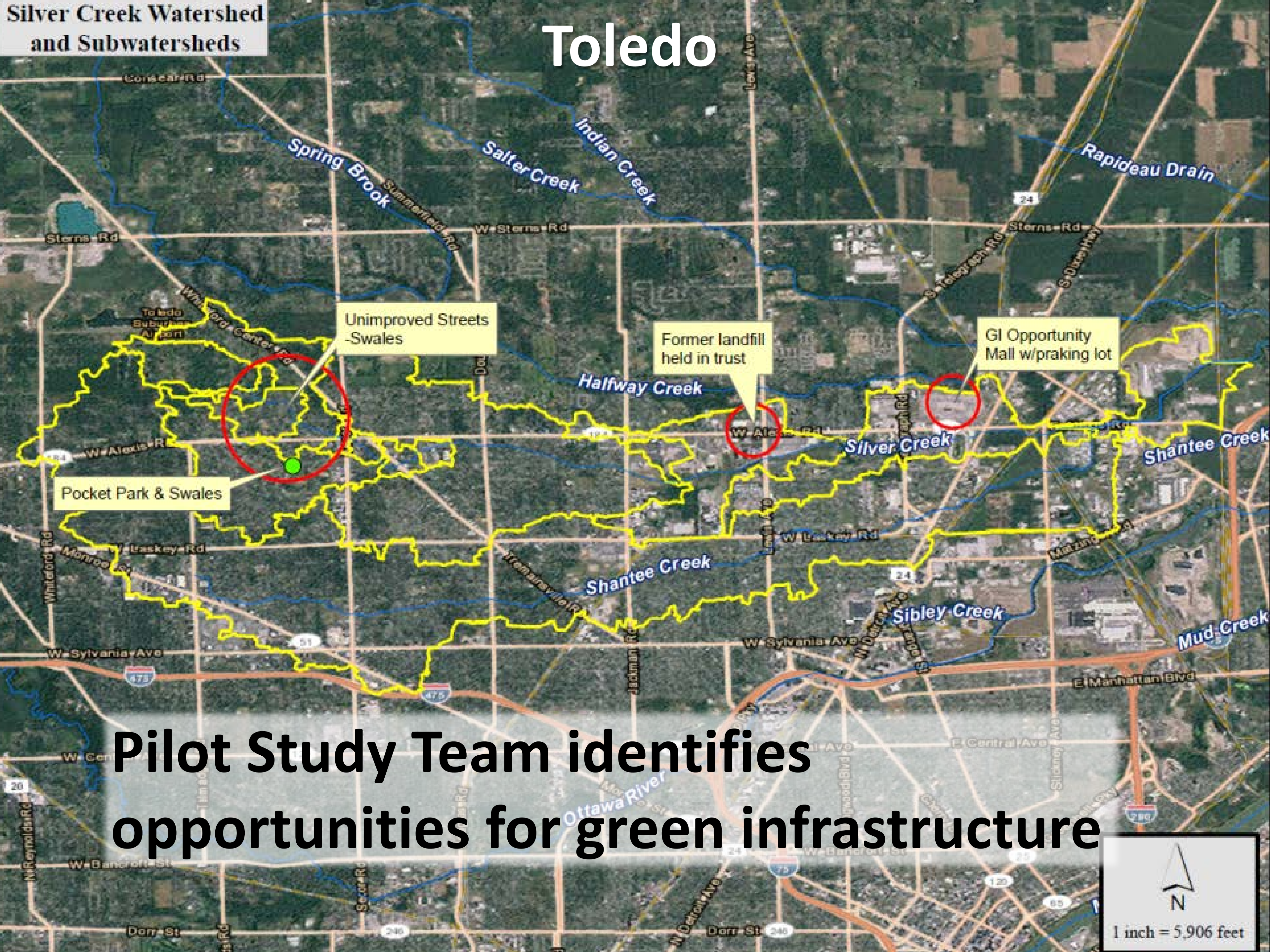
86 acre-feet
(future conditions)

TOLEDO

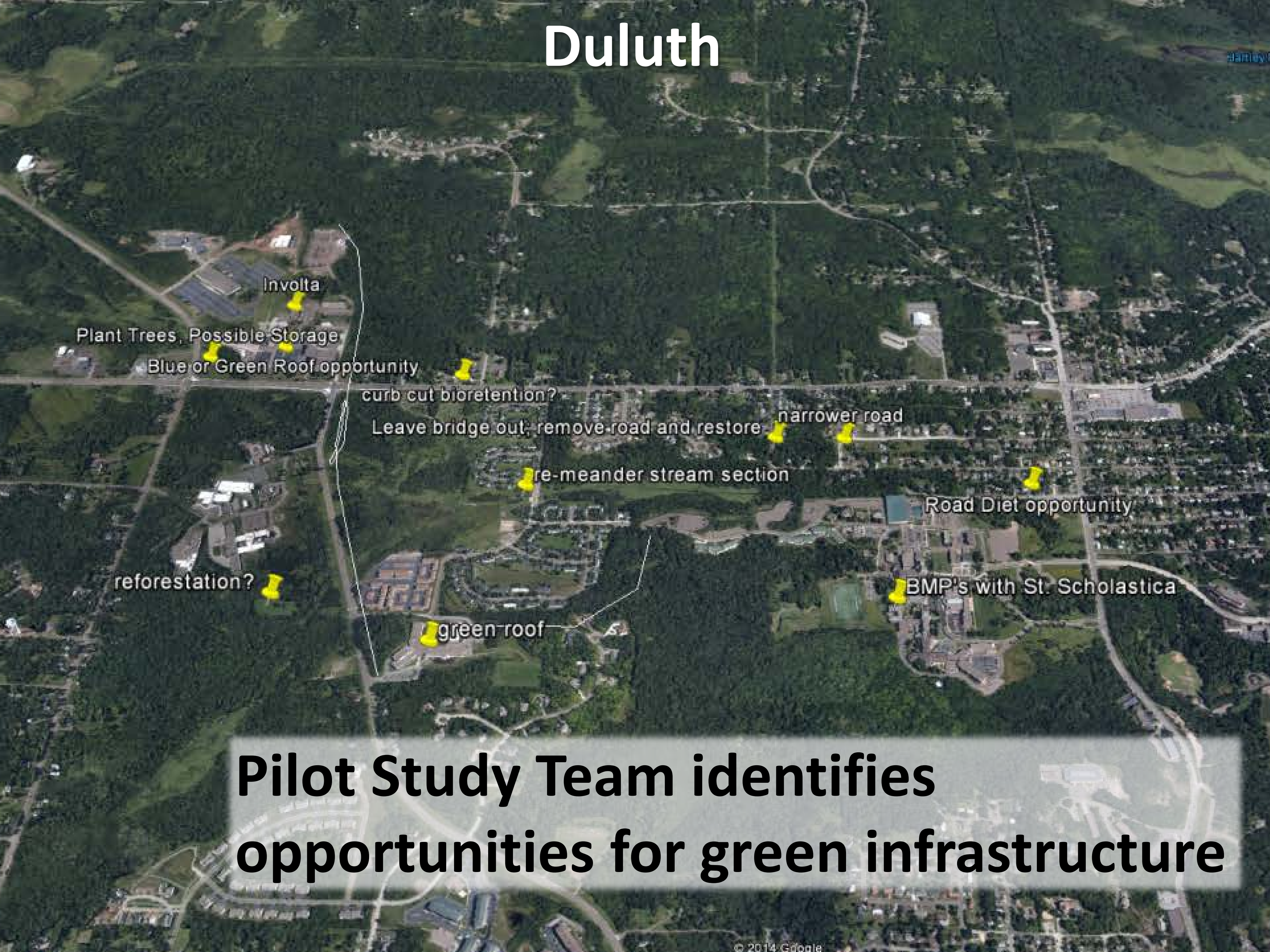
30 acre-feet
(current conditions)

32 acre-feet
(future conditions)

What and how much of each?


Silver Creek Watershed and Subwatersheds
Toledo
Spring Brook
Salter Creek
Indian Creek
Rapideau Drain
Summerfield Rd
W Sterns Rd
Sterns Rd
Toledo Suburban Airport
Whiteford Center Rd
Unimproved Streets -Swales
Former landfill held in trust
GI Opportunity Mall w/praking lot
Halfway Creek
W Alexis Rd
Silver Creek
Shantee Creek
Pocket Park & Swales
W Laskey Rd
Laskey Rd
Monroe St
Whiteford Rd
Shantee Creek
Sibley Creek
Mud Creek
W Sylvania Ave
E Manhattan Blvd
Pilot Study Team identifies opportunities for green infrastructure
Ottawa River
W Bancroft St
Dorr St
N
1 inch = 5,906 feet

Duluth



Pilot Study Team identifies opportunities for green infrastructure

GI Options of Interest

- Bioretention/bioswales along unimproved roads
- Blue Roofs
- Permeable Pavement (Unimproved Roads)
- Permeable Pavement (Sidewalk)
- Underground Storage
- Parcel Buy-outs (for on site detention)

Step 4. Assess how much flood damages are reduced using GI

Flood Reduction Scenarios

3. Current precipitation and current land use using GI

4. Future precipitation and future land use using GI

Toledo

How much are flood damages reduced using GI?

$740K*

$453K*

*Flood damage to buildings

Toledo

How much are flood damages reduced using GI?

$930K*

$527K*

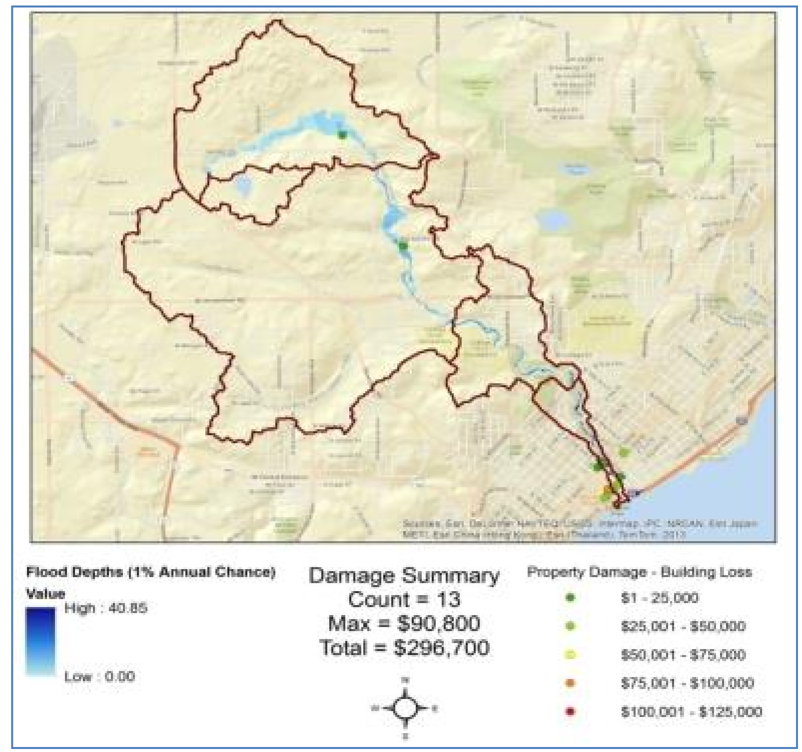
*Flood damage to buildings

Duluth

How much are flood damages reduced using GI?

$400K*

$296K*



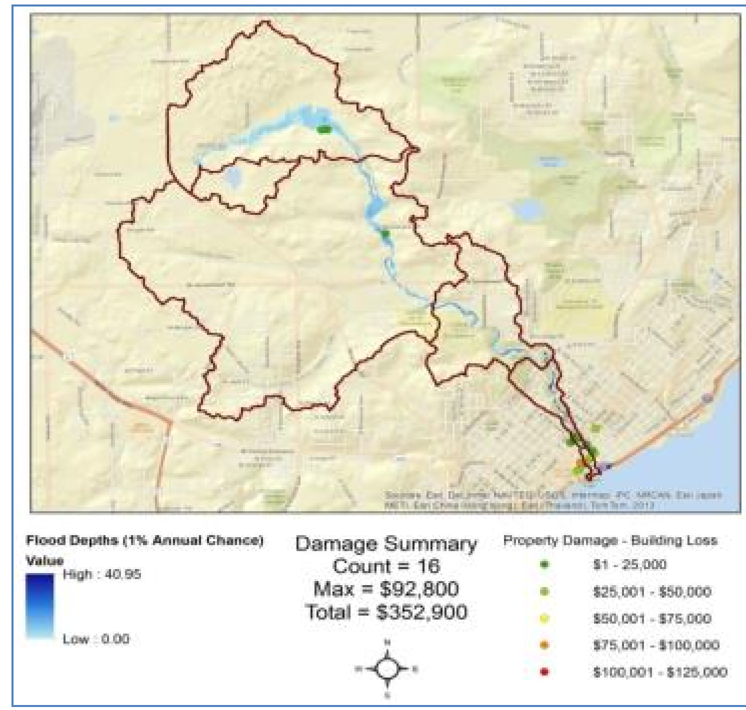
***Flood damage to buildings**

Duluth

How much are flood damages reduced using GI?

$420K*

$352K*



***Flood damage to buildings**

Toledo

Risk Reduced with GI Storage

No Green Infrastructure Storage

Current land use/current precipitation: 1%*

Future land use/future precipitation: 1.45%*

RISK

With Green Infrastructure Storage

Current with green infrastructure providing flood storage: 0.50%*

Future with green infrastructure providing flood storage: 0.71%

*Percent chance that a storm will occur in a year with peak discharge of 1,255 cfs and cause damages

Duluth

Risk Reduced with GI Storage

No Green Infrastructure Storage

Current land use/current precipitation: 1%*

Future land use/future precipitation: 1.84 %*

RISK

With Green Infrastructure Storage

Current with green infrastructure providing flood storage: 0.24%*

Future with green infrastructure providing flood storage: 0.51%*

*Percent chance that a storm will occur in a year with peak discharge of 1,530 cfs and cause damages

Estimated unit cost of green infrastructure

Step 5. Compare costs and benefits

Costs of green infrastructure to obtain storage using least expensive GI option

Toledo
30 acre-feet of storage with
least expensive GI = $1.77M

Duluth
76 acre-feet of storage with
least expensive GI = $4.3M


Benefits = Damages Avoided

Toledo’s Benefits

- For 20-year period: $700K not spent on flood damages to buildings ($1.77M for GI)

- For 50-year period: $1.77M not spent on flood damages to buildings ($1.77M for GI)

Duluth's Benefits

- For 20-year period: $1.63 million not spent on flood damages ($4.3M for GI)
- For 50-year period: $4.6M not spent on flood damages ($4.3M for GI)

You may be thinking…

1. Numbers are low
2. Costs outweigh benefits

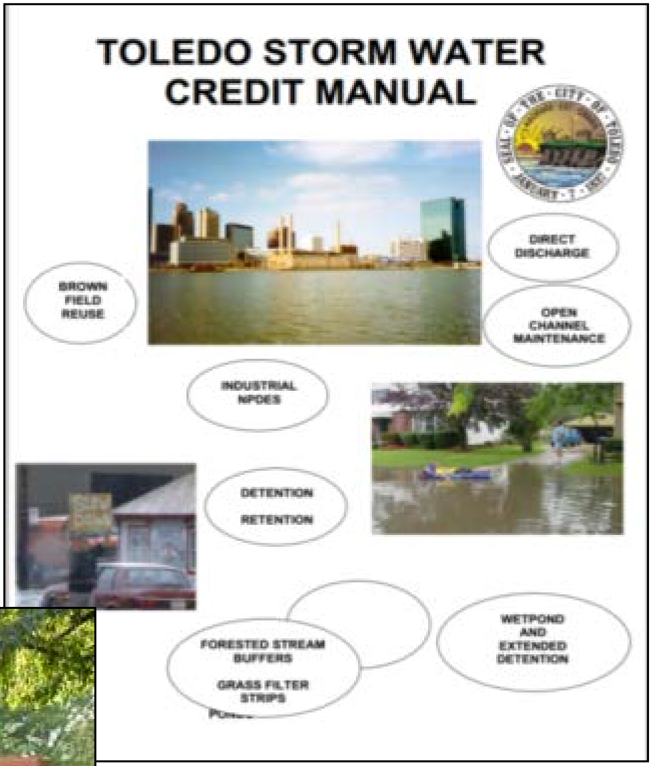
You Need Data…

- Buildings
- Roads, bridges
- Stormwater infrastructure
- Recreation
- Wages
- Land damages

We Had…

- Buildings (*Both communities*)
- ~~Roads, bridges~~
- Stormwater infrastructure (*Duluth only*)
- Recreation (*Duluth only*)
- ~~Wages~~
- Land damages (*Duluth only*)

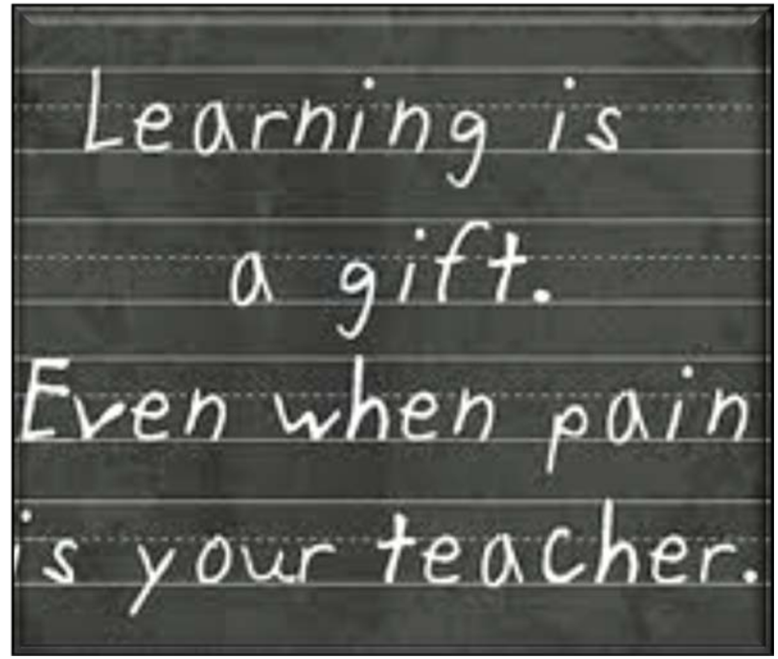
How Toledo Is Using Results



How Duluth Is Using Results

Lessons Learned

- Focus on longer term
- Hard to get all the data
- Look to implement GI over time
- Leverage other infrastructure investments
- Get a champion that is not elected or works for the city
- Consider benefits that cannot be monetized in decisions
- Partners are critical



What’s Next for NOAA?

Sharing what we have learned!

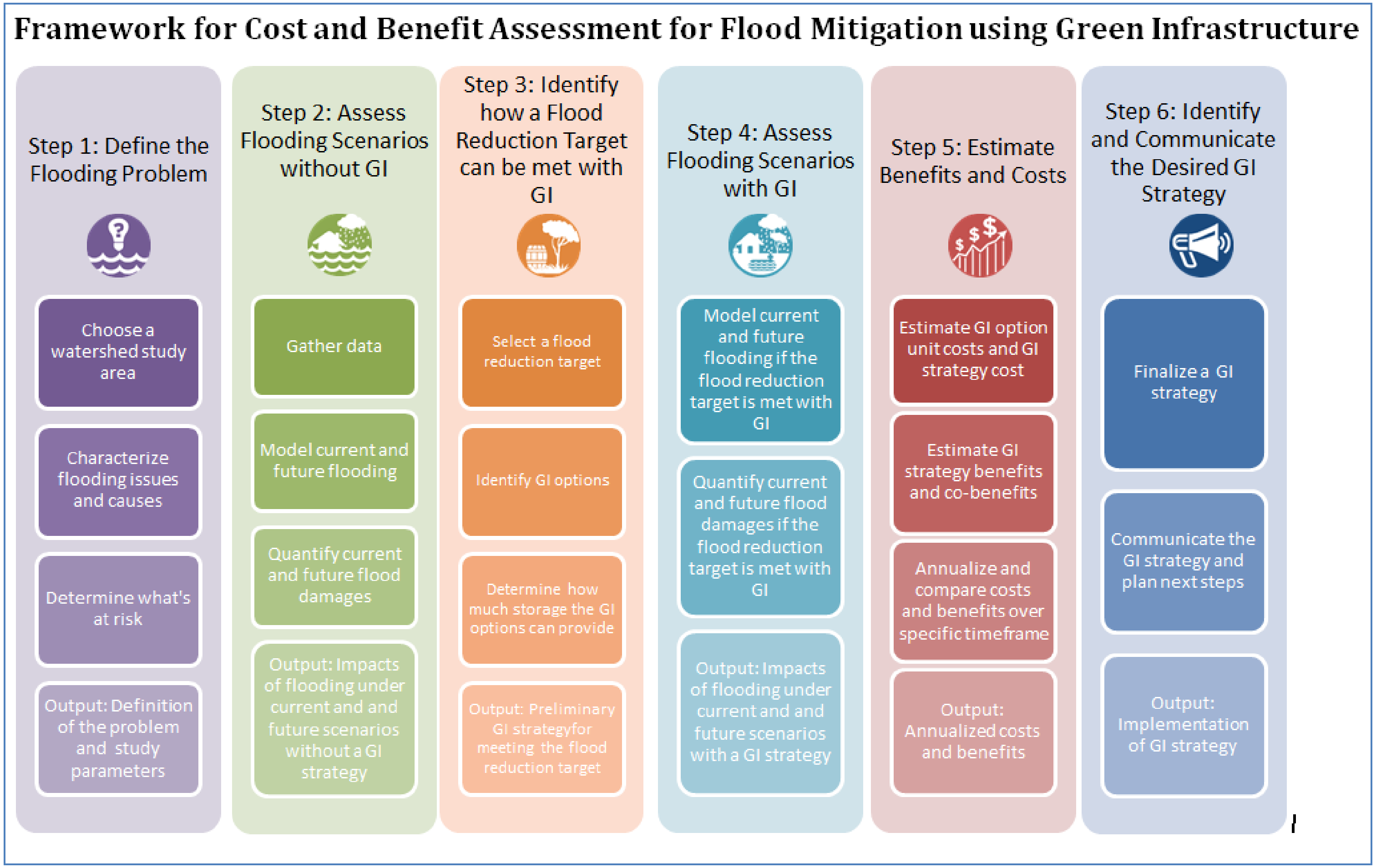
- Process Guide
- Data Matrix
- Green Infrastructure Options to Reduce Flooding

Digital Coast

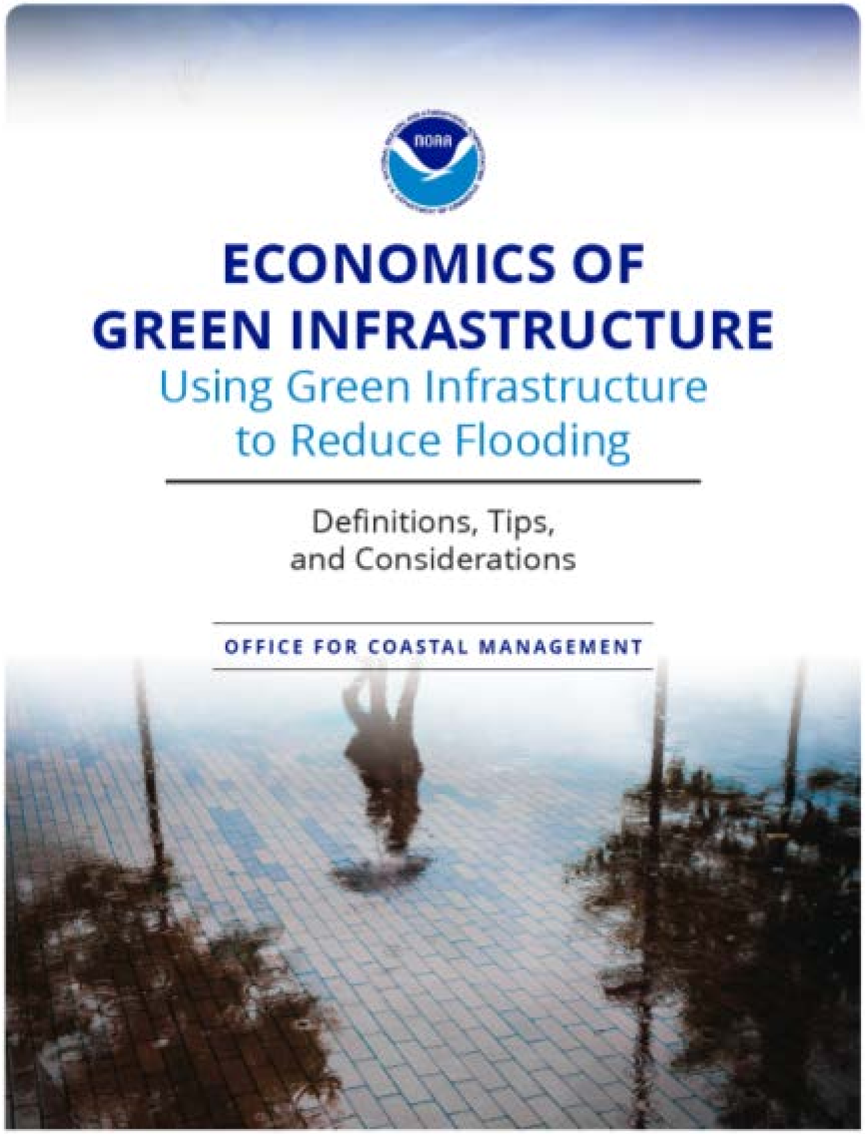
coast.noaa.gov/digitalcoast/

coast.noaa.gov/digitalcoast/publications/climate-change-adaptation-pilot

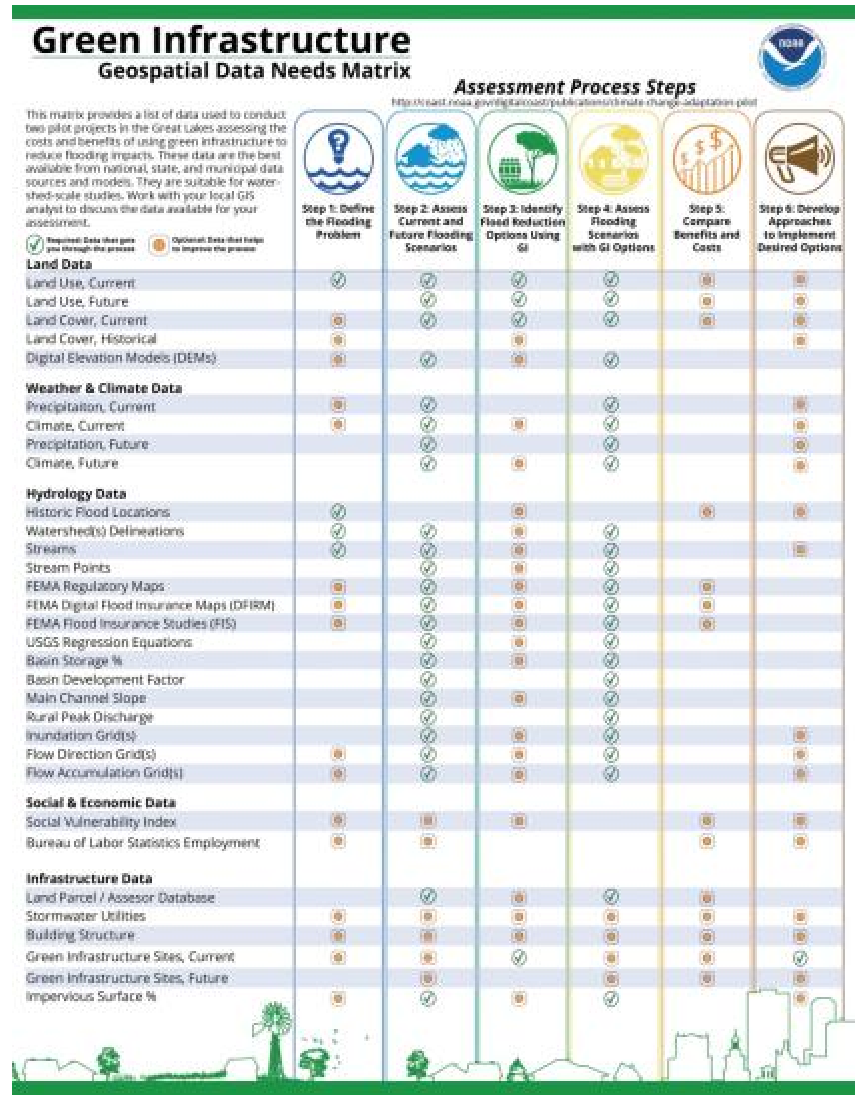
Assessing Costs and Benefits of Green Infrastructure for Flood Mitigation: A Process Guide for Communities



Companion Pieces



GI Options



Green Infrastructure
Geospatial Data Needs Matrix

This matrix provides a list of data used to conduct two pilot projects in the Great Lakes assessing the costs and benefits of using green infrastructure to reduce flooding impacts. These data are the best available from national, state, and municipal data sources and models. They are suitable for watershed-scale studies. Work with your local GIS analyst to discuss the data available for your assessment.

✓ Required: Data that gets you through the process
● Optional: Data that helps to improve the process

Assessment Process Steps

http://coast.noaa.gov/digitalcoast/publications/climate-change-adaptation-pilot

	Step 1: Define the Flooding Problem	Step 2: Assess Current and Future Flooding Scenarios	Step 3: Identify Flood Reduction Options Using GI	Step 4: Assess Flooding Scenarios with GI Options	Step 5: Compare Benefits and Costs	Step 6: Develop Approaches to Implement Desired Options
Land Data						
Land Use, Current	✓	✓	✓	✓	●	●
Land Use, Future		✓	✓	✓	●	●
Land Cover, Current	●	✓	✓	✓	●	●
Land Cover, Historical	●		●			●
Digital Elevation Models (DEMs)	●	✓	●	✓		
Weather & Climate Data						
Precipitaiton, Current	●	✓		✓		●
Climate, Current	●	✓	●	✓		●
Precipitation, Future		✓		✓		●
Climate, Future		✓	●	✓		●
Hydrology Data						
Historic Flood Locations	✓		●		●	●
Watershed(s) Delineations	✓	✓	●	✓		
Streams	✓	✓	●	✓		●
Stream Points		✓	●	✓		
FEMA Regulatory Maps	●	✓	●	✓	●	
FEMA Digital Flood Insurance Maps (DFIRM)	●	✓	●	✓	●	
FEMA Flood Insurance Studies (FIS)	●	✓	●	✓	●	
USGS Regression Equations		✓	●	✓		
Basin Storage %		✓	●	✓		
Basin Development Factor		✓		✓		
Main Channel Slope		✓	●	✓		
Rural Peak Discharge		✓		✓		
Inundation Grid(s)		✓	●	✓		●
Flow Direction Grid(s)	●	✓	●	✓		●
Flow Accumulation Grid(s)	●	✓	●	✓		●
Social & Economic Data						
Social Vulnerability Index	●	●	●		●	●
Bureau of Labor Statistics Employment	●	●			●	●
Infrastructure Data						
Land Parcel / Assesor Database		✓	●	✓	●	
Stormwater Utilities	●	●	●	●	●	●
Building Structure	●	●	●	●	●	●
Green Infrastructure Sites, Current	●	●	✓	●	●	✓
Green Infrastructure Sites, Future		●		●	●	●
Impervious Surface %	●	✓	●	✓		●

Data Matrix

Contact information:

Lori Cary-Kothera

Lori.Cary-Kothera@noaa.gov

843-740-1243

Digital Coast

coast.noaa.gov/digitalcoast/

coast.noaa.gov/digitalcoast/publications/climate-change-adaptation-pilot

Downtown Links Corridor Project
Tucson, Arizona

Border Green Infrastructure Forum
May 2015

Downtown LINKS

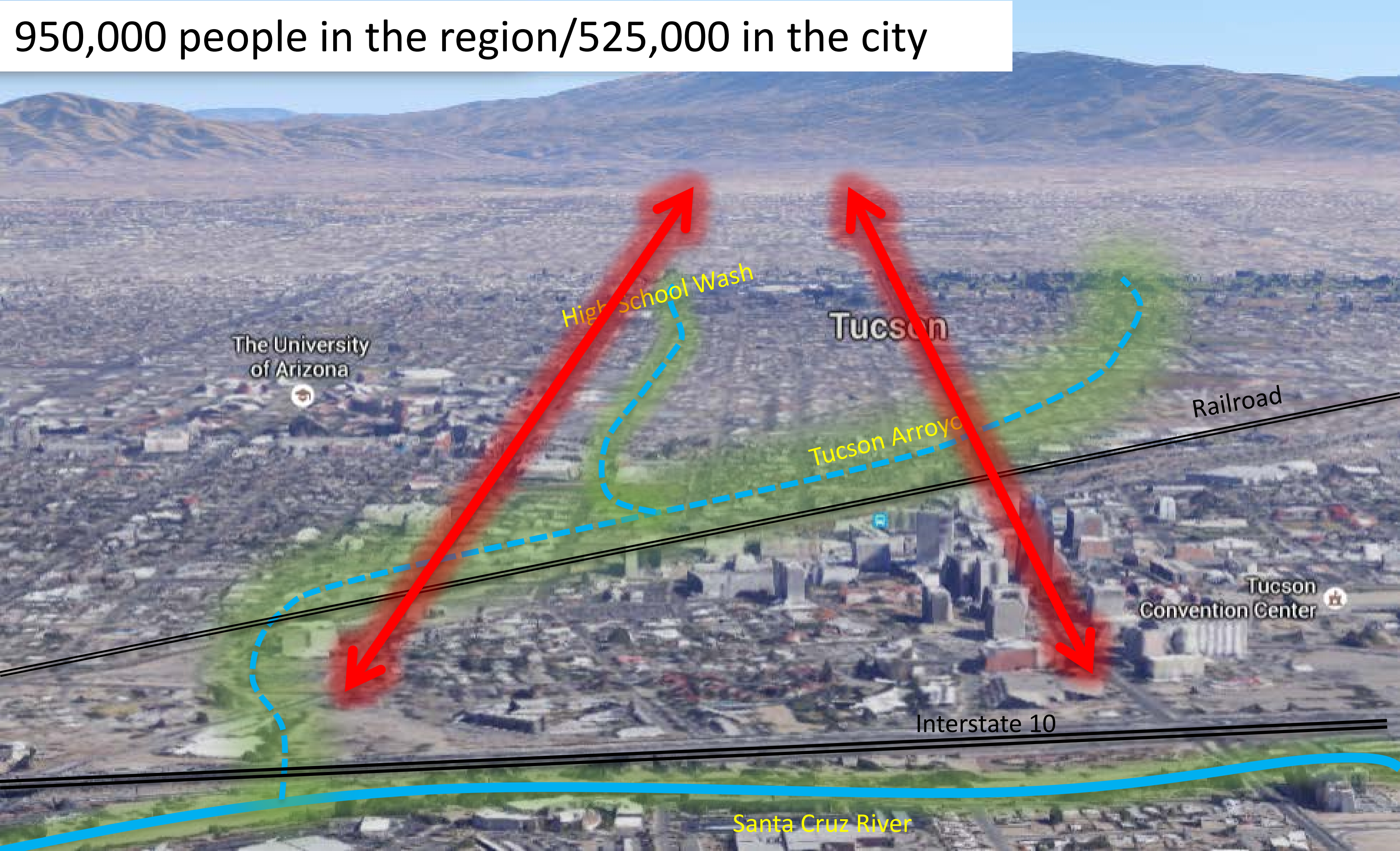
RTA Regional Transportation Authority

CITY OF TUCSON FOUNDED 1775

HDR

Tucson Valley
view looking east

950,000 people in the region/525,000 in the city

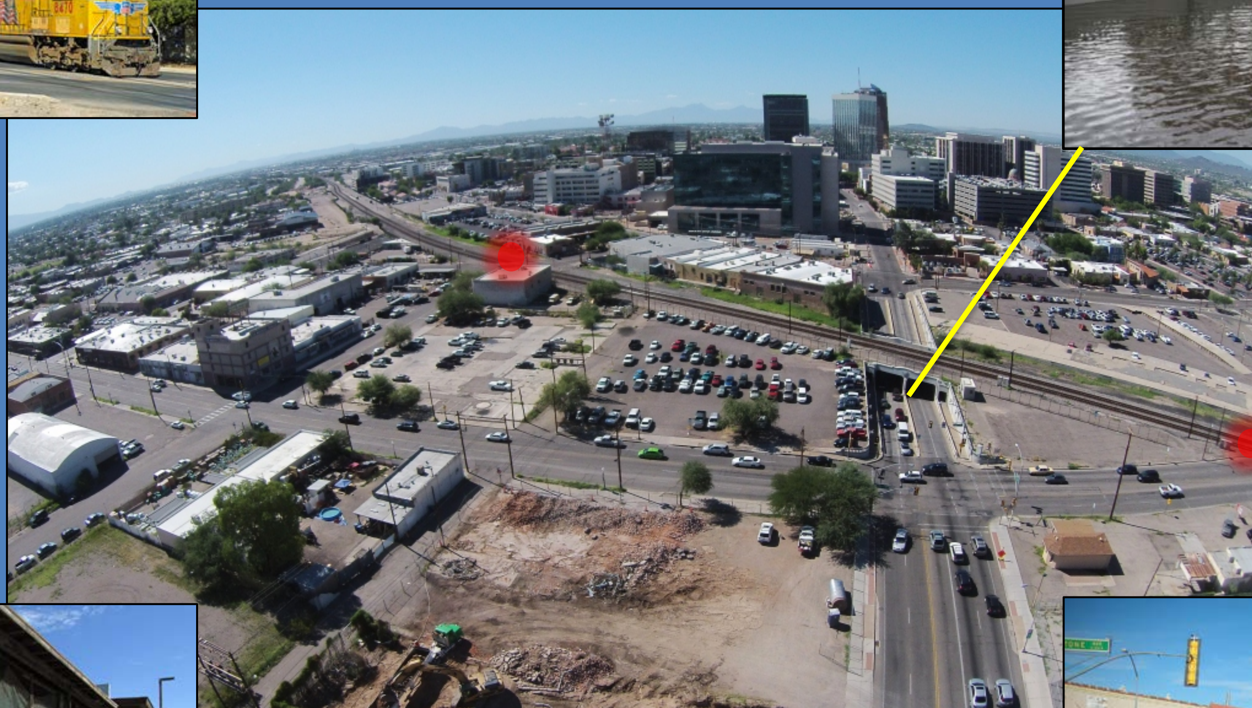


Downtown Tucson
view looking west

Challenges

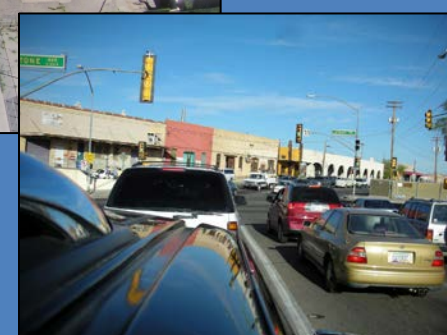
45 trains each day
delays & fatalities

flooding &
emergencies



old industrial zone/
soil contamination

traffic circulation/
bike & ped safety



Project Goals

1980s to 2000s: there a major shift in transportation planning

not just about roads, but also creating livable communities

Improve Multi-modal Capacity, Connectivity, and Safety

- roadway improvements, <u>but no freeway design</u>
- bike lanes and sidewalks
- rail crossing improvements for all modes

Improve the Drainage System to Reduce Flooding

- Tucson Arroyo, High School Wash, and others

Improve the Image of the Corridor

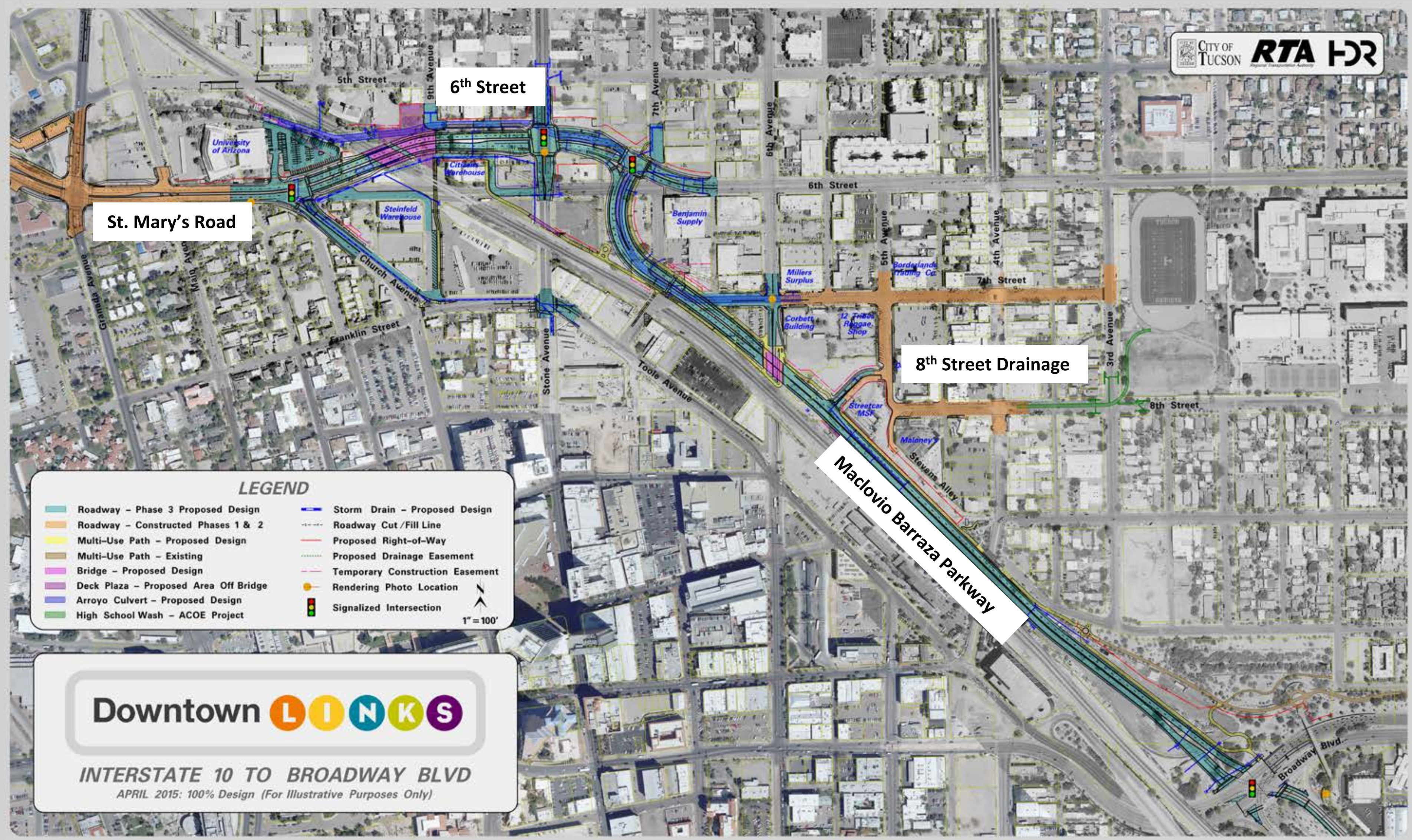
- native desert landscaping
- environmental clean-up of industrial properties
- sustainable design: reduce, re-use, recycle
- public art

Encourage Good Land Use Redevelopment

- Historic preservation, revitalization, housing, shops

"Downtown Links" Corridor Alignment

2005- planning began. 2008- final alignment approved by Mayor and Council.



Scope and Budget

Scope for Design: (HDR Inc., and consultant team)

The project is in the 20-year Regional Transportation Authority (RTA) plan approved by voters in 2006. A 1.3 mile long multi-modal roadway corridor linking I-10 and Broadway.

- New roadway corridor with 4 vehicle lanes, bike lanes, sidewalks, separated bike path
- Drainage improvements: new Tucson Arroyo culvert
- 6th Street Underpass at the Union Pacific Railroad
- Rail-crossing improvements to establish a federal Quiet Zone
- 9th Avenue Deck Plaza with public space, landscaping, public art
- Native desert landscaping and passive water harvesting
- Public art – 6 total artists for corridor

Budget: $84.6M

- $76.1M RTA funds
- $8.5M HURF funds

FEMA Floodplain

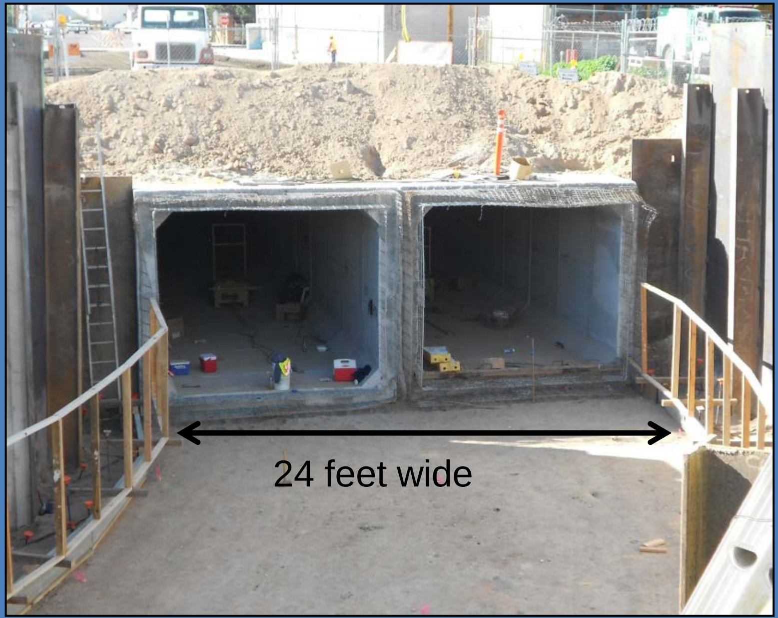
Current

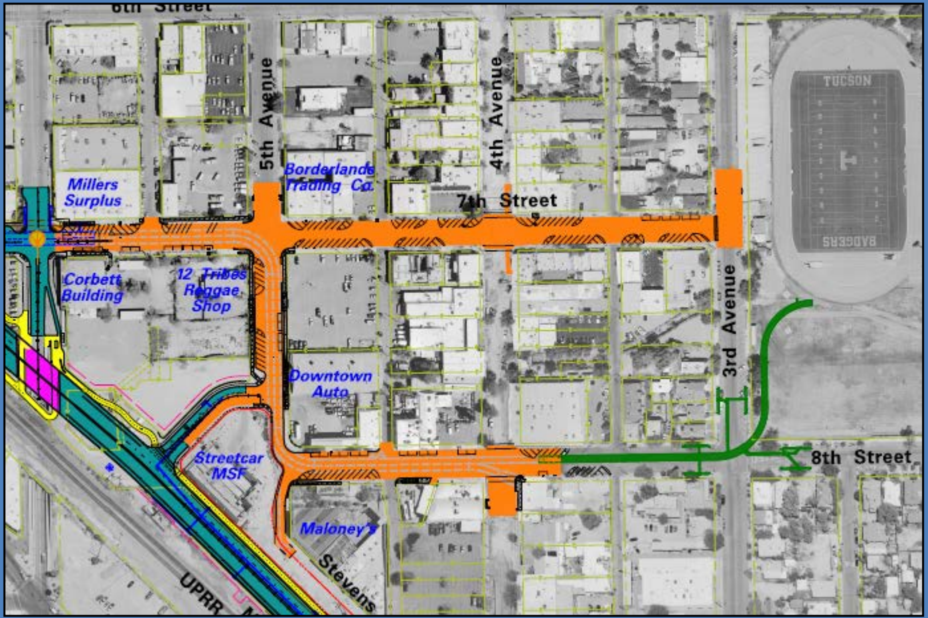

Fourth Avenue- 2009


Fourth Avenue- 2009

Phase I: 8th Street Drainage

Completed in May 2012





Phase II: St. Mary's Road

Completed in May 2014

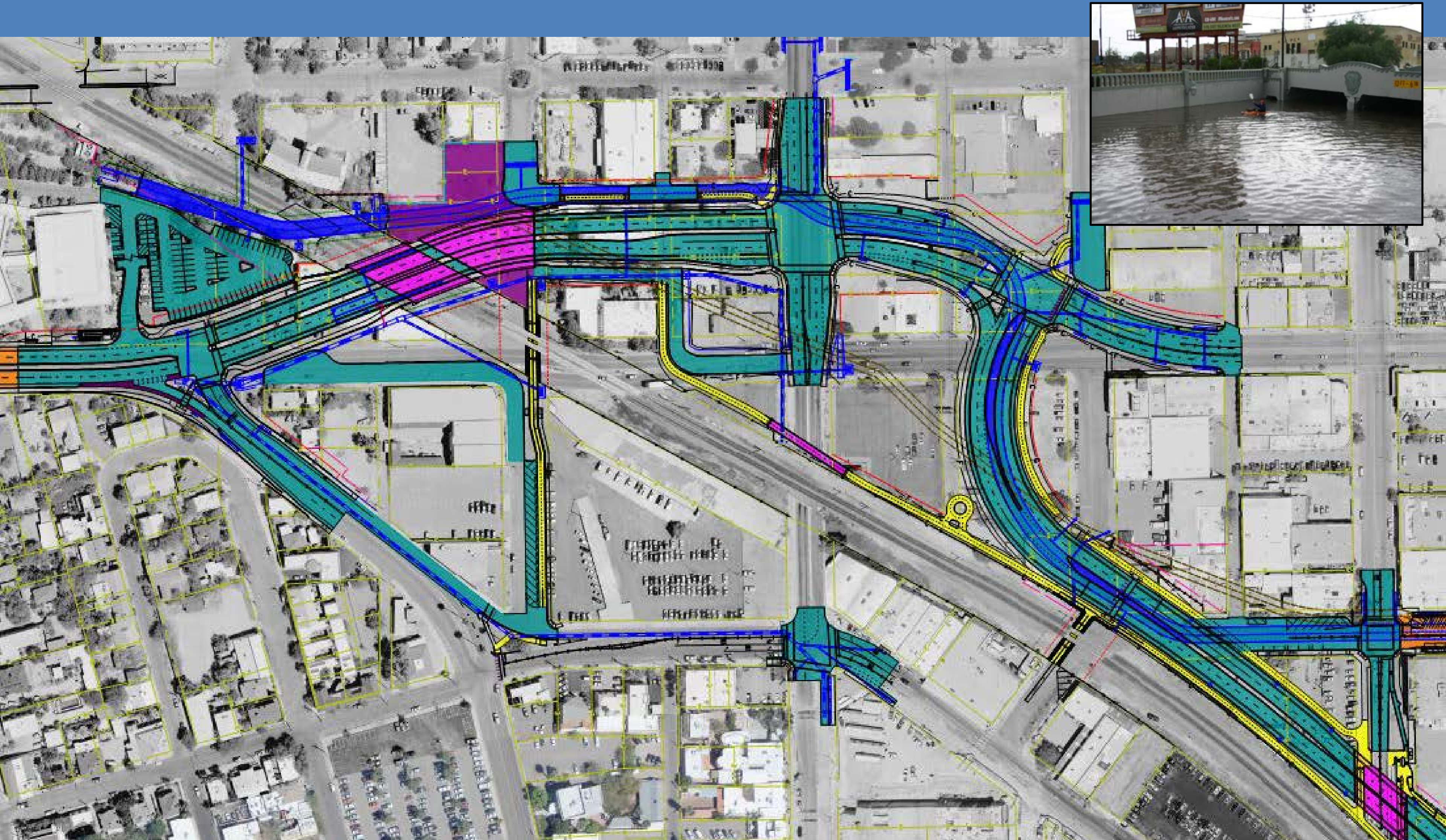
- Re-use of concrete
- Re-use of asphalt
- Sonoran plants
- Water-harvesting
- LED lighting
- Protected bike lanes

Phase II: St. Mary's Road

Completed in May 2014

Phase III: Church Ave. to Broadway

Drainage, Connectivity, Reduce Congestion, Lighting, etc…



Phase III: Church Ave. to Broadway

Demolition, Reuse and Recycle

6th Street Underpass

Looking east from Church Ave. intersection

Rendering for illustrative purposes only

9^{th} Avenue Deck Plaza

Looking west from future 6^{th} Street Underpass

9th Avenue Deck Plaza

Rendering for illustrative purposes only

Stone Ave. Bike/Ped Bridge

Looking south from future 6th Street intersection

Rendering for illustrative purposes only

Maclovio Barraza Parkway Bridge

Looking south along 6th Avenue

Future Maclovio Barraza Parkway

Looking northwest from Broadway

Next Steps

- **Phase III Design**
  - Finalize 100% Plans in June 2015
  - Work with artists to finalize project art
- **Property Acquisitions**
  - Complete acquisitions and demolitions in 2015
- **Utility Relocations**
  - Private Utility (power, phone/com, other…)
  - Tucson Water
  - Pima County Sewer
- **Phase III Construction**
  - Begin mid 2016 and finish late 2018

More Information

Downtown Links Website
www.downtownlinks.info

Tom Fisher, Project Manager (Planning)
City of Tucson Department of Transportation
tom.fisher@tucsonaz.gov

Brent Kirkman, Project Engineer
HDR Inc.
Brent.Kirkman@hdrinc.com

L.A. Story:

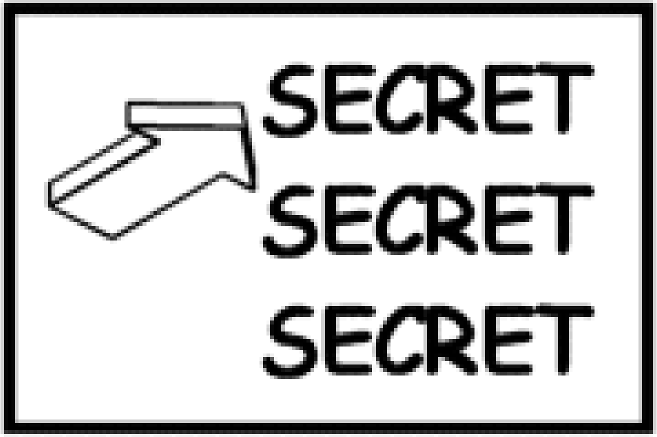
From Gray to Green in a Semi-Arid Megalopolis

L.A. Story, 1991

Border Green Infrastructure Forum
Tucson, AZ
May 20, 2015

Presented by Edith de Guzman
Director of Research, TreePeople

HERRING



talk

ERR
ERR

HEARTED

THODEEPUGHT

TreePeople Founded in 1973

April 23, 1973

Andy vs. the Bureaucratic Deadwood

BY MICHAEL SEILER
Times Staff Writer

Andy Lipkis, a 19-year-old college freshman very much into ecology, had this idea a couple of years ago: The trees in the San Bernardino National Forest are dying from the smog that drifts east out of Los Angeles, so find some smog-resistant trees and replant them there.

After all, Lipkis thought, the experts say the forest in the Big Bear-Lake Arrowhead-Barton Flats area could be dead in as little as 20 years if nothing is done.

A pure case for a bit of individual initiative, right? One young man could get the ecological bandwagon rolling.

It wasn't quite that easy. There were some complications along the way. Like the bureaucracy of the California Division of Forestry.

Lipkis discovered a few months ago that the division had 20,000 smog-resistant Sierra redwoods and sugar pines, all under a year old, growing in its tree nursery up near Davis.

Andy told the forestry people his plan. They said that it was a nice idea, but rules are rules, and the division does not give its baby trees away. If they're not sold, they're plowed under.

They cost two and one-half cents per tree and Andy wanted all 20,000 trees.

Tight Student Budget

TreePeople

TreePeople’s Mission

To inspire, engage and support the people of Los Angeles to take personal responsibility for the urban environment, making it healthy, fun, safe and sustainable – and share the process as a model for the world.

TreePeople

TreePeople Today

Forestry

Education

Policy and Research

TreePeople

TreePeople's Vision

Tree Canopy Cover *>25%* + **Local Water Supply *>50%*** + **Healthy Soil**

=

A Climate-Resilient Los Angeles

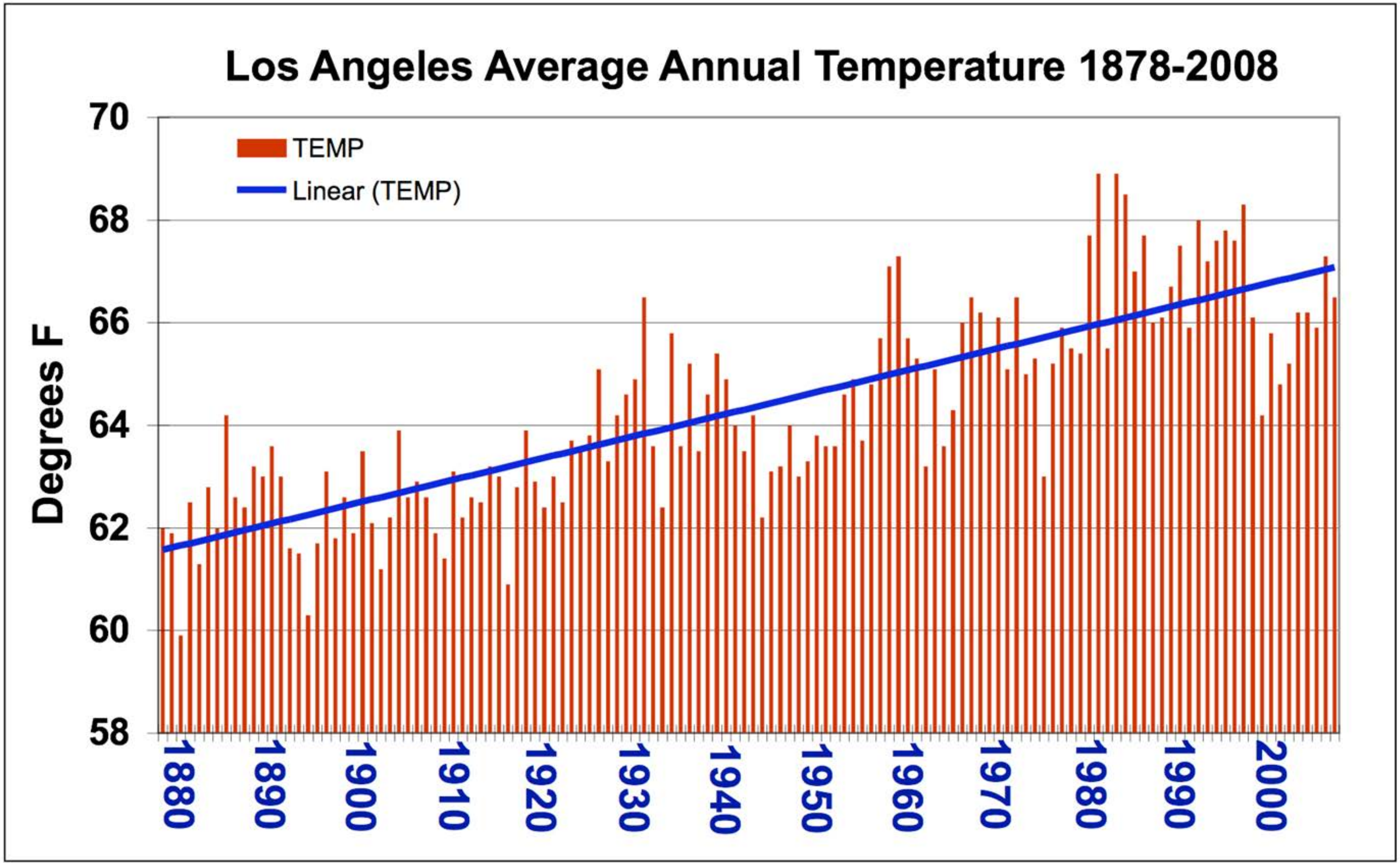
TreePeople

Urban Forest?

Street with no tree canopy, Los Angeles

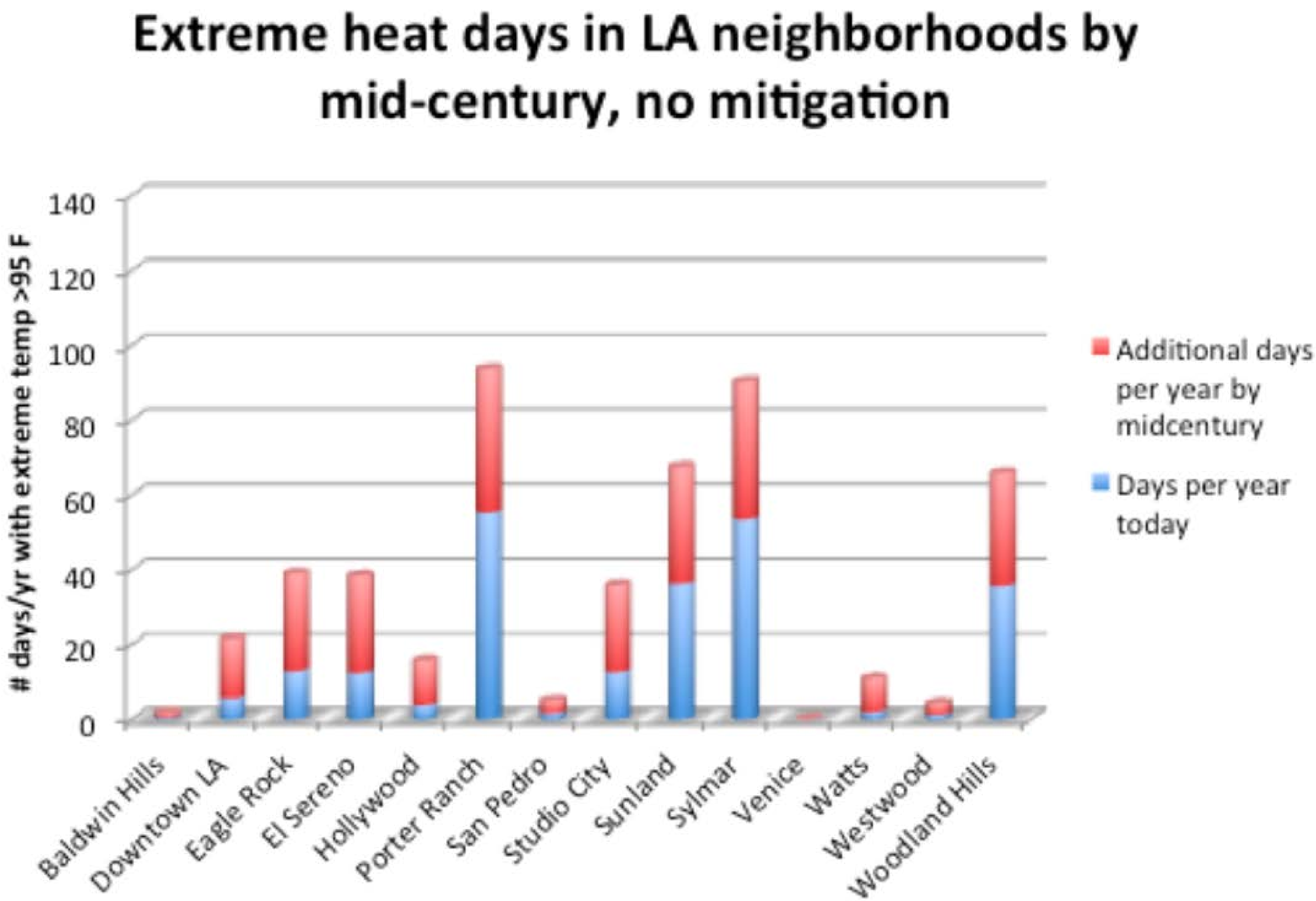
TreePeople

Urban Heat



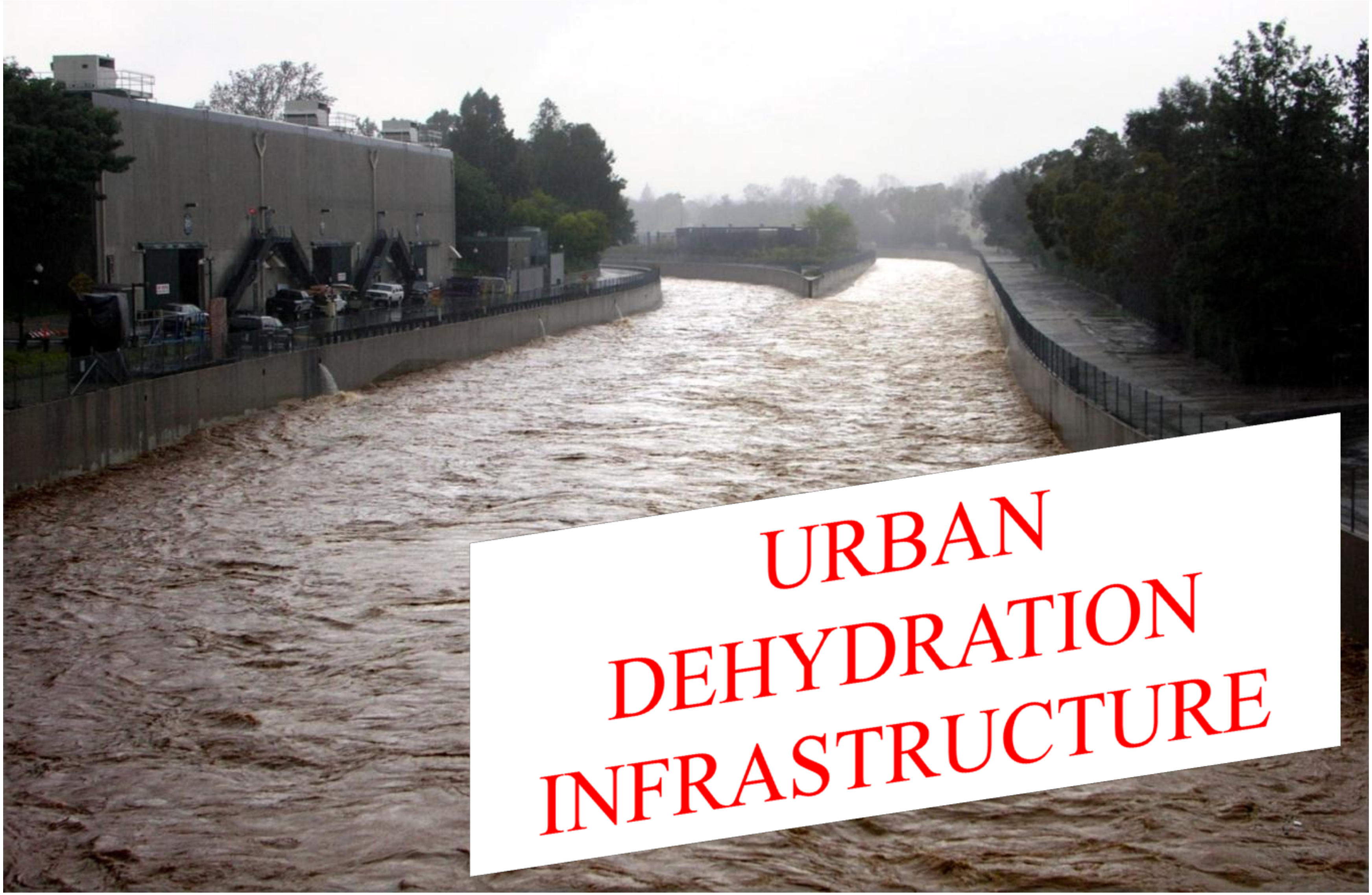
TreePeople

Urban Heat

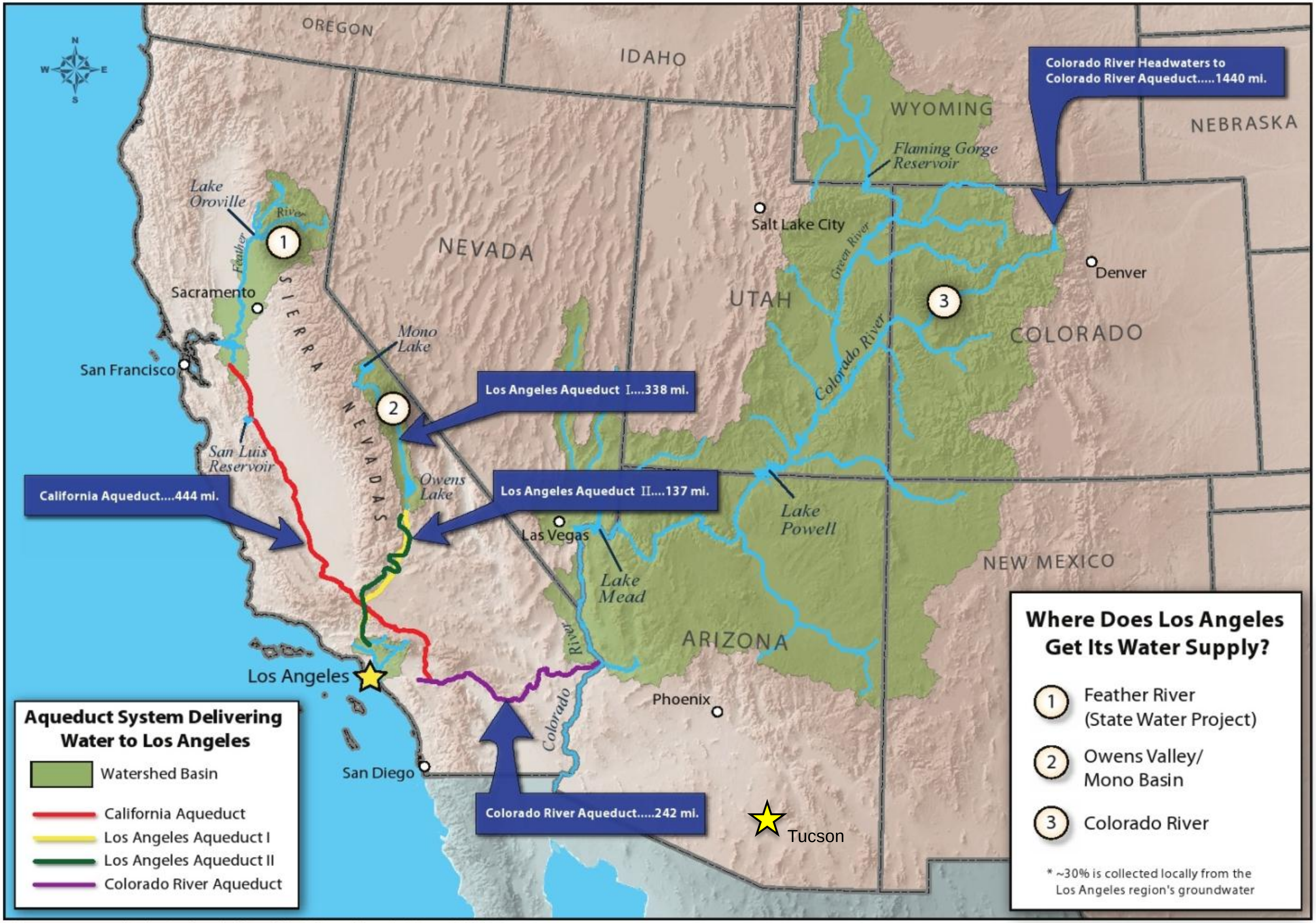


Dr. Alex Hall, UCLA, "Mid-Century Warming in the Los Angeles Region," c-change.la/temperature

Water Management?



Headwaters of the Los Angeles River



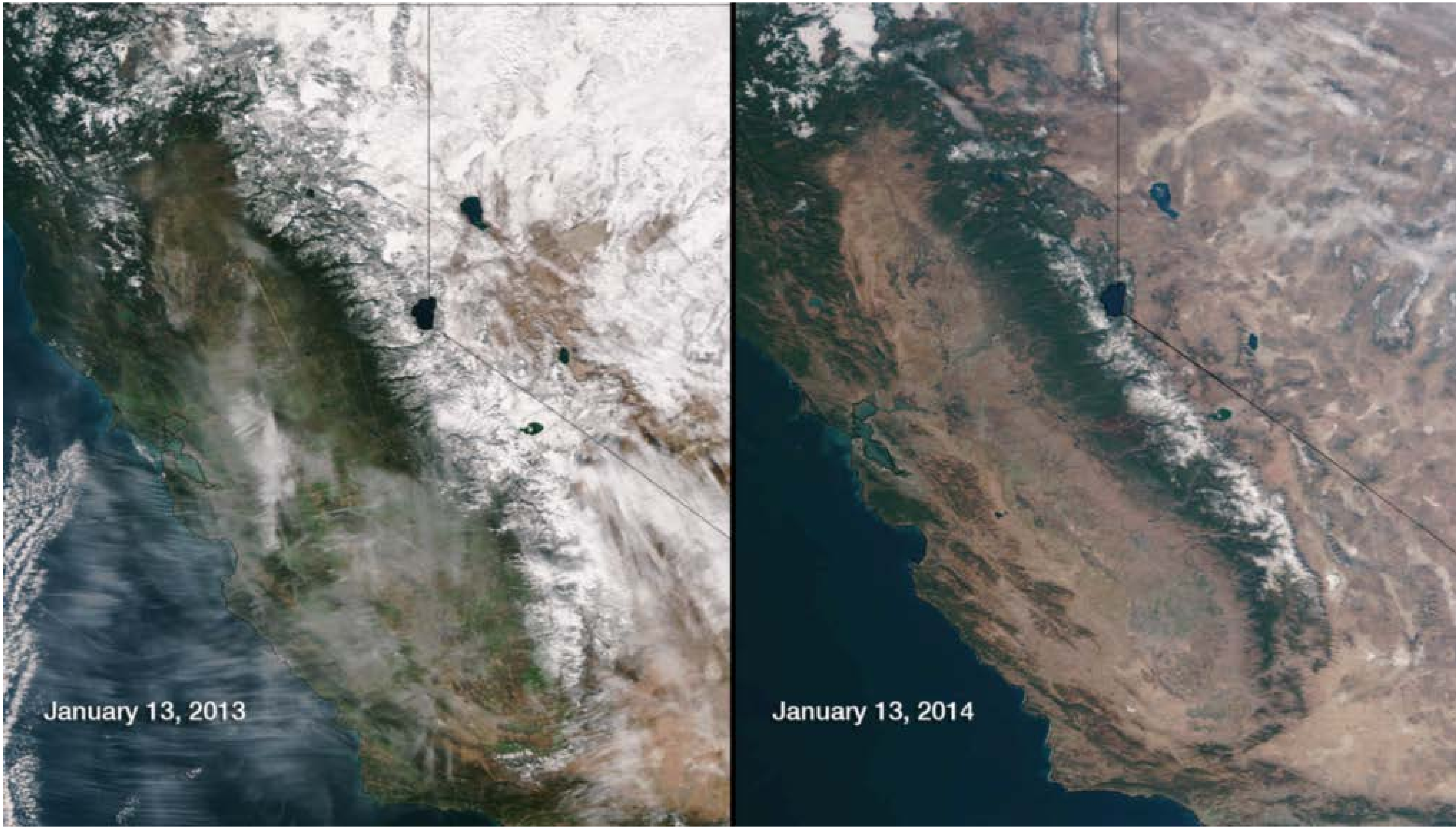
This map was created by the Los Angeles & San Gabriel Rivers Watershed Council, 2008 ©

Map courtesy of Council for Watershed Health

Less water available for import

Photos: www.aquafornia.com

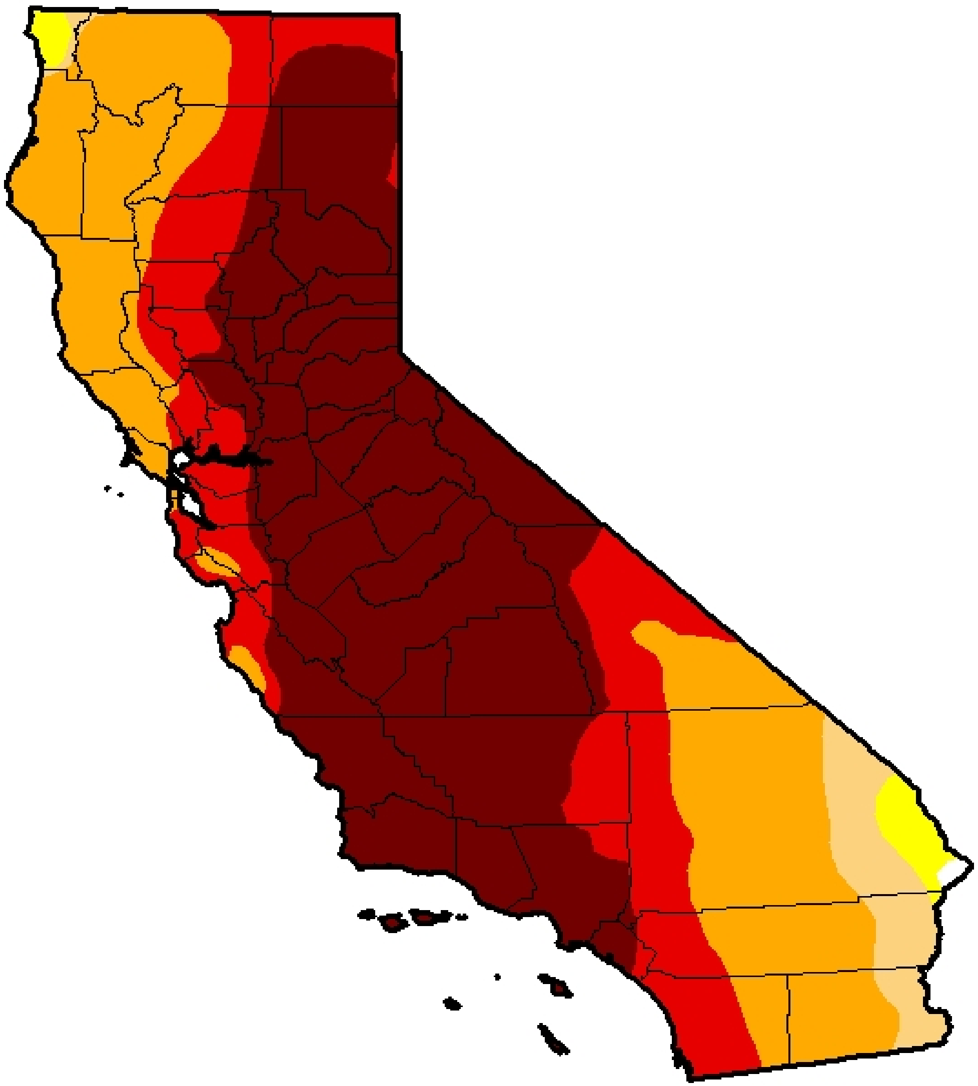
The drought



http://www.nnvl.noaa.gov/MediaDetail2.php?MediaID=1483&MediaTypeID=1

TreePeople

U.S. Drought Monitor
California



May 5, 2015

(Released Thursday, May. 7, 2015)

Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.14	99.86	98.28	93.91	66.60	46.77
Last Week 4/28/2015	0.14	99.86	98.11	93.44	66.60	46.77
3 Months Ago 2/3/2015	0.16	99.84	98.13	93.57	77.46	39.99
Start of Calendar Year 12/30/2014	0.00	100.00	98.12	94.34	77.94	32.21
Start of Water Year 9/30/2014	0.00	100.00	100.00	95.04	81.92	58.41
One Year Ago 5/6/2014	0.00	100.00	100.00	95.93	76.68	24.77

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

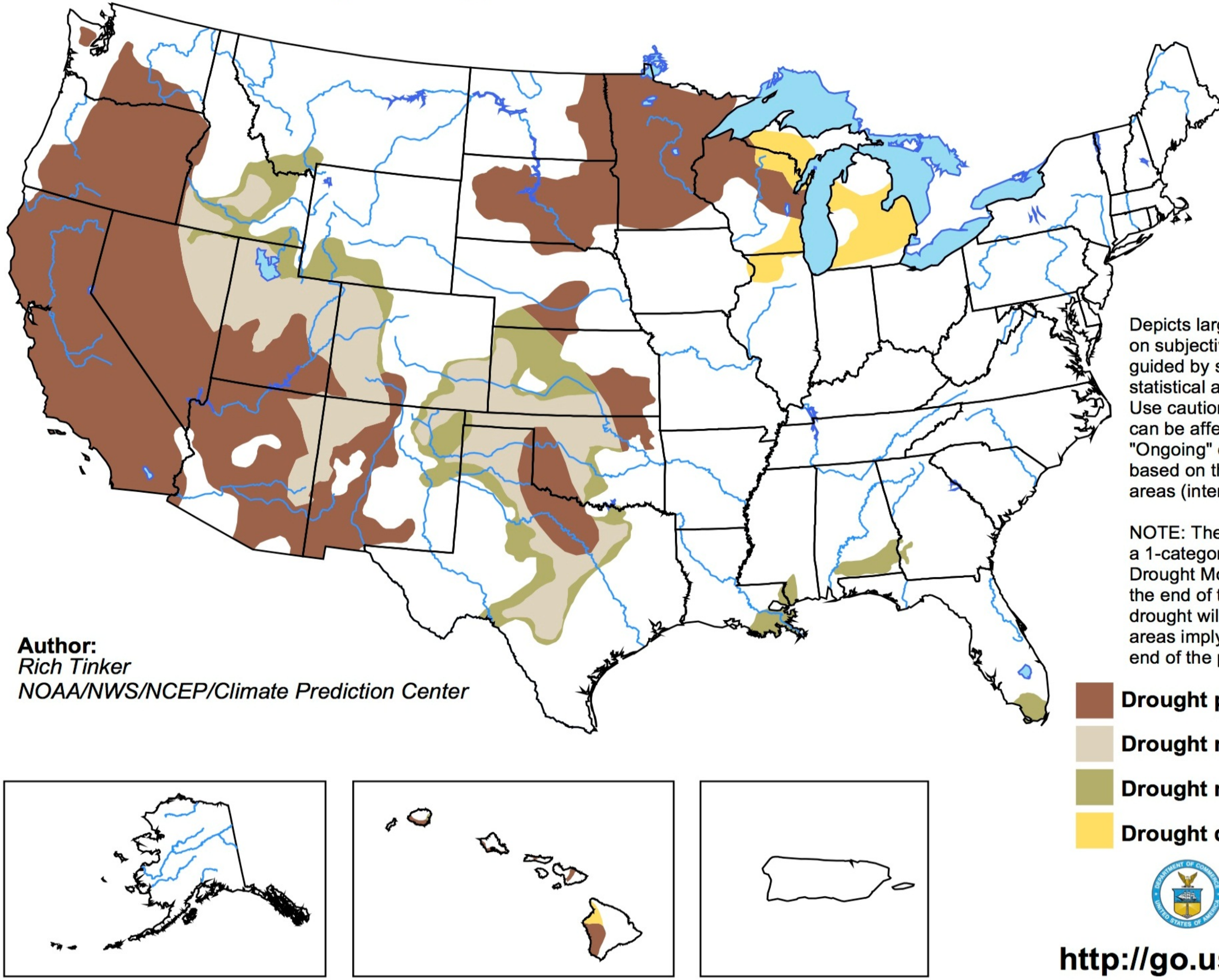
Author:
Mark Svoboda
National Drought Mitigation Center

http://droughtmonitor.unl.edu/

U.S. Seasonal Drought Outlook

Drought Tendency During the Valid Period

Valid for April 16 - July 31, 2015
Released April 16, 2015



Author:
Rich Tinker
NOAA/NWS/NCEP/Climate Prediction Center

Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Use caution for applications that can be affected by short lived events. "Ongoing" drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to D4).

NOTE: The tan areas imply at least a 1-category improvement in the Drought Monitor intensity levels by the end of the period, although drought will remain. The green areas imply drought removal by the end of the period (D0 or none).

Drought persists/intensifies
Drought remains but improves
Drought removal likely
Drought development likely

http://go.usa.gov/hHTe

Water Management?

Headwaters of the Los Angeles River

TreePeople

Watershed Management

Residential rain garden in Los Angeles

Stormwater infiltration infrastructure beneath Elmer Avenue Project

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Urban Heat Island

Urban Forest

TreePeople

How can we shift from gray to green?

To change the way the city looks and *functions*, we must change the way government agencies and communities *manage* the city.

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Nature is the model

Green Infrastructure

Ecosystem Management

Low Impact Development

Biomimicry

Collaborative Governance

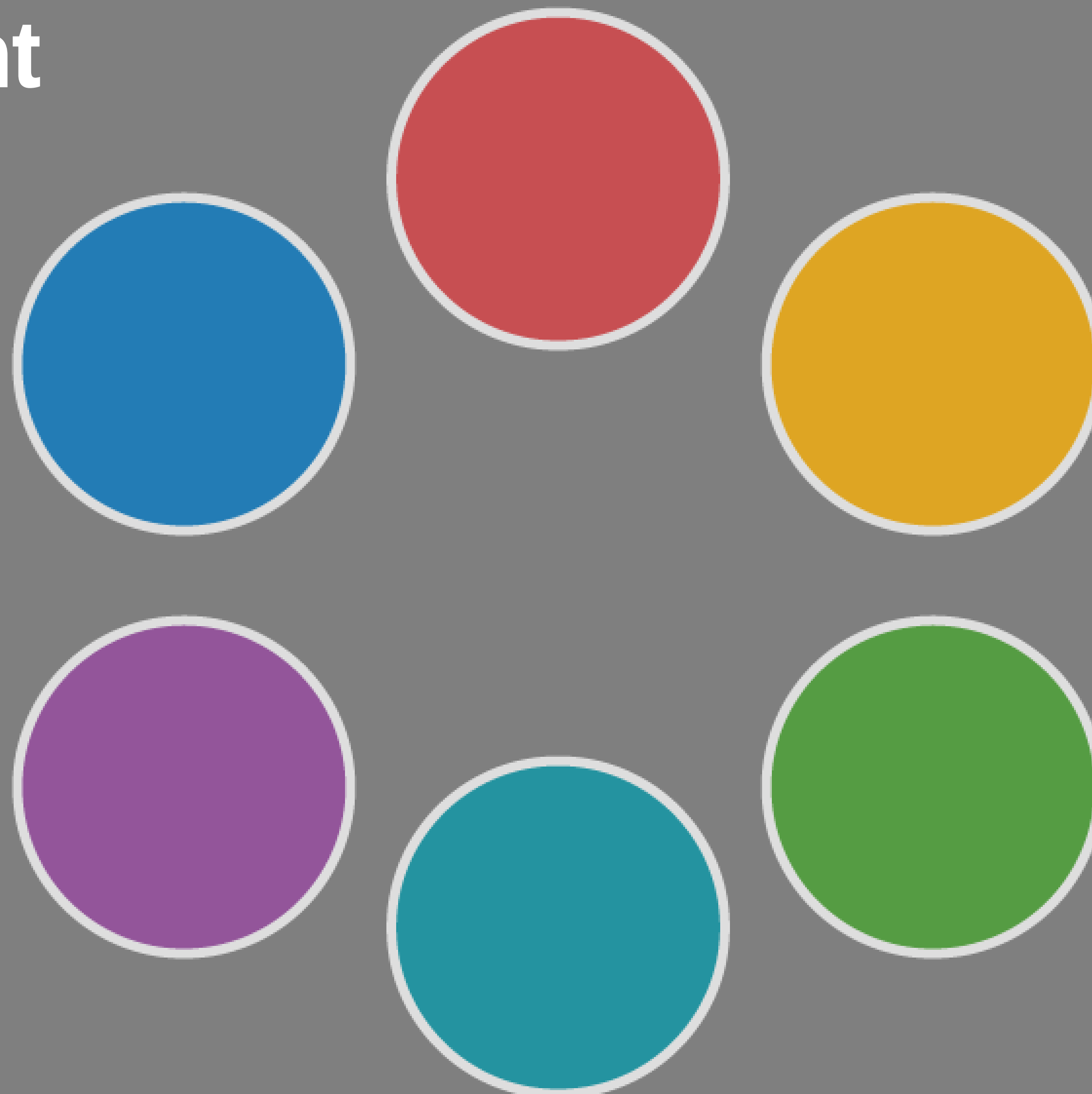
Multiple-Benefit Projects

TreePeople

Disintegrated Management

Where Los Angeles Started

Disintegrated approach wastes resources, duplicates efforts and imposes unsustainable practices.



Disintegrated Management

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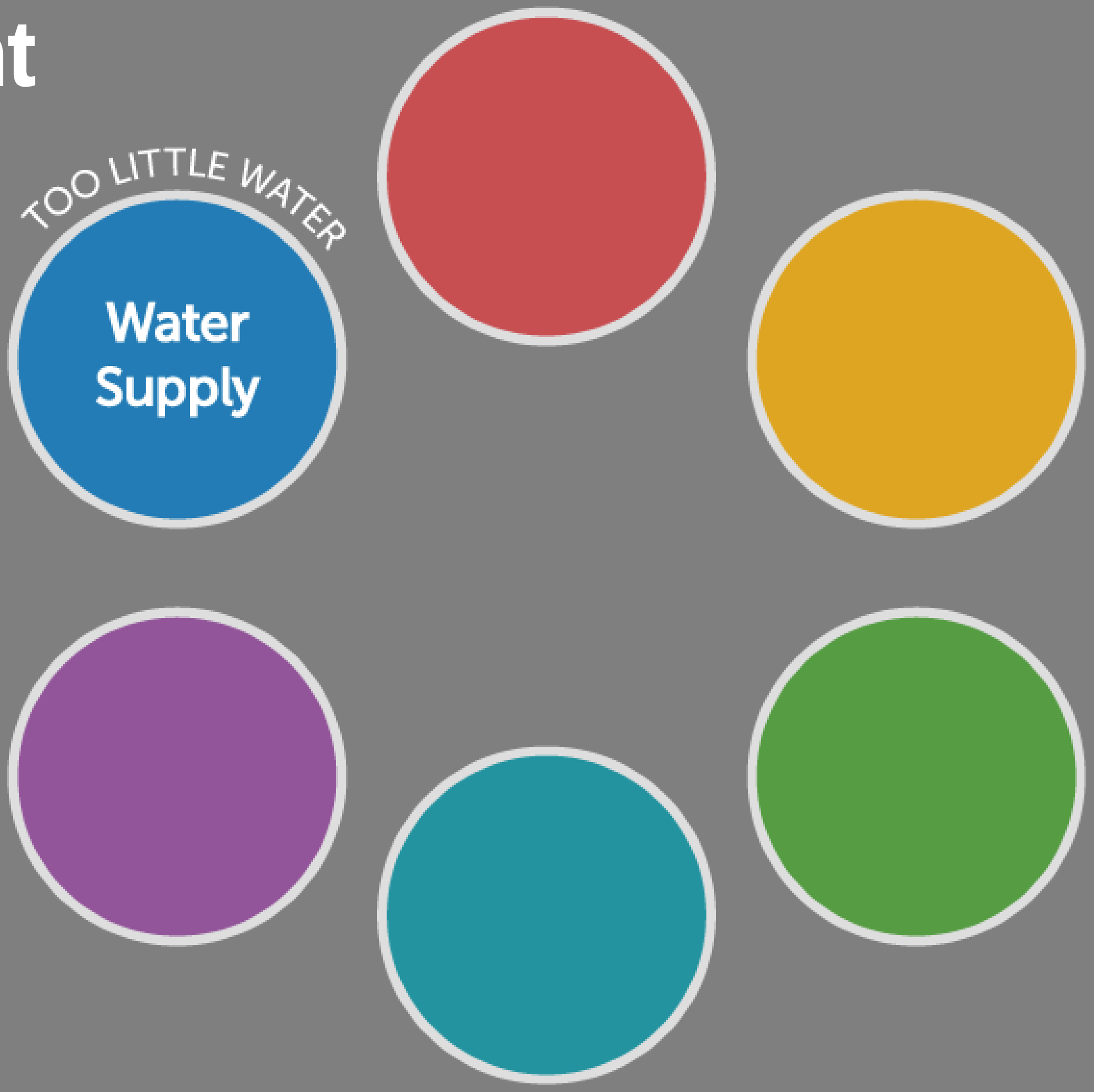

Disintegrated Management

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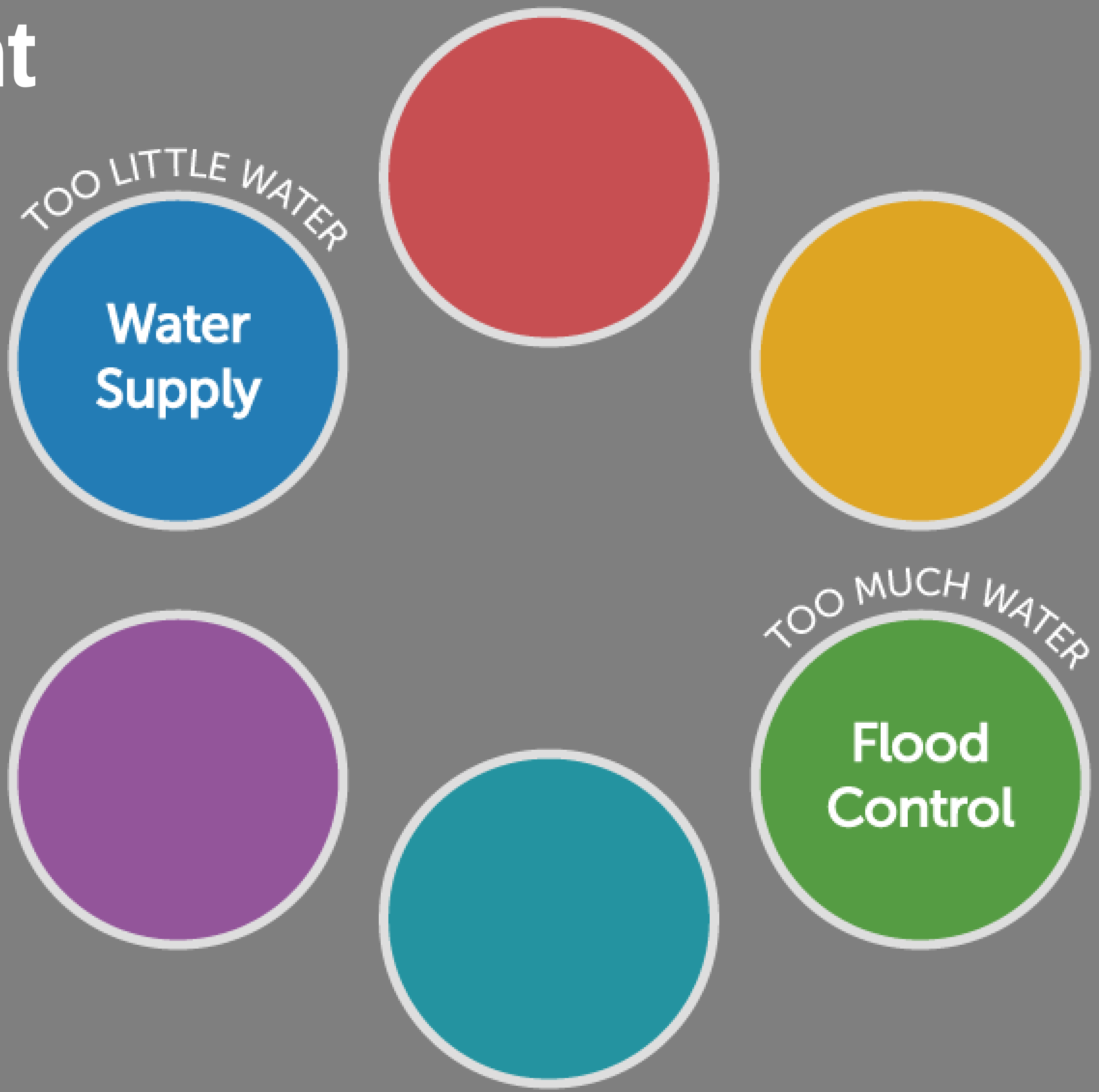

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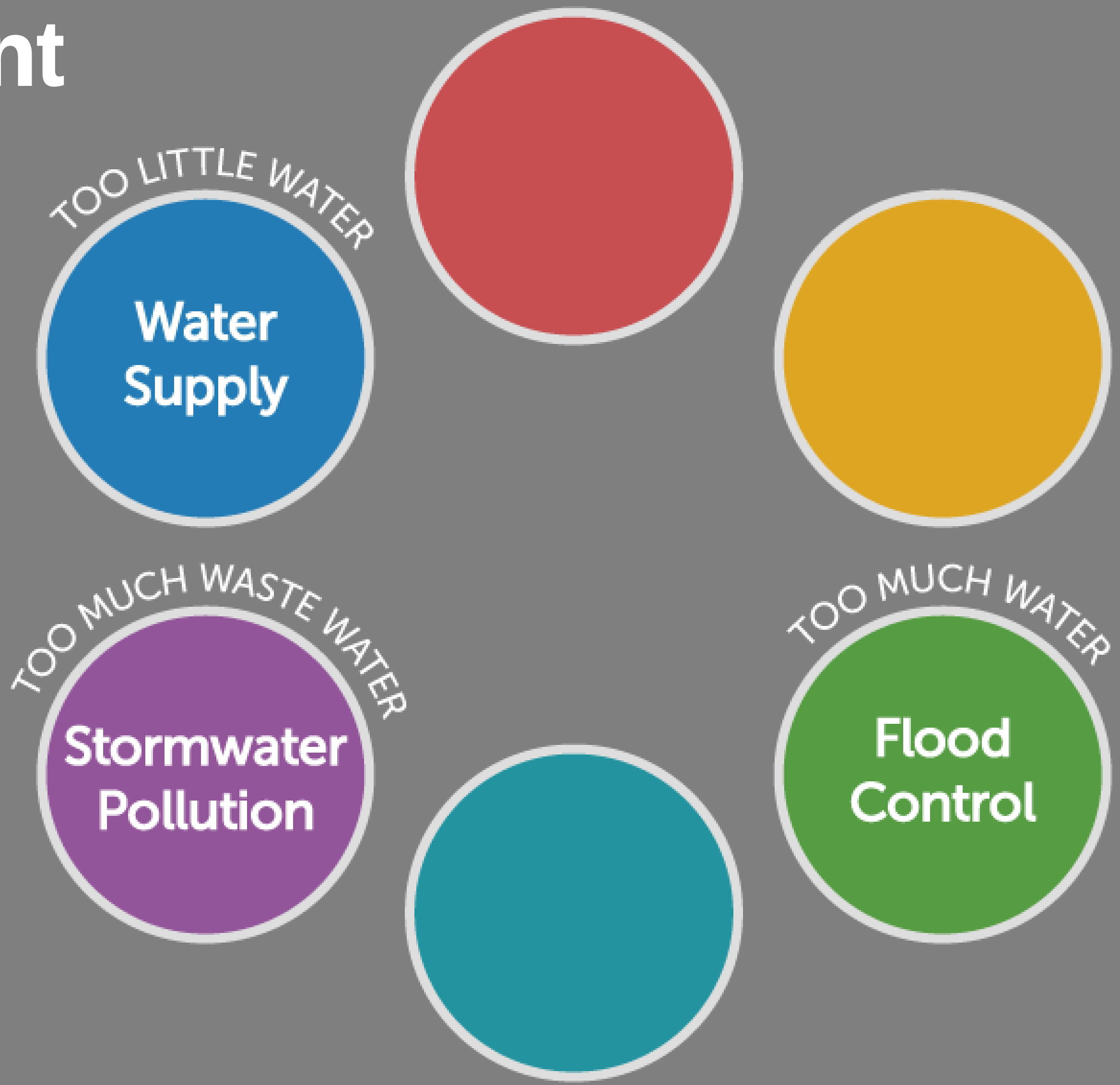

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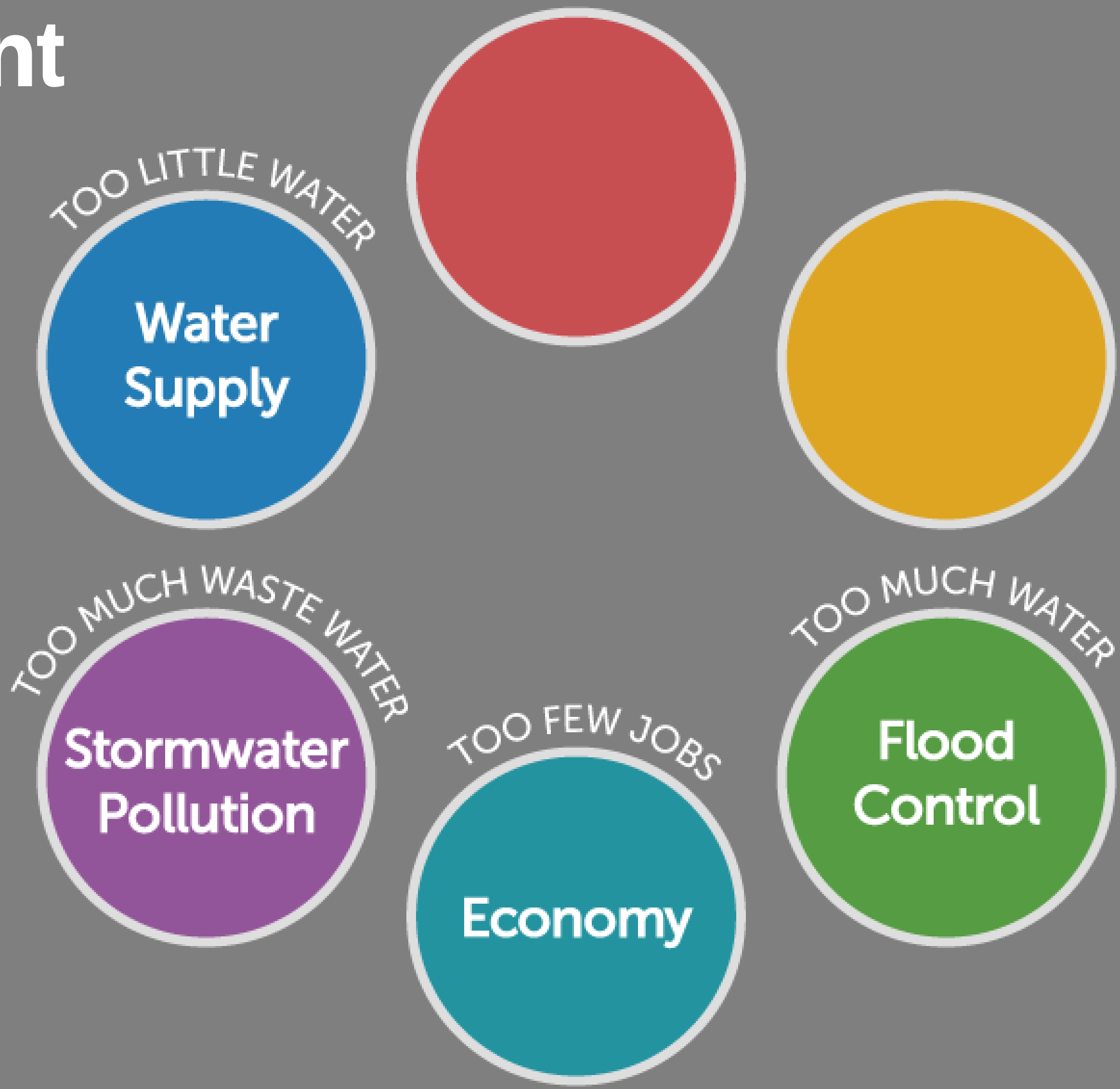

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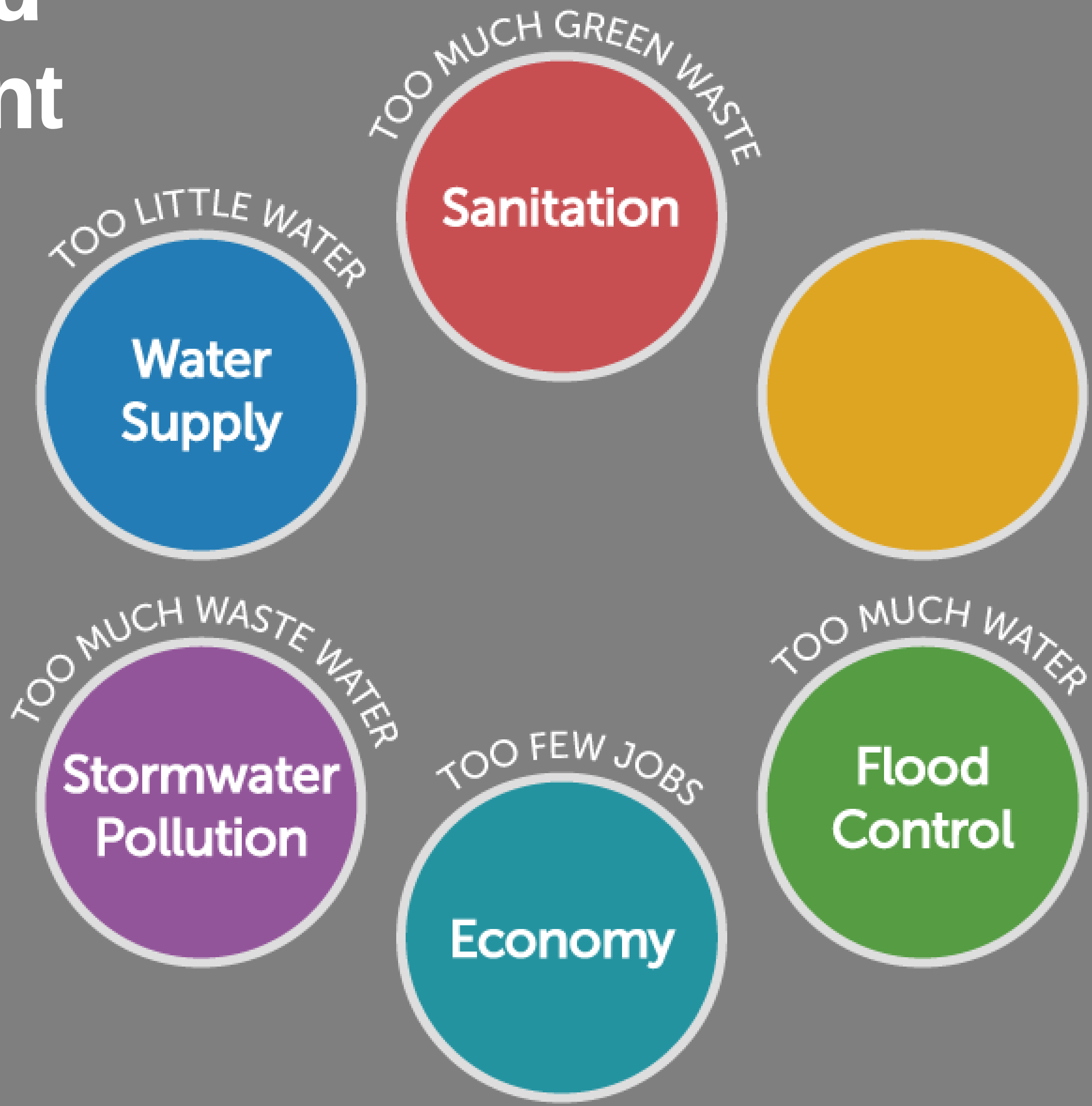

Disintegrated Management

Where Los Angeles Started

Disintegrated approach wastes resources, duplicates efforts and imposes unsustainable practices.

Shifting to Integrated Management

Where Los Angeles Needs to Be

Integrated approach also creates jobs and liberates funds for emerging green technologies.

Partners – Local, State, Federal and NGO

LA DWP Los Angeles Department of Water & Power

County of Los Angeles California

Council for Watershed Health

Watershed Protection City of Los Angeles

Water LA

capture • conserve • reuse

U.S. Department of the Interior Bureau of Reclamation

Friends of the Los Angeles River

Heal the Bay

California Strategic Growth Council

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The shift began in Los Angeles in the 1990s

CRISIS

- Environmental, social and economic unrest – Rodney King riots, raising the walls of the L.A. River

OPPORTUNITY

- **Design charrette** to redesign Los Angeles
- **Demonstration project** to prove technical, economic, social feasibility of green infrastructure
- **Cost-benefit/co-investment model** to show benefits

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Impacts and Changes

- Los Angeles Flood Control Division creates *Watershed Management Division*
- L.A. City Stormwater Management becomes *Watershed Protection Division*
- Sun Valley Watershed: first large-scale demo
- Integrated Resources Plan for Water
- $500 Million Bond Passed in 2004 (Proposition O)
- Integrated Regional Water Management law

TreePeople

Current Efforts

- One Water
- Enhanced Water Management Plans
- L.A. City Stormwater Capture Master Plan
- L.A. Basin Stormwater Conservation Study
- L.A. River revitalization
- Multi-Agency Collaborative (LA City & County)

Federal Agency Support for the
Green Infrastructure Collaborative

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The shift continues today

CRISIS

- Climate change impacts and forecasts – water/heat
- Drought
- Cost of imported water
- Water quality non-compliance

OPPORTUNITY

- Public awareness/pressure
- Political will to collaborate
- Ramp up to the tipping point – *status quo*, not "demonstration"

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Lessons Learned

1. Collaboration/integration is essential, though it is not always easy to achieve
2. Co-investment/integration makes the impossible possible
3. The multi-benefit approach opens up multiple partnerships and leads to no-regrets, future-proof projects and programs
4. Priorities might change, but co-equal environmental, social and economic goals do not – and they provide the best guiding principles
5. Public engagement – not just outreach or education – is part of the solution

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The Next Phase of Integration

1. Full-time integrated planning, construction, operations
2. Integrated funding for capital projects, maintenance and operations
3. Regulatory timelines aligned & authority shared
4. Partner/hosts have liability protection
5. Federal>State>Local program integration

Thank you!

Edith de Guzman
Director of Research, TreePeople
edeguzman@treepeople.org

TreePeople

Great Streets

5/20/15

What is a Great Street?

- Accommodates **all road users**, regardless of age, ability, or mode of transportation
- Have positive impacts on public health, economic development, roadway safety, and traffic congestion
- Contribute to neighborhoods
- Be highly interconnected
- Be unique and promote community pride

Exchange of Ideas

Engineering / Public Works

- ***Technical Design***
- ***Maintenance***
- Stormwater
- Utilities

Planning

- ***Design Standards***
- ***Public Outreach***
- ***Community Health***
- ***Economic Sustainability***

El Paso Experience

- Street Tree Ordinance – 2011
- New Comprehensive Plan “Plan El Paso” – 2012
- Transportation Planning Program created – 2012
- Street Capital Improvement Program adopted – 2012

- New Street Design Standards – 2013 (CIP Projects)
- Interim Bicycle Map – 2013 (CIP Project)
- New Median Design Standards – 2014 (CIP Projects)
- New Tree and Plan List for Streets – 2014 (CIP Projects)

El Paso Experience

- Bicycle Advisory Committee created – 2014
- Great Streets Plan – 2015
- Bicycle Plan – 2015

- Tree Farm to provide inventory of trees for Street CIP projects, medians, parks, and other quality of life projects
- 1,044 trees planted in CIP Projects for 2015 YTD, including 323 trees in Downtown
- 752 trees harvested at the Tree Farm and ready for planting


4 ft
3 ft
3 ft
4 ft
8 ft
10 ft
10 ft
8 ft

Neighborhood Avenue

Neighborhood Avenue

Neighborhood Avenue

Neighborhood Avenue


SPEED HUMP
11036

GLENGARRY
PODS


9500


High Ridge
Franklin Hills
STOP


Blanchard Ave 1000
ONE WAY
ONE WAY

1025
CUSTOM DOORS


CITY OF EL PASO TEXAS
MAGOFFIN PARK
MAYOR OSCAR LEESER
CITY REPRESENTATIVES
ANN MORGAN LILLY
DISTRICT 1
LARRY E. ROMERO
DISTRICT 2
EMMA ACOSTA
DISTRICT 3
CARL L. ROBINSON
DISTRICT 4
CITY MANAGER
JOYCE A. WILSON
ARCHITECTURE INC.
GERRY GUTIERREZ, AIA

SANTA FE ST.

SCALE: 1" = 30'

LEGEND

- 63 STREET TREES
- 27 PEDESTRIAN LIGHTING
- 9 IRON ADJUSTABLE TREE WELLS
- 2 BENCHES
- 2 TRASH RECEPTACLES
- 20 SHRUBS
- 1220 sq. ft. OF LANDSCAPED PARKWAY
- 7060 sq. ft. OF TREATED CONCRETE CROSSWALK
- 5320 sq. ft. OF CONCRETE SIDEWALK


September 15, 2012-
January 6, 2013
EL PASO MUSEUM OF ART
WestStar Bank
EL PASO CONVENTION AND PERFORMING ARTS CENTER
DAVE KOZ
AND FRIENDS
Dec. 13
Plaza
Theatre
WestStar Bank
EL PASO CONVENTION AND PERFORMING ARTS CENTER
ONLY


AND PERFORM


7054


200 West
100 West
San Antonio
PARKING


RIGHT LANE CLOSED
KEEP RIGHT
PUSH BUTTON FOR

City’s One Landscape Standard

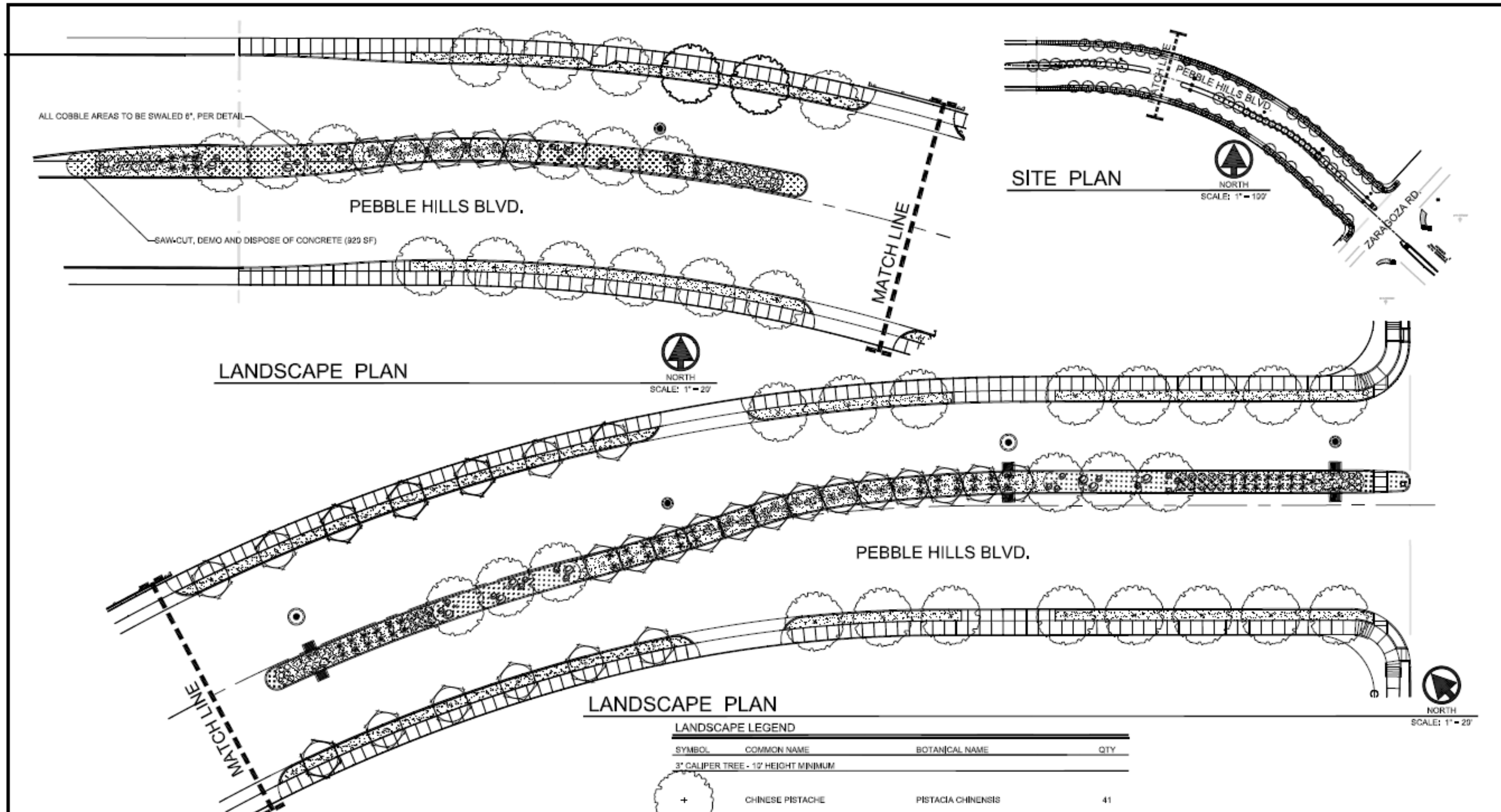

CAMINO REAL HOTEL
Main
El Paso Museum of Art


CAMINO REAL HOTEL


CAMINO REAL HOTEL
ONE WAY


CHASE


ONE WAY
400 FRANKLIN 300
ARTISAN HOTEL
ONE WAY
AVAILABLE



LANDSCAPE LEGEND

SYMBOL	COMMON NAME	BOTANICAL NAME	QTY
3" CALIPER TREE - 10' HEIGHT MINIMUM			
	CHINESE PISTACHE	PISTACIA CHINENSIS	41
	SEEDLESS DESERT WILLOW	CHILOPSIS LINEARIS 'ART'S SEEDLESS'	31
5 GALLON SHRUB - 18" HEIGHT MINIMUM UNLESS OTHERWISE INDICATED			
	YELLOW BELLS	HESPERALOE PARVIFLORA	39
	RED YUCCA	HESPERALOE PARVIFLORA	25
	REDOLENS ACACIA	ACACIA REDOLENS	31
	CHIHUAHUAN RAIN SAGE	LEUCOPHYLLUM LAEVIGATUM	16
1 GALLON SHRUB - GROUND COVER			
	PURPLE LANTANA	LANTANA MONTEVIDENSIS	38
	SUN GOLD GAZANIA	GAZANIA RIGENS 'SUN GOLD'	24
GRAVELS			
	3/4" FRANKLIN RED ROCK, 3" DEPTH & NONWOVEN WEED BARRIER FABRIC, SEE ROCK/SCREENING DETAIL		
	COBBLESTONE BLEND - 20% 6", 60% 2"-4", 20% PEA GRAVEL, 3" DEPTH & NONWOVEN WEED BARRIER FABRIC, SEE ROCK/SCREENING DETAIL		
GRAVELS			
	FRANKLIN RED BOULDER - 2X2 AND 3X3 - HALF BURIED PER DETAIL		26/13

LANDSCAPE NOTES

- ALL UTILITY EASEMENTS SHALL BE MARKED PRIOR TO EXCAVATION, AND PARTICULAR ATTENTION PAID TO TREE PLACEMENT WITHIN AND THROUGHOUT SITE.
- THERE SHALL BE NO STEEL EDGING BETWEEN ROCK TYPES.
- CONTRACTOR SHALL PROVIDE ROCK SAMPLES AND OBTAIN APPROVAL FROM OWNER PRIOR TO FINAL DELIVERY OF QUARRIED MATERIALS.
- CONTRACTOR TO PAY CLOSE ATTENTION TO FINISH GRADES, SHOULD GRAVELED AREAS EXCEED 4:1 SLOPE, CONTRACTOR TO OBTAIN APPROVAL OF LANDSCAPE DESIGNER PRIOR TO MULCH INSTALLATION.
- ALL TREES SHALL BE SINGLE LEADER TRUNK, UNLESS INDICATED IN PLANS.

desert elements LANDSCAPE DESIGN, LLC

FILE No. 238444

NO. | DATE | REVISION | REMARKS | BY

Moreno Cardenas Inc.
Leaders in Project Delivery & Performance

IRRIGATOR'S SEAL

IRRIGATOR'S NOTE

SCALE

PROJECT NAME
PEBBLE HILLS BOULEVARD STREET & DRAINAGE IMPROVEMENTS

City of El Paso
ENGINEERING
and Construction Management
218 N. CAMPBELL ST. PH. (915) 212-0065

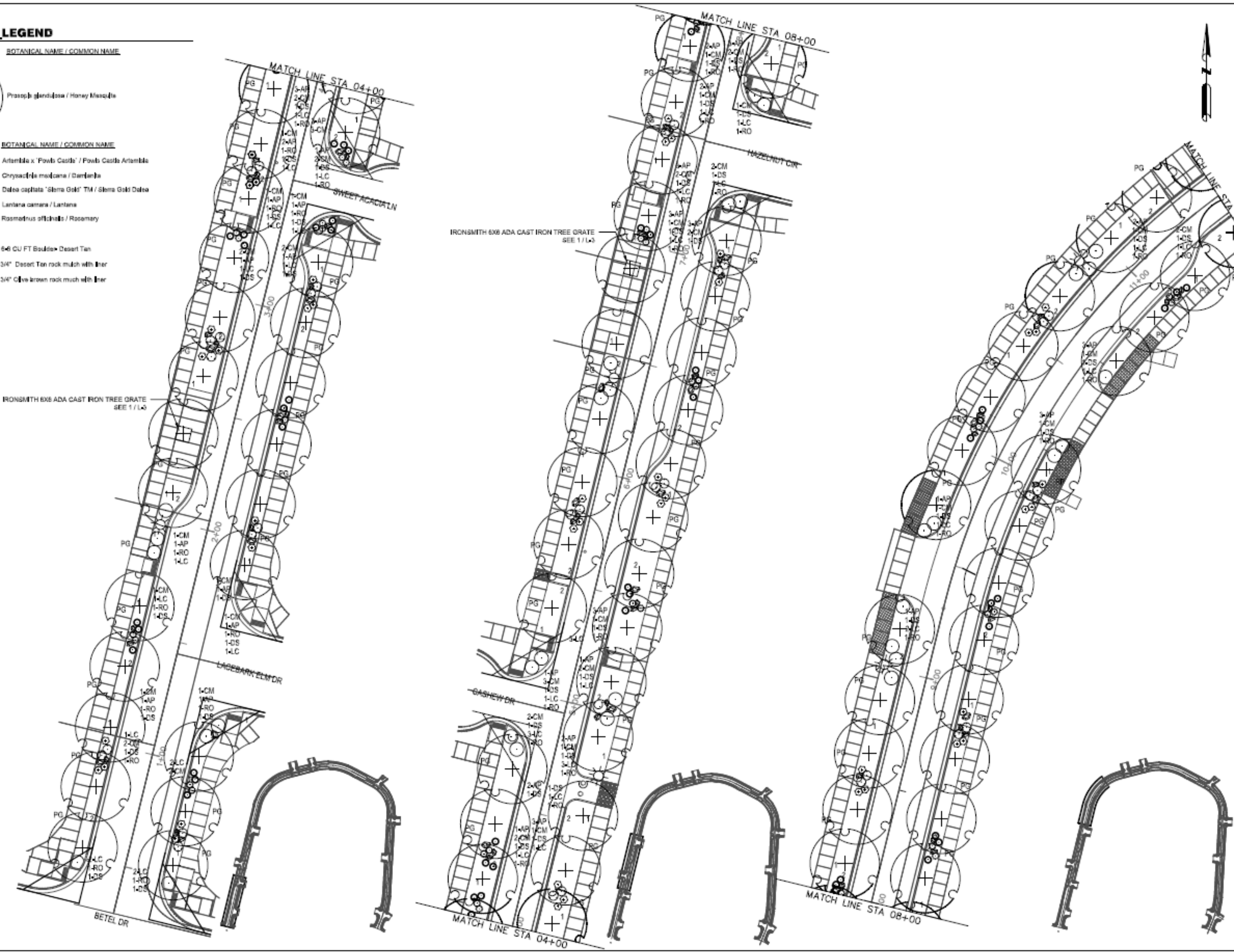
SHEET TITLE
LANDSCAPE PLAN

SHEET L1
1 OF 3

PLANT_LEGEND

TREES	BOTANICAL NAME / COMMON NAME
	Prosopis glandulosa / Honey Mesquite

SHRUBS	BOTANICAL NAME / COMMON NAME
	Artemisia x 'Powis Castle' / Powis Castle Artemisia
	Chrysactinia mexicana / Damianita
	Dalea capitata 'Sierra Gold' TM / Sierra Gold Dalea
	Lantana camara / Lantana
	Rosmarinus officinalis / Rosemary
	6-8 CU FT Boulder- Desert Tan
1	3/4" Desert Tan rock mulch with liner
2	3/4" Olive brown rock much with liner



REFERENCES – BENCHMARKS

FILE:

DATE	REVISIONS	BY

ARCHITECT'S SEAL

SCALE
HOR: 1" : 20'
VER: –
DATE: APRIL 2015
DESIGN BY: LT
DRAWN BY: LT/DLH
CHKD. BY: SD
APPD. BY:

PROJECT NAME

KERNEL CIRCLE
STREET IMPROVEMENTS

CITY OF EL PASO
ENGINEERING

Wright&Dalbin
ARCHITECTS, INC.

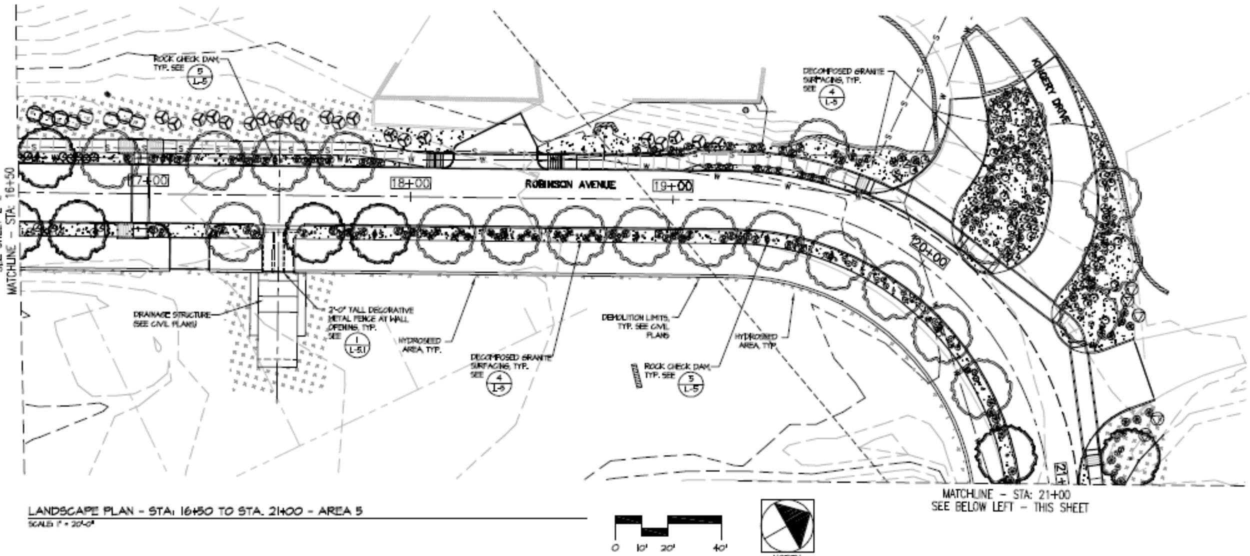
SHEET TITLE

LANDSCAPE
PLAN
SHEET 2 OF 5

SHEET

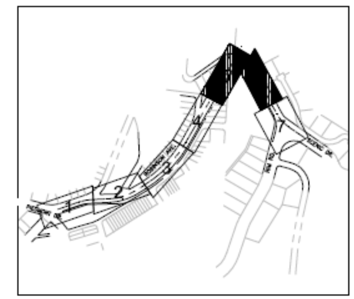
L-2 of L-11

Pen Table File
$TIME$
$DATE$
$PLOT DRIVER$



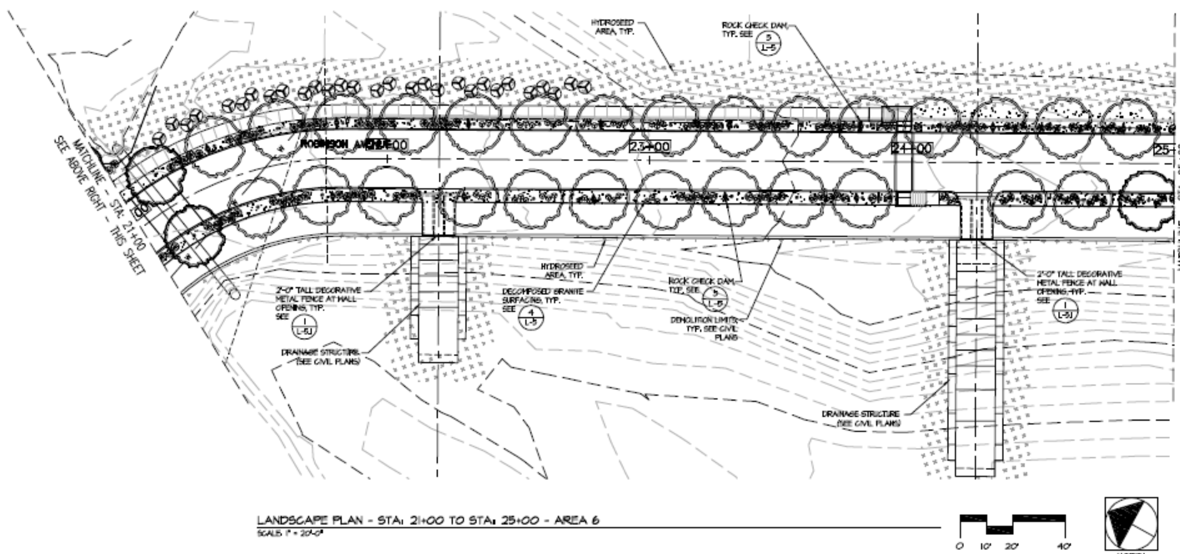
LANDSCAPE PLAN - STA: 16+50 TO STA. 21+00 - AREA 5

SCALE: 1" = 20'-0"



AREA KEYMAP

SCALE: N.T.S.



LANDSCAPE PLAN - STA: 21+00 TO STA: 25+00 - AREA 6

SCALE: 1" = 20'-0"

LANDSCAPE LEGEND

SYMBOL	BOTANICAL NAME	COMMON NAME
TREES		
	PROSOPIS GLANDULOSA	THORNLESS HONEY MESQUITE
SHRUBS		
	EREMOPHILA HYGROPHANA	BLUE BELLS
	EREMOPHILA MACULATA	VALENTINE
	LARREA TRIDENTATA	CREOSOTE
	LEUCOPHYLLUM FRUTESCENS	GREEN CLOUD SAGE (GREEN FOLIAGE)
	LEUCOPHYLLUM PRUINOSUM	FRAGRANT RAIN SAGE (SILVER FOLIAGE)
	SALVIA GREGGII	AUTUMN SAGE
	SALVIA CHAMAEDRYOIDES	MEXICAN BLUE SAGE
GROUNDCOVERS		
	BERLANDIERA LYRATA	CHOCOLATE FLOWER
	LANTANA MONTEVIDENSIS	PURPLE TRAILING LANTANA
	LANTANA X 'NEW GOLD'	NEW GOLD LANTANA
ACCENTS		
	MUHLENBERGIA CAPILLARIS	REGAL MIST MUHLENBERGIA
HYDROSEED AREAS		
	AREAS TO RECEIVE HYDROSEEDING OF NATIVE SEED MIX, SEE LANDSCAPE SCHEDULE AND SPECIFICATIONS.	
INORGANIC SURFACING		
	AREAS TO RECEIVE DECOMPOSED GRANITE ROCK MULCH SURFACING: 3" MINUS GRADATION, COLOR: TO MATCH EXISTING NATIVE ROCK. SEE SPECIFICATIONS.	
	AREAS TO RECEIVE RIP RAP SURFACING. 3" TO 12" SIZE, COLOR: TO MATCH EXISTING NATIVE ROCK. SEE SPECIFICATIONS.	
	ROCK CHECK DAM	
NOTES		
SEE LANDSCAPE DETAILS AND SCHEDULE SHEET L-5.		

McGann & Associates
Landscape Architects and Planners

Texas Board of Architectural Examiners Registration No. 5115

FILE No. 238488

NO.	DATE	REVISION REMARKS	BY

Moreno Cardenas Inc.
Leaders in Project Delivery & Performance

L.ARCHITECTS SEAL

THESE PLANS WERE RELEASED UNDER THE AUTHORITY OF SCOTT MARTINEZ, RLA# 2715 TO BE ISSUED AS A FINAL SUBMITTAL TO THE CITY OF EL PASO FOR REVIEW. IT IS NOT TO BE USED FOR CONSTRUCTION OR FINAL PERMIT ISSUANCE.

L.ARCHITECT'S NOTE

THE SEAL APPEARING ON THIS DOCUMENT WAS AUTHORIZED BY SCOTT MARTINEZ, RLA# 2715 ON May 18, 2015. ALTERATION OF A SEALED DOCUMENT WITHOUT PROPER NOTIFICATION TO THE RESPONSIBLE LANDSCAPE ARCHITECT IS AN OFFENSE UNDER THE TEXAS BOARD OF ARCHITECTURAL EXAMINERS

SCALE

Horiz.
Vert.
Date MAY 2015
Design by S.M.
Drawn by P.R.
Chkd. by D.S.
Appd. by D.M.
JOB No. 14-1008

PROJECT NAME

ROBINSON AVENUE STREET AND DRAINAGE IMPROVEMENTS

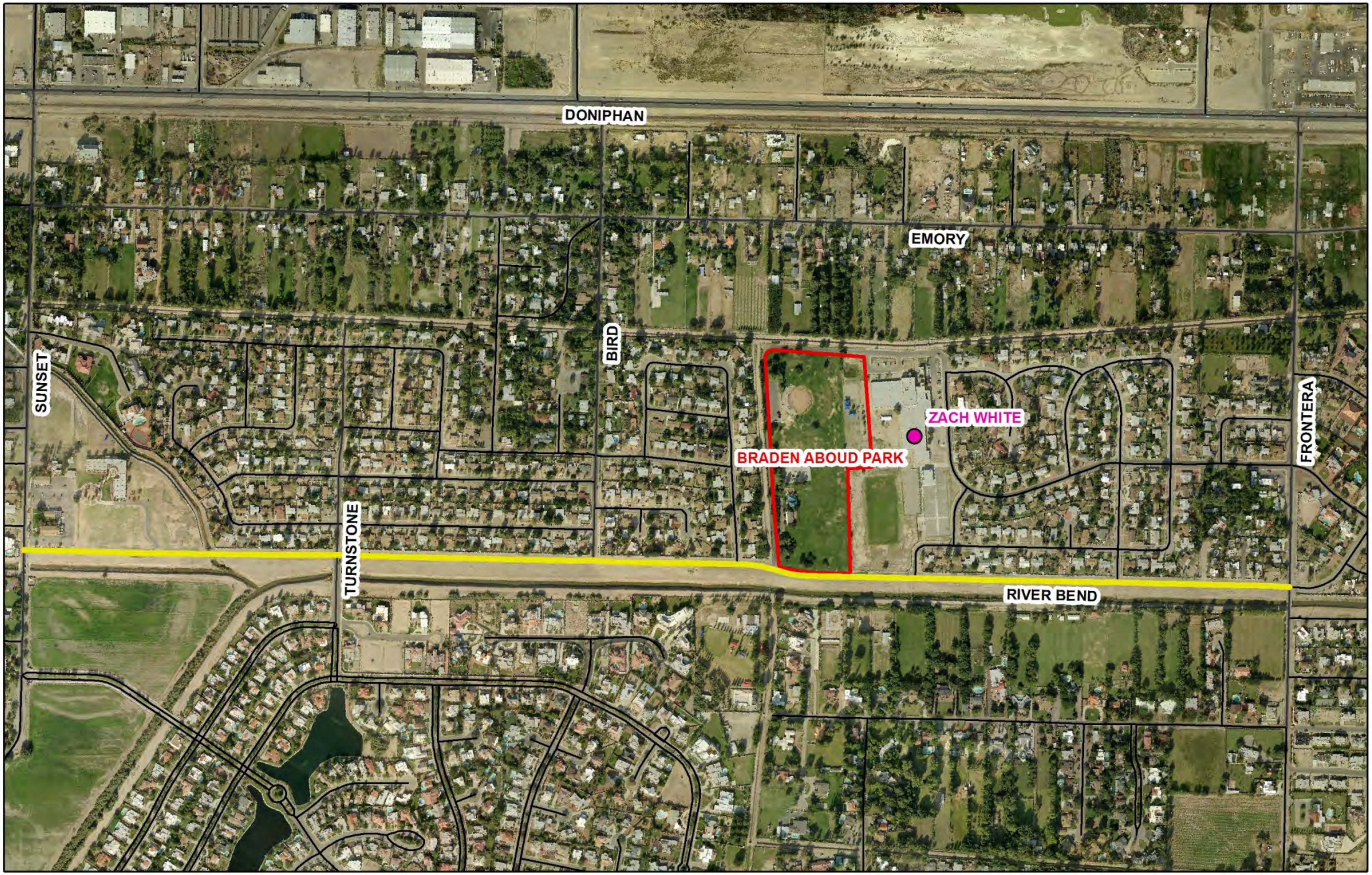
City of El Paso
ENGINEERING
and Construction Management
218 N. CAMPBELL ST. PH. (915) 212-0065

SHEET TITLE

LANDSCAPE PLAN

SHEET
L-3

3 OF 13



The features represented on this map are in the Texas State Plane Coordinate system, Central Zone, NAD 83, units feet, using the Lambert Conformal Conic projection.
This map was generated using ArcGIS by Transportation Planning for the City of El Paso, Texas.
222 S. Campbell St.
El Paso, Texas, 79901
915.541.4680
This map is designed for illustrative purposes only. The features depicted here are approximate and more site-specific studies may be required to draw accurate conclusions. Enlargements of this map to scales greater than its original can induce errors and may lead to misinterpretations of the data. Transportation Planning makes no claim to its accuracy or completeness.

River Bend Drive

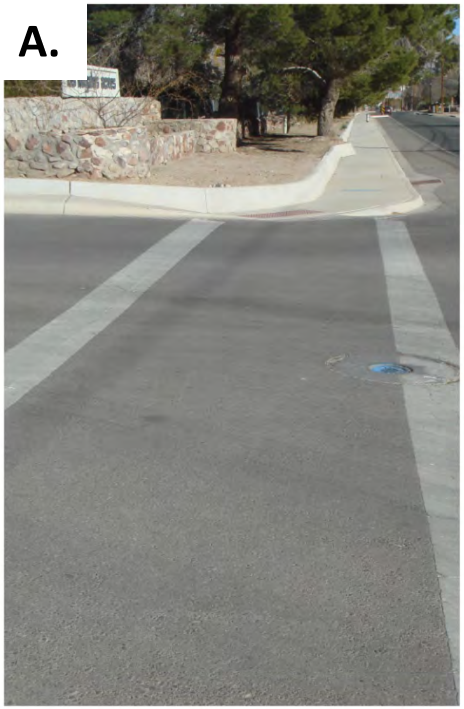
Sunset Drive to Frontera Road

0 0.1 0.2 0.4 0.6 0.8 Miles

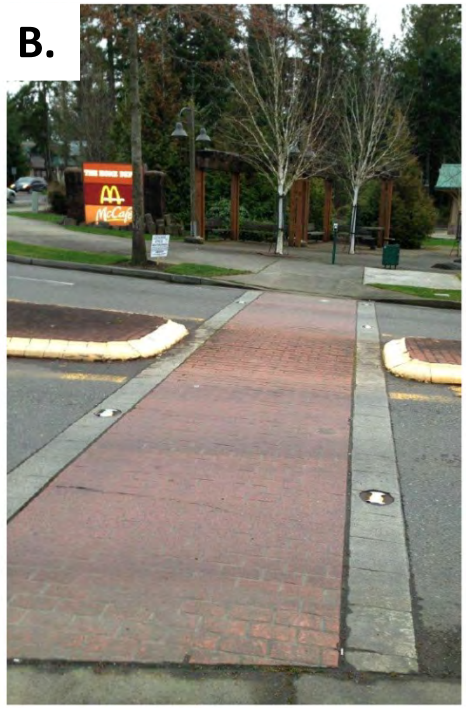
Looking Northwest from Frontera

Looking Southeast from Braden Aboud Park

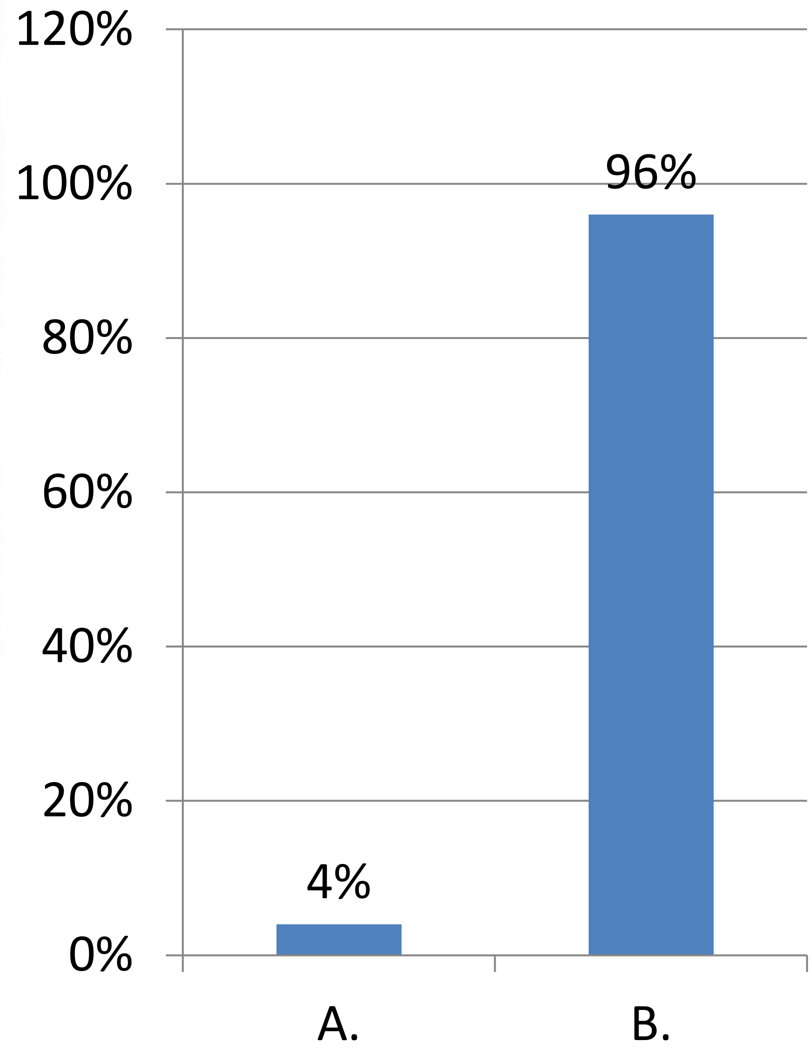
1. Select your preference for crosswalk design:



Painted



Textured

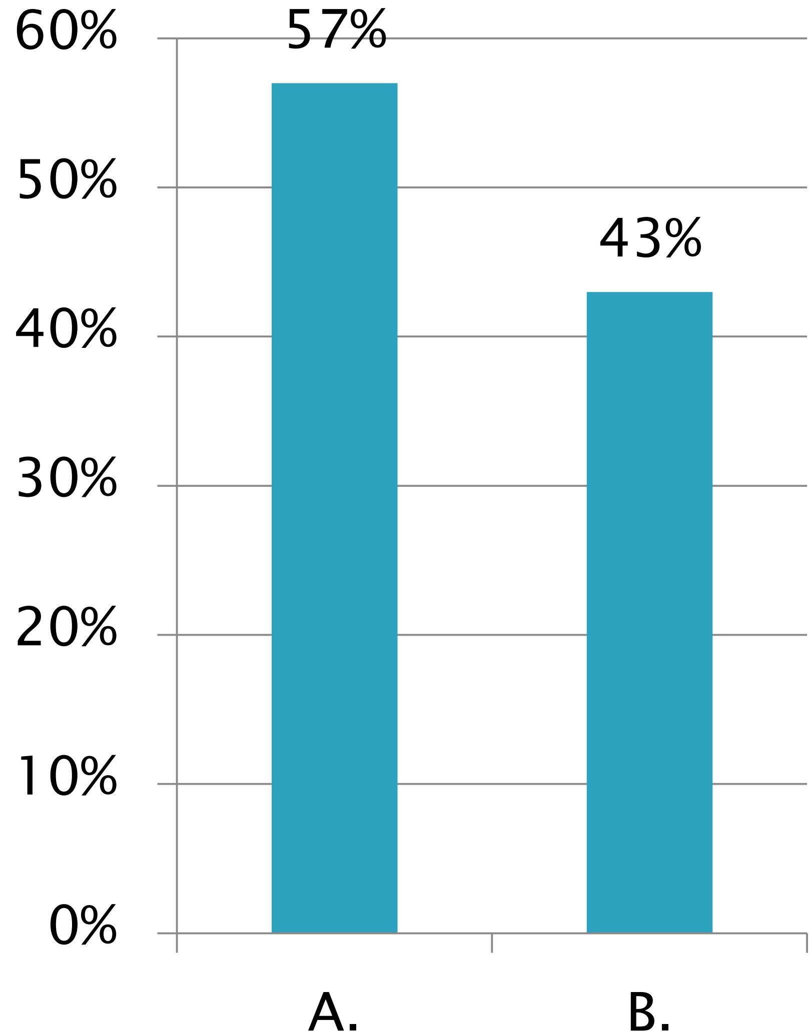


Traffic circle

3. Should a traffic circle be placed at the Turnstone and River Bend intersection?

A. Yes

B. No



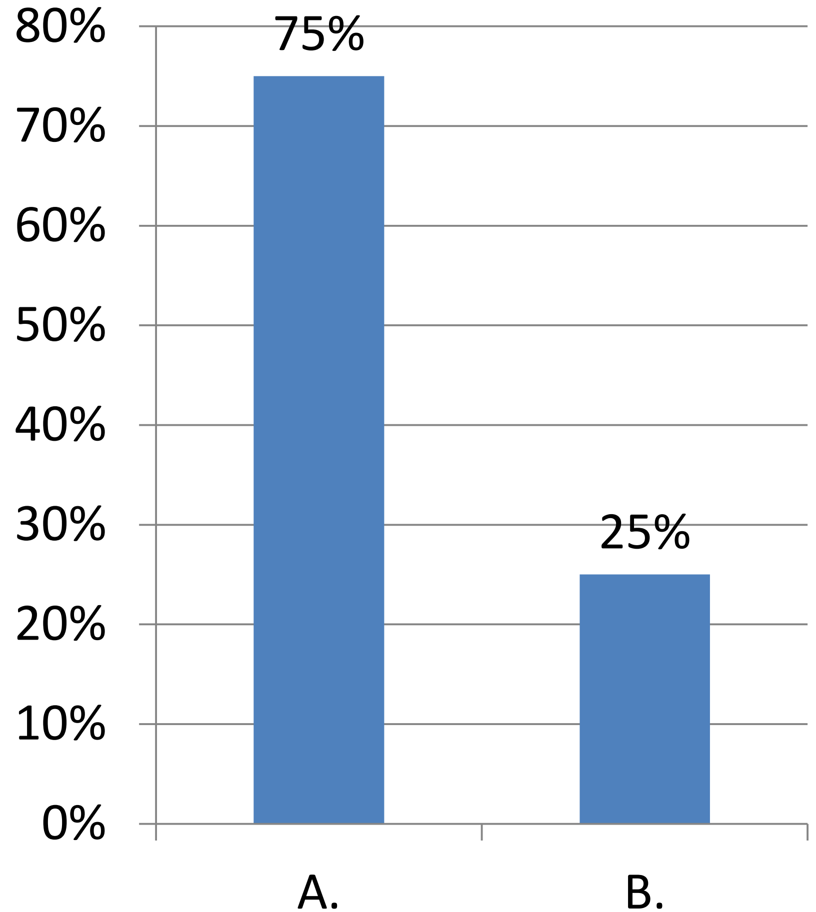
Parallel Parking Lanes

No Parking Lanes

4. Parallel parking should be included at Braden Aboud Park and Zach White Elementary School (easterly side of the roadway):

A. Yes

B. No



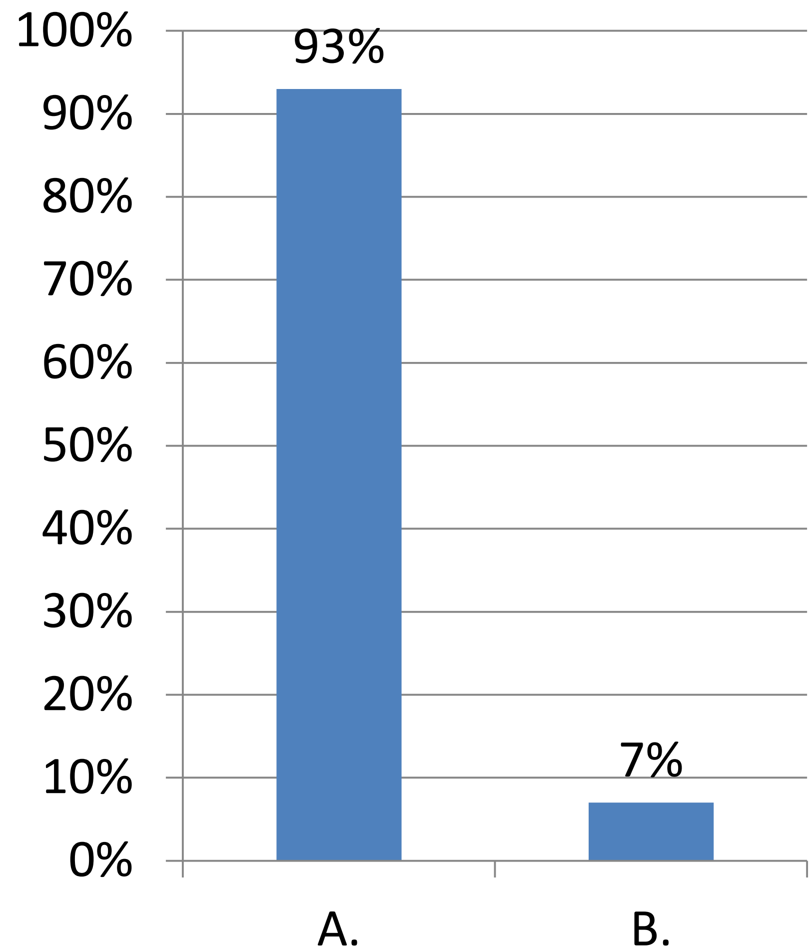
Shared-Use Path

Sidewalk

5. What type of pedestrian amenities should be located along the easterly side of River Bend Drive?

A. Shared-Use Path

B. Sidewalk

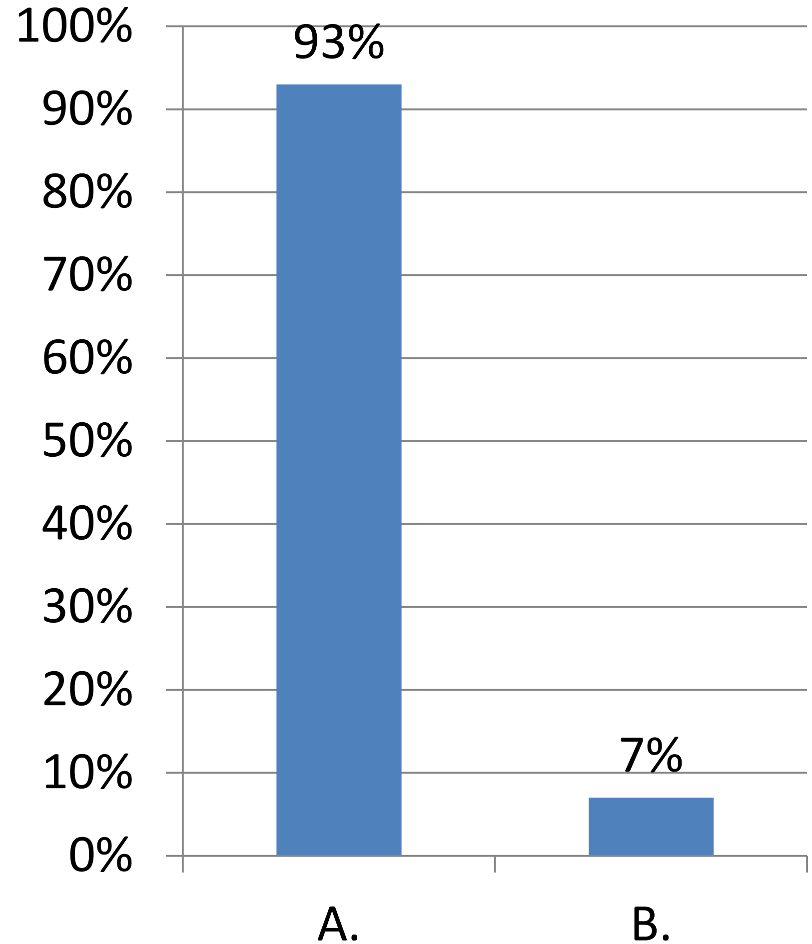


Street Trees

6. Should street trees be placed along the easterly side of River Bend Drive?

A. Yes

B. No



Landscaping

A. Formal Trees/Vegetation

Landscaping

B. Informal Trees/Vegetation

Landscaping

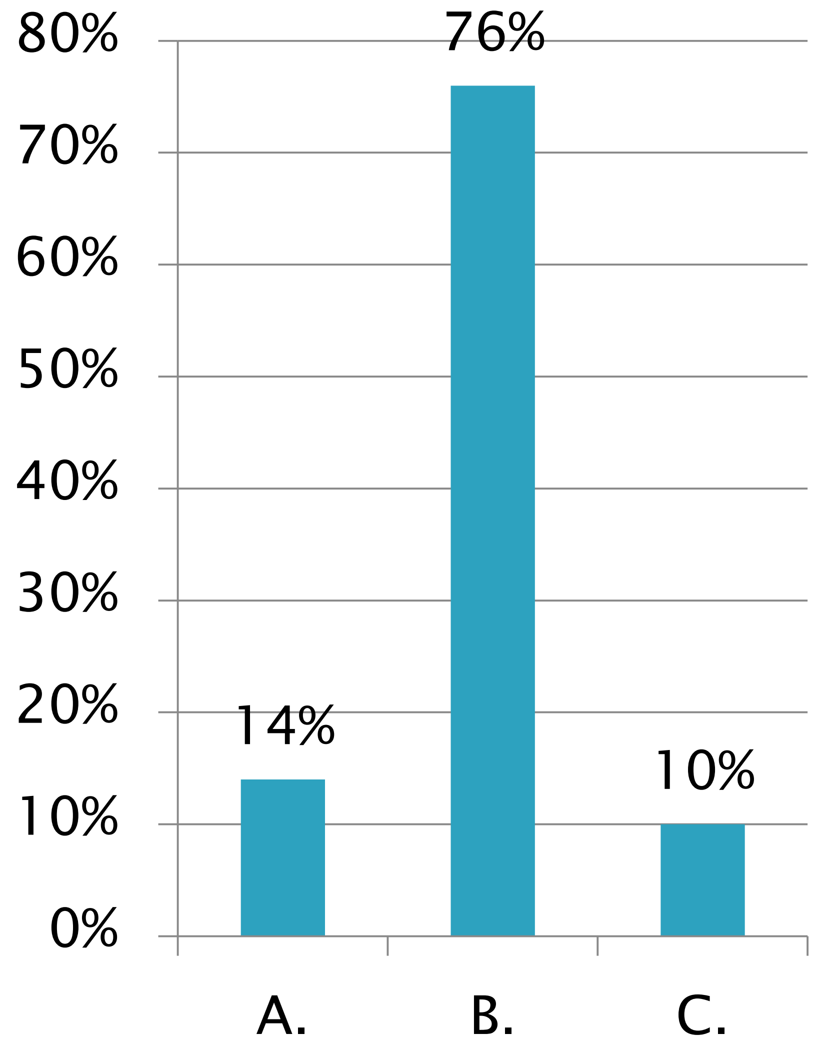
C. Desert Vegetation

7. Select landscaping type:

A. Formal trees/vegetation

B. Informal trees/vegetation

C. Desert vegetation

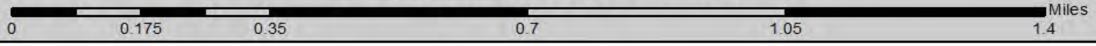



BIKE LANE

The features represented on this map are in the Texas State Plane Coordinate system, Central Zone, NAD 83, units feet, using the Lambert Conformal Conic projection.
This map was generated using ArcGIS by Transportation Planning for the City of El Paso, Texas
801 Texas Ave.
El Paso, Texas, 79901
915.212.0083
This map is designed for illustrative purposes only. The features depicted here are approximate and more site-specific studies may be required to draw accurate conclusions. Enlargements of this map to scales greater than its original can induce errors and may lead to misinterpretations of the data. Transportation Planning makes no claim to its accuracy or completeness.

Transportation Alternatives Program

Resler Drive
Existing Area Bicycle Facilities

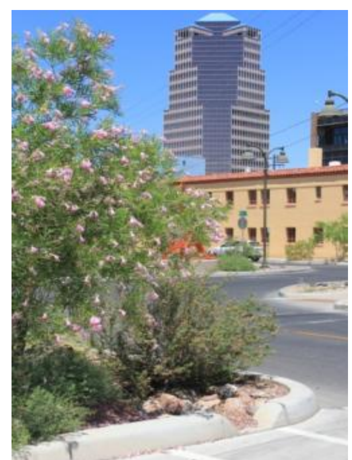


Transportation Planning
Moving El Pasoans Toward The Future

The Social Process of System Change Toward a Green Infrastructure Approach

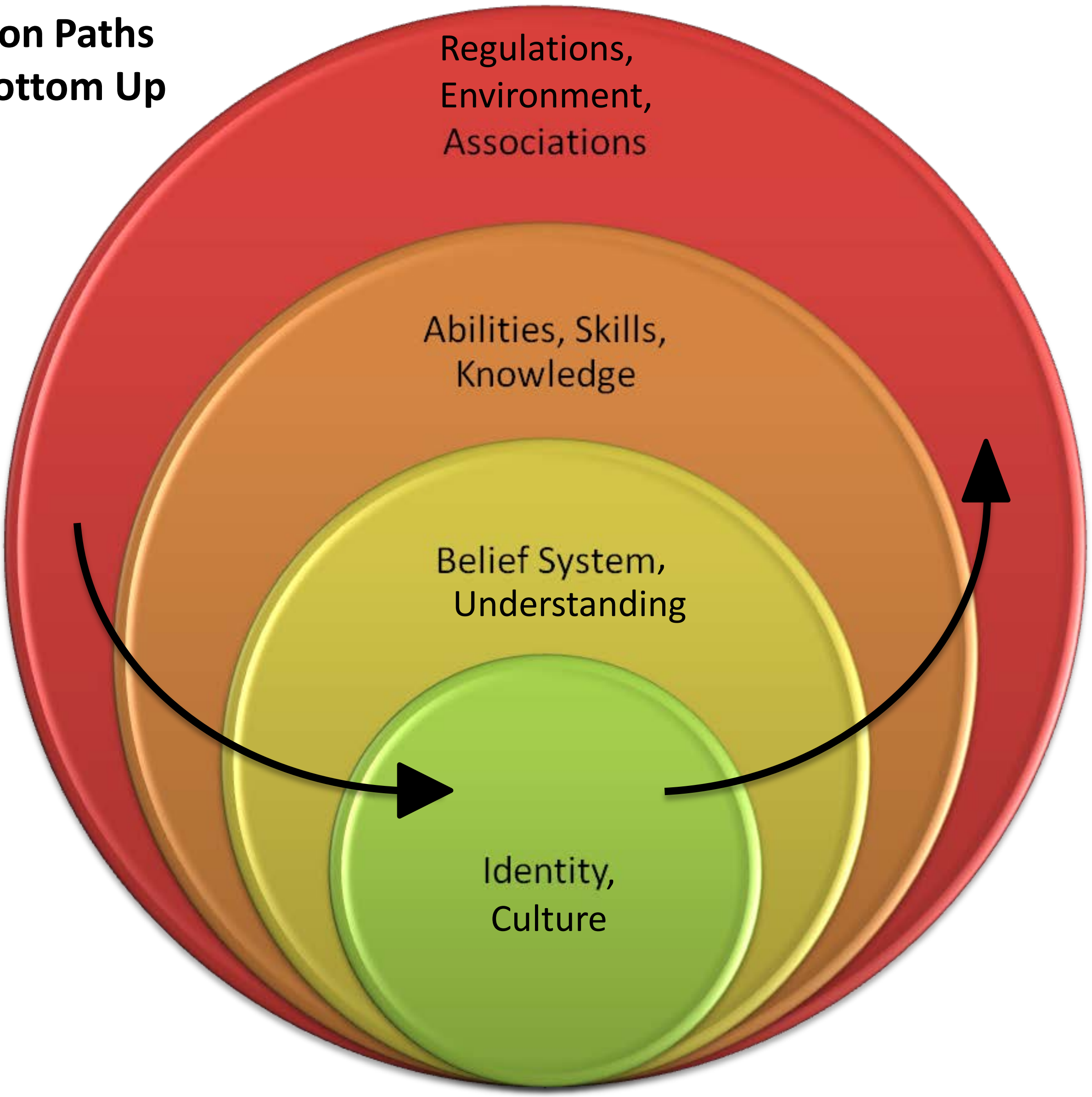
Mead Mier,
Watershed Planning Lead
Pima Association of Governments
Tucson, AZ

PAG
Pima Association of Governments



Bateson's Logical Levels of Change

-Health Framework
-Communication Paths
-Top Down/ Bottom Up



Cross Jurisdictional, Integrated Planning

Green Infrastructure/ Low Impact Development

A. Community Efforts
B. Municipal Staff Roles
C. Communication in General
D. Political Support

Arid Environment is Unique

No combined sewers

(No sanitary sewer overflows)

Not stormwater quality violations

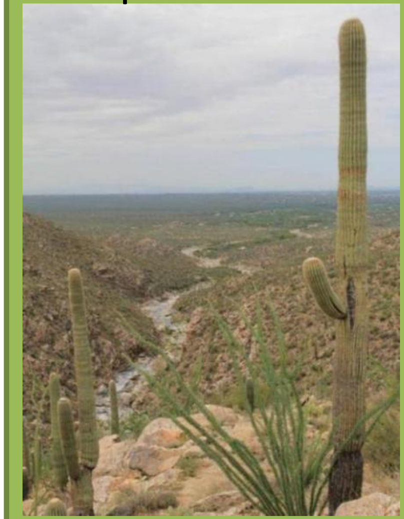
(No Consent Decrees)

…Different drivers of GI/LID

Rainwater Harvesting

Community driven

Empowered with water security

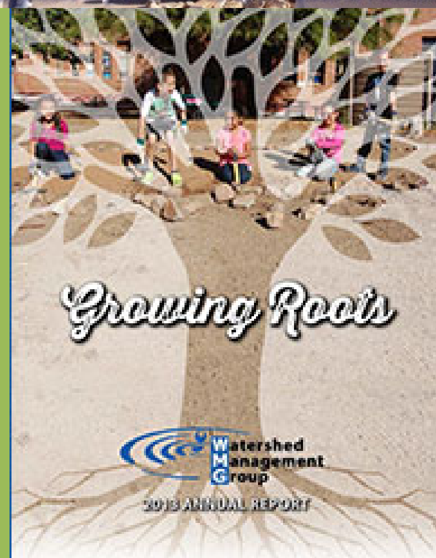


Streets as conveyance

Watershed health

Community Driven / Grassroots Organizing

Assets Based

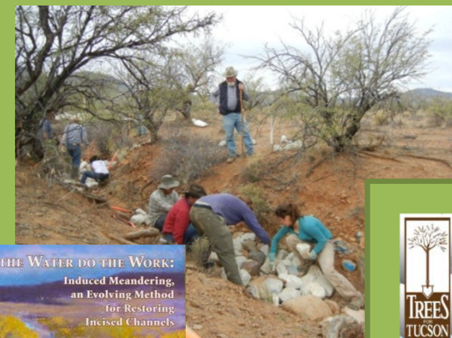


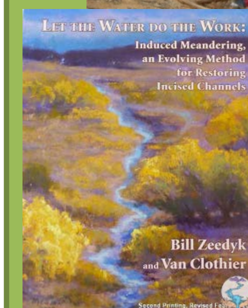
Barn Raising Model

An inclusive green economy strong enough to lift people out of poverty

GREEN FOR ALL

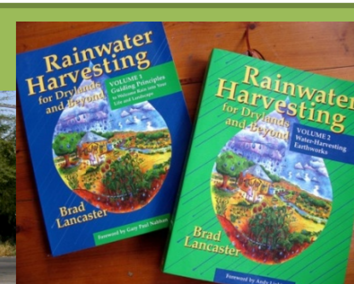
Informed by those Impacted





Create Local Practitioners

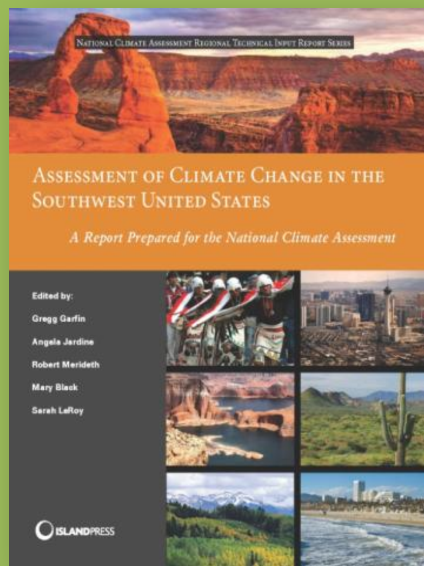
Promotoras



Waste into Resources

Environmental Justice

2013 Institute of Environment



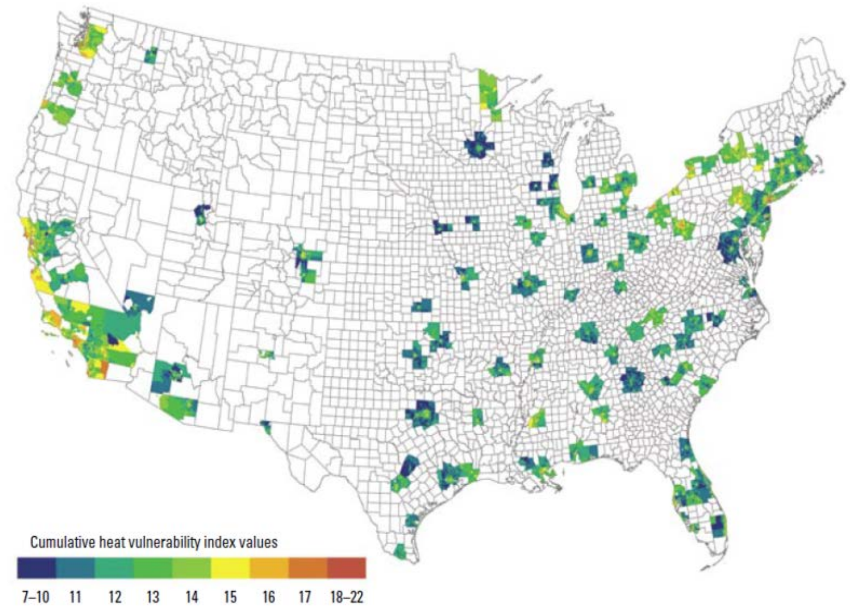


Figure 1. National map of cumulative heat vulnerability index by census tract ($n = 39{,}794$).

- Sharon Harlan, ASU
- Az Dept of Health Services
- *U.S. Census Bureau American Community Survey (ACS)*
- *Mapping Community Determinants of Heat Vulnerability , Reid et al*

"**Heat stress**, a recurrent health problem for urban residents, has been the **leading weather-related cause of death** in the United States since 1986. . . – and the **highest rates of RESIDENTS nationally are found in Arizona.**

Disproportionate Impact

Physical, social, and economic factors:

- Older persons
- The **poor**
- Socially isolated, **mobility** restrictions
- Health

Community & Municipal Planning

Moving from a deficit approach to an asset approach	
Where we are now - the deficit approach	**Where an asset way of thinking takes us**
Start with deficiencies and needs in the community	Start with the assets in the community
Respond to problems	Identify opportunities and strengths
Provide services to users	Invest in people as citizens
Emphasise the role of agencies	Emphasise the role of civil society
Focus on individuals	Focus on communities/ neighbourhoods and the common good
See people as clients and consumers receiving services	See people as citizens and co-producers with something to offer
Treat people as passive and done-to	Help people to take control of their lives
'Fix people'	Support people to develop their potential
Implement programmes as the answer	See people as the answer

Photo by John Sartin

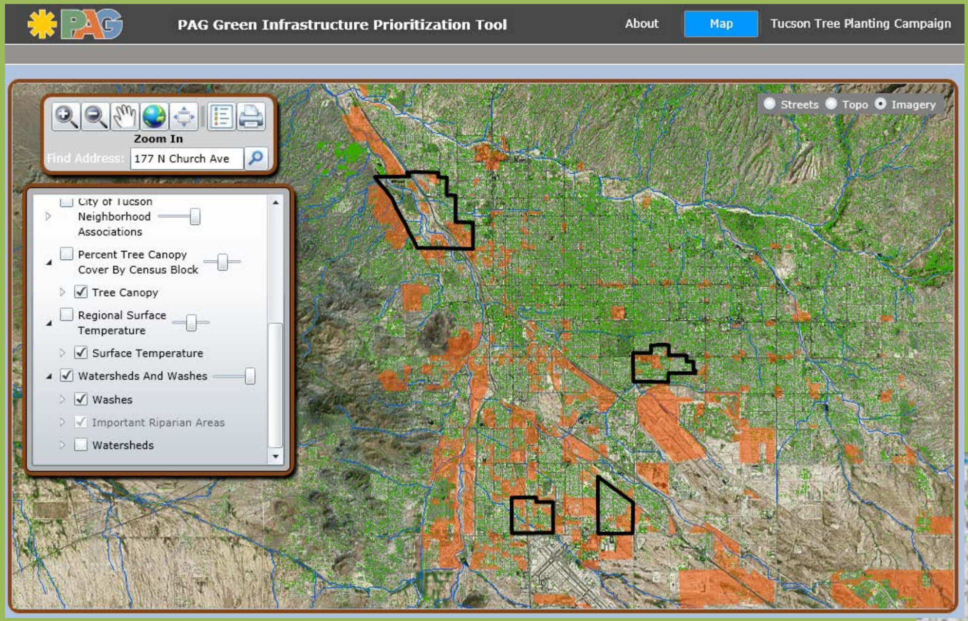
A. Community
   - ✓ **Assets Approach**

B. Municipal Staff / Institutions
   - **Professional Tools**
   - **Strategic Planning**
   - **Collaboration**
   - **Demonstrations**
   - **Standards, Guidance**

C. Communication

D. Political

Municipal & Community Planning



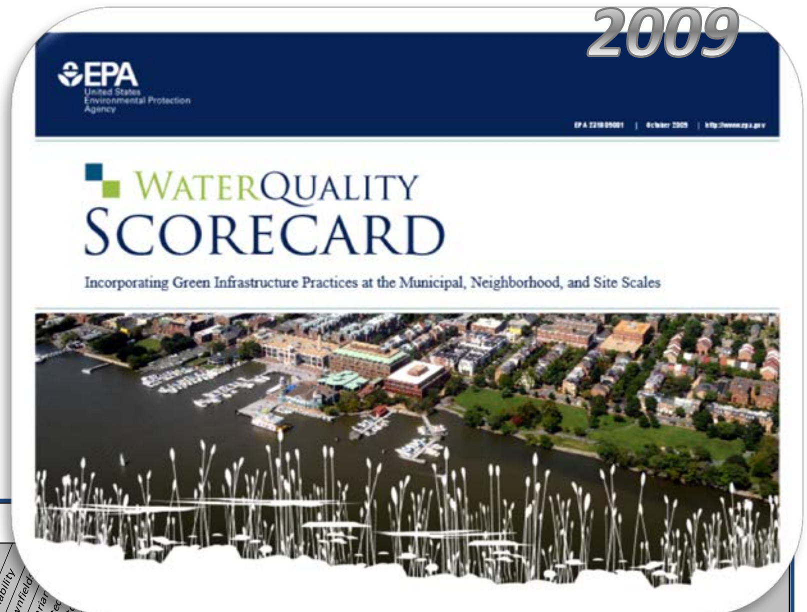
- Green Infrastructure to Combating Heat
- Decision Support Tool
- Prioritize distribution of limited resources

PAG's Interactive Web-Map
http://gismaps.pagnet.org/PAG-GIMap

Slide by PAG

Municipal Progress- Inventory

- 1980 - 2012
- Analyzed 70+ policies, projects, educational; efforts, etc. around Pima County
- New: LID/GI Terminology



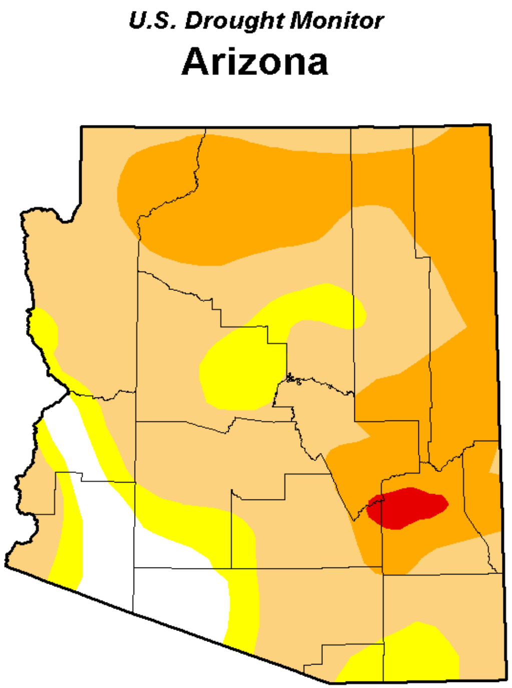
e.g. curb cuts, shade trees

Regional Green Stormwater Infrastructure Survey (Progress Report)

Secto		Type of Implementation	Specific GI/LID Effort	Date	Year	Rainwater Harvesting	Stormwater Harvesting	Graywater Harvesting	Native Plants/ Xeriscaping	Wildlife Corridors/ Habitat	Green Jobs	Shade Trees	Curb Cuts	Urban Ecosystem (Services)	Groundwater Recharge	Sustainability	Brownfields	Riparian Protec Resto	UHI	Pervio	Wash		
Gov. and Quasi-Gov.	City of South Tucson	Education	City of South Tucson Environmental Workplace Development and Job Training Program	December, 2011 (onging)	2011		x				x					x	x					7-week course of intense education to prepare participants for a position in the environmental workforce, including training in stormwater management, sustainability, and site assessment. Funded by an EPA Brownfields Job Training Grant	Derek Koller: (520) 551-7887, dkoller@allwynenvironmental.com or Joel Gastelum: JGastelum@southtucson.org
Gov. and Quasi-Gov.	City of South Tucson	Guideline	Growing Smarter Comprehensive Plan Update	2002 (?)	2002				x			x										Includes objectives and strategies to convert vacant land into community gardens and encourage low-water-use tree planting	City of South Tucson Planning and Zoning (http://www.southtucson.org/government/department-and-divisions/planning-and-zoning.html)
Gov. and Quasi-Gov.	City of South Tucson	Guideline	City of South Tucson Comprehensive Plan	1999	1999				x													Includes strategies to incorporate xeriscape landscaping into future conversion of right-of-way into linear park	City of South Tucson Planning and Zoning (http://www.southtucson.org/government/department-and-divisions/planning-and-zoning.html)
Gov. and Quasi-Gov.	City of Tucson	Guideline	Mayor Jonathan Rothschild's 180-day work plan	Dec-June, 2012	2012	x	x	x			x											Gives priority to solar energy and water conservation, road design to minimize runoff and maximize recharge, and increasing low water use and native shade trees on city streets; goal to make Tucson an industry leader in solar power and water conservation	City of Tucson Mayor's Office (http://cms3.tucsonaz.gov/home/announcement/mayors-180-day-status-report)
Gov. and Quasi-Gov.	City of Tucson	Guideline	Watercourse Preservation Resolution (#15269)	April, 1990	1990		x		x	x				x				x			x	"The Mayor and Council find that protection and preservation of natural drainage systems should be the primary emphasis of City stormwater management efforts. Nonstructural solutions to flooding hazards shall be the preferred strategy over structural solutions."	City of Tucson Department of Transportation (http://cms3.tucsonaz.gov/transportation/watercourse-preservation)
Gov. and Quasi-Gov.	City of Tucson	Guideline	Landscape Advisory Committee	created in 1990	1990				x			x		x								Advises Mayor and Council on the design, management, planning, and policy of Tucson's vegetation; includes a water conservation specialist on the 11-person committee	City of Tucson Planning and Development Services (http://cms3.tucsonaz.gov/planning/news/committees/lac/index.html)
Gov. and Quasi-Gov.	City of Tucson	Education	Urban Heat Island Workshops	2005	2005		x					x							x			Annual workshop to educate City staff on the urban heat island and ways to mitigate its effects	City of Tucson, Irene Ogata (Irene.Ogata@tucsonaz.gov)
Gov. and Quasi-Gov.	City of Tucson	Guideline (if approved)	City of Tucson General Plan update (Green Infrastructure Element)	Will be taken to voters in Nov. 2013	2013	x	x		x	x		x									x	Contains a Green Infrastructure Element that provides a mixture of requirements and guidelines for more fully implementing GI/LID practices across the city	City of Tucson Housing and Community Development Dept. (http://cms3.tucsonaz.gov/plantucson), (http://cms3.tucsonaz.gov/sites/default/files/12minutes/green_infrastructure_final_working_document_021012.pdf)

Foundation - Water Resources Policies

- •1984 Tucson Water Waste Ordinance ("water cops")
- •1991 Tucson Xeriscape Landscaping Ordinance
- •2009 State Blue Ribbon Panel
- •2014 Pima County Drought Plans



March 31, 2015
(Released Thursday, Apr. 2, 2015)
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	7.07	92.93	80.21	29.49	0.97	0.00
Last Week 3/24/2015	7.07	92.93	80.21	29.49	0.97	0.00
3 Months Ago 12/30/2014	0.00	100.00	83.05	35.34	3.84	0.00
Start of Calendar Year 12/30/2014	0.00	100.00	83.05	35.34	3.84	0.00
Start of Water Year 9/30/2014	0.00	100.00	84.58	37.92	3.76	0.00
One Year Ago 4/1/2014	0.00	100.00	87.99	57.01	5.18	0.00

Intensity:
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
Eric Luebehusen
U.S. Department of Agriculture

http://droughtmonitor.unl.edu/

Consider Drought Stage 2-
Tucson Irrigation Restrictions

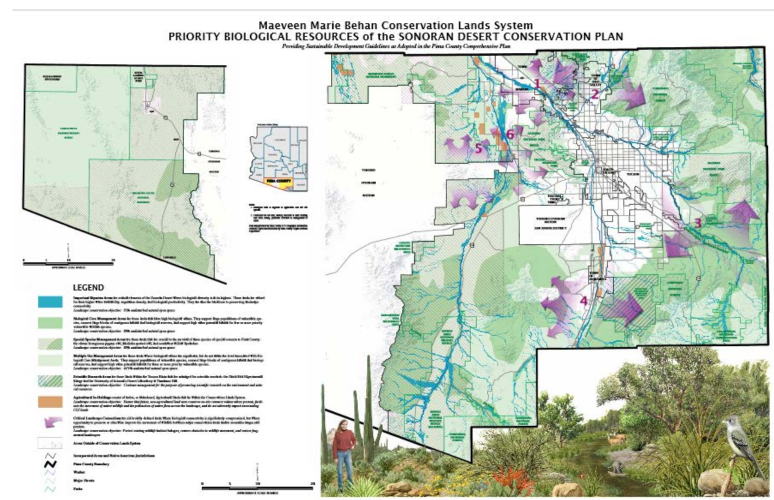
Foundational Policies

- Large Scale GI Connectivity

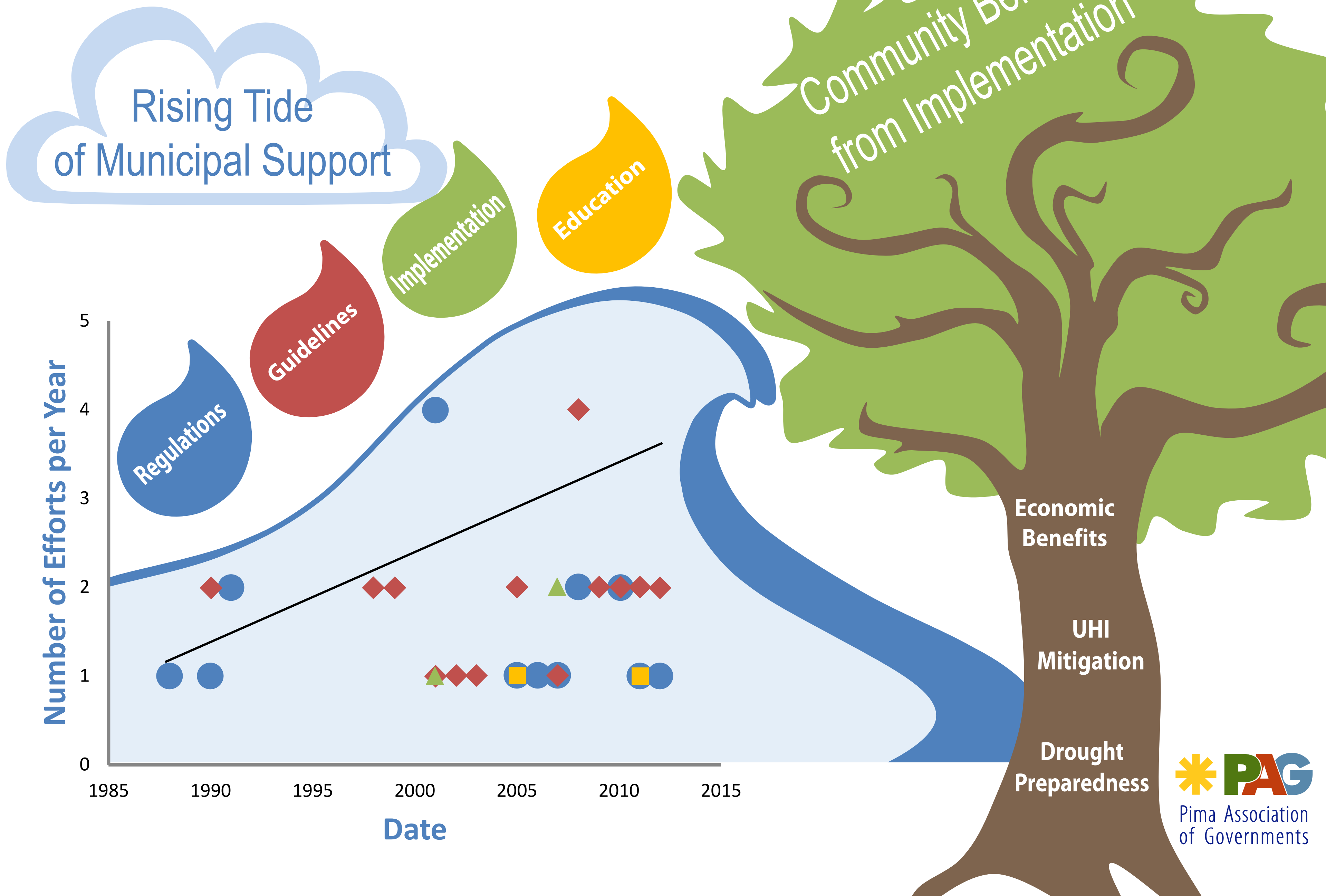
•2001 Marana Land Development Code - Protection of wildlife corridors

•2001 Pima County Sonoran Desert Conservation Plan- Conservation Lands System

•2006 Regional Transportation Authority- Funding for Wildlife Linkages

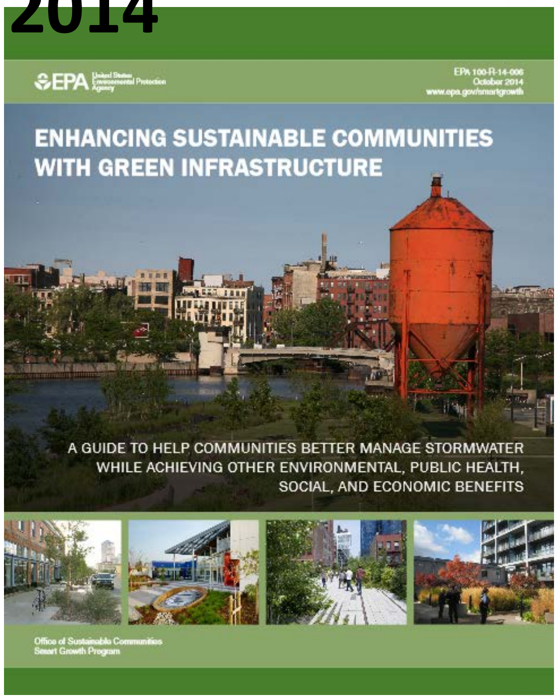


PAG Regional Report on Green Stormwater Infrastructure



Future Direction

2014



Learn more in *Enhancing Sustainable Communities With Green Infrastructure*: www.epa.gov/smartgrowth/green-infrastructure.html

Joint Effort: LID Working Group

Public: Pima County

- Regional Flood Control District
- Development Services Dept.
- Dept. of. Transportation
- Dept. of. Environmental Quality

PIMA COUNTY

Public: City of Tucson

- Office of Conservation & Sustainable Development
- Dept. of Transportation: Stormwater Division

TUCSON WATER

Education: Univ. of Arizona

- Environmental Research Lab
- Drachman Institute
- Facilities
- Water Research Resource Center
- Biosphere 2

Public: Other

PAG Pima Association of Governments

ORO VALLEY ARIZONA FOUNDED 1974

MARANA

Professional/Trade

Stantec

TETRA TECH

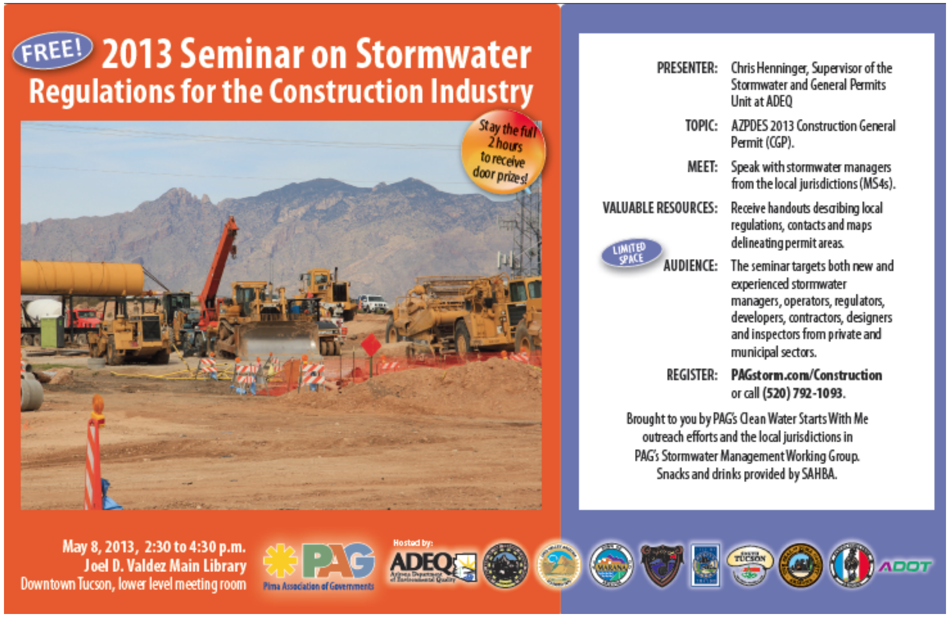
WHEAT DESIGN GROUP LANDSCAPE ARCHITECTS

Non-Profit

Watershed Management Group

Slide by RFCD with Re-Arrangement by PAG

Stormwater Quality Management

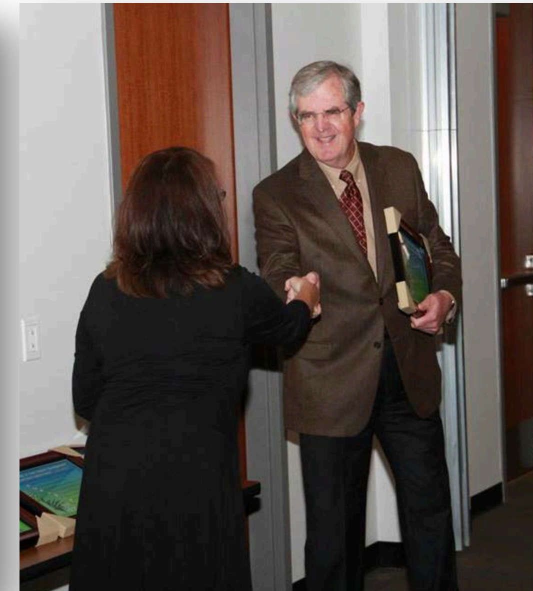


Construction Seminars
(Industry Guidance and Training)

Stormwater Management Working Group
(Staff level information sharing, Collaboration)

Preparations for Federal EPA LID Requirements
(Pro-Active, Top Down Support)

LID Working Group, 2015 Workshop



Photos by PAG and WRRC

LOW IMPACT DEVELOPMENT/
GREEN INFRASTRUCTURE

PAG
Pima Association of Governments

CITY OF TUCSON

PIMA COUNTY

THE UNIVERSITY OF ARIZONA

Stantec

Watershed Management Group

WHEAT DESIGN GROUP
LANDSCAPE ARCHITECTS

TOWN OF MARANA ARIZONA

Case Studies

Awards For Leaders and Demonstration sites

PIMA COUNTY

Imagery by RFCD, Photo by PAG

2011 Goals: LID Working Group

PIMA COUNTY

Develop a Vision

Review Regulatory Mechanisms

Research Effectiveness

Research Return on Investment

Educate/Train/ Coordinate

PAG Resolution Supporting GI/LID 2012

PAG Inventory 2012

RFCD Case Studies 2014

Cost-Benefit Study 2013-2014

EPA Assistance 2013

Guidance Manual 2015

Slide by PAG and RFCD

Greywater Story… a familiar story

The case for guidance

Arizona Breaks New Ground

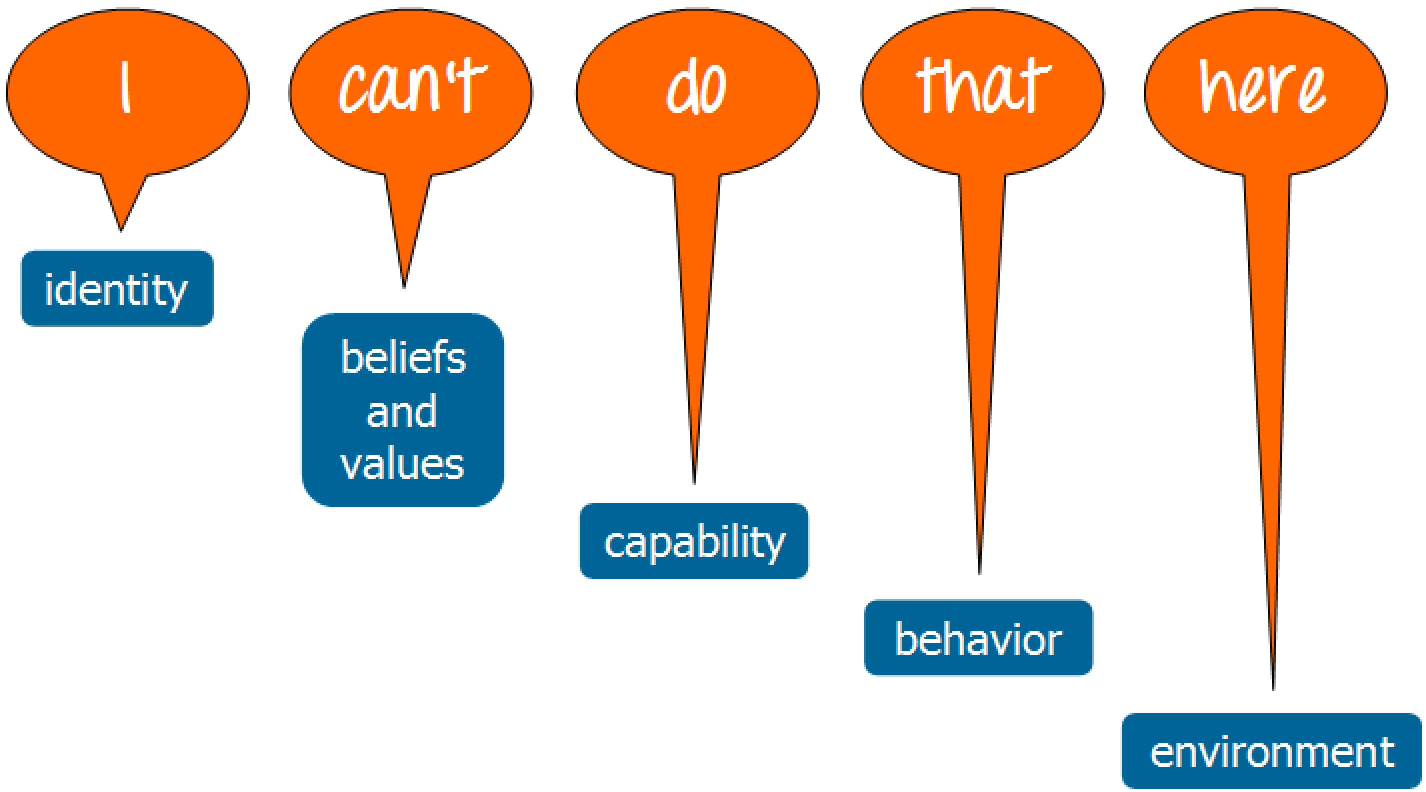
•1998, Val Little of Water Conservation Alliance of Southern Arizona (Water CASA)

•Survey in southern AZ found 13% of residents used greywater, all illegally

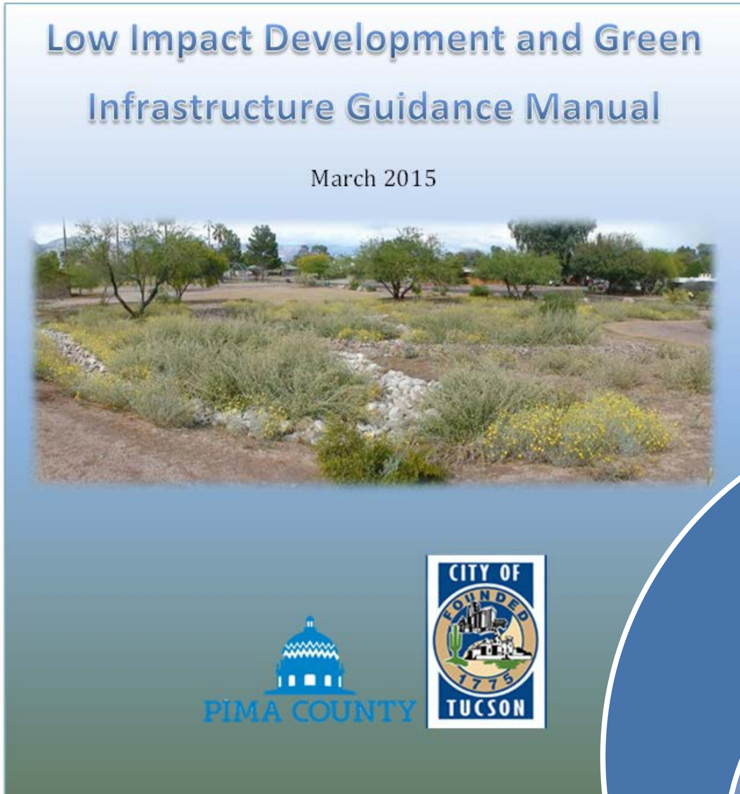
•Restrictive codes prevented teaching greywater safety

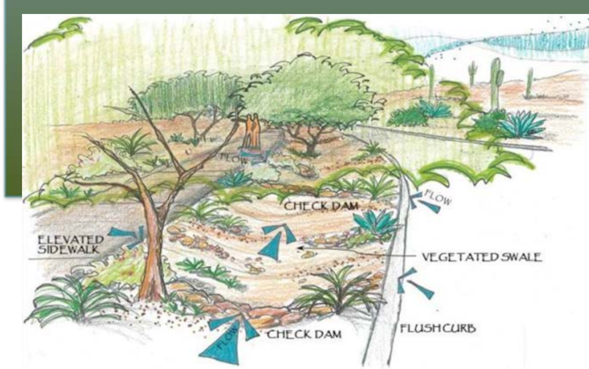
•Systems that follow the guidelines are legal — without permits, fees, or inspections

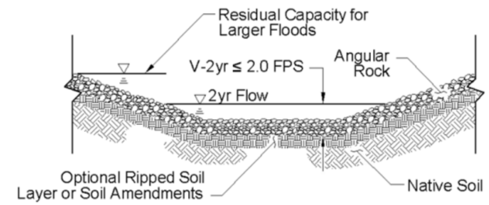
The case for guidance…



Guidance Manual







GI/LID Strategies

- Flood Control
- Stormwater Management
- Pollution Prevention
- Energy Efficiency
- Pedestrian Friendly

LID Site Planning

- Natural Flow Paths Preserved
- Impervious Area Minimized
- Less Soil Compaction and Disturbance

Structural GI Practices

- Harvesting Rainwater and Stormwater
- Conveyance Features that are Naturalized

Images by RFCD, Slide Assembled by PAG

A. Community

B. Municipal Staff
   - ✓ **Listen**
   - ✓ **Common Terms across Silos**

C. Communication in the Social Process
   - **Research**
     - ➢ **Speak Money and Required Objectives**
   - **Marketing**

D. Political

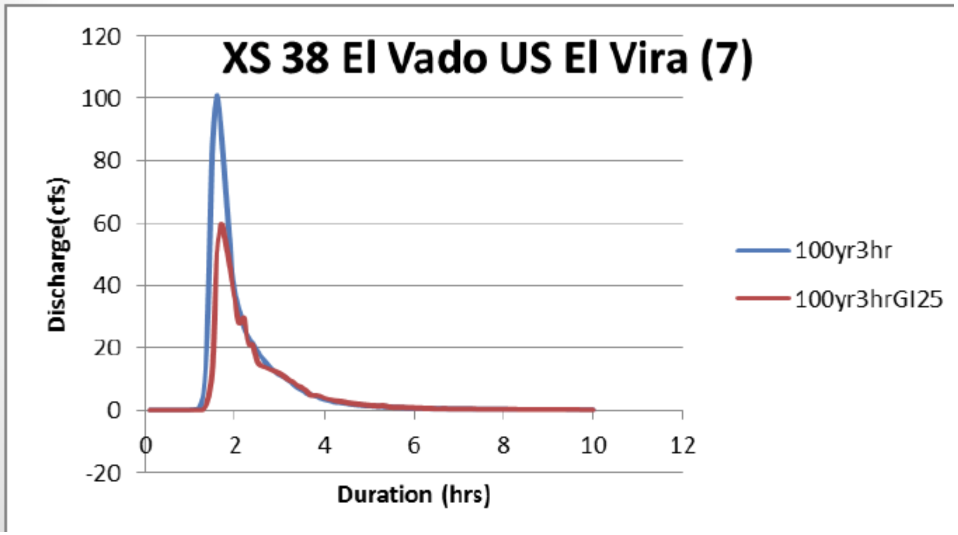
Slide created by RFCD and WMG

Research influences Social Process

Flooding Issues

Drainage Area:

30 acres



Economics

Financial Benefits

Increased Value- Pavement longevity
Property and sales

Increased Safety- Traffic accidents
Heat injury / mortality
Flooding

Reduced Costs- Irrigation
Air pollution
Energy

AutoCASE™

✓For **every $1** a community **invests** in rain gardens and green streets **over $6 of value are created** when accounting for **direct** and **indirect** economic values.

PIMA COUNTY

PAG Pima Association of Governments

CITY OF TUCSON

Watershed Management Group

Stantec

Public Survey

- Stormwater Quality – Outreach is Required
- LID is a Best Management Practice (EPA/ADEQ)
- Measured Action/ Awareness of Public

Tell me if the listed Low Impact Development practice has been implemented or installed at your home or business

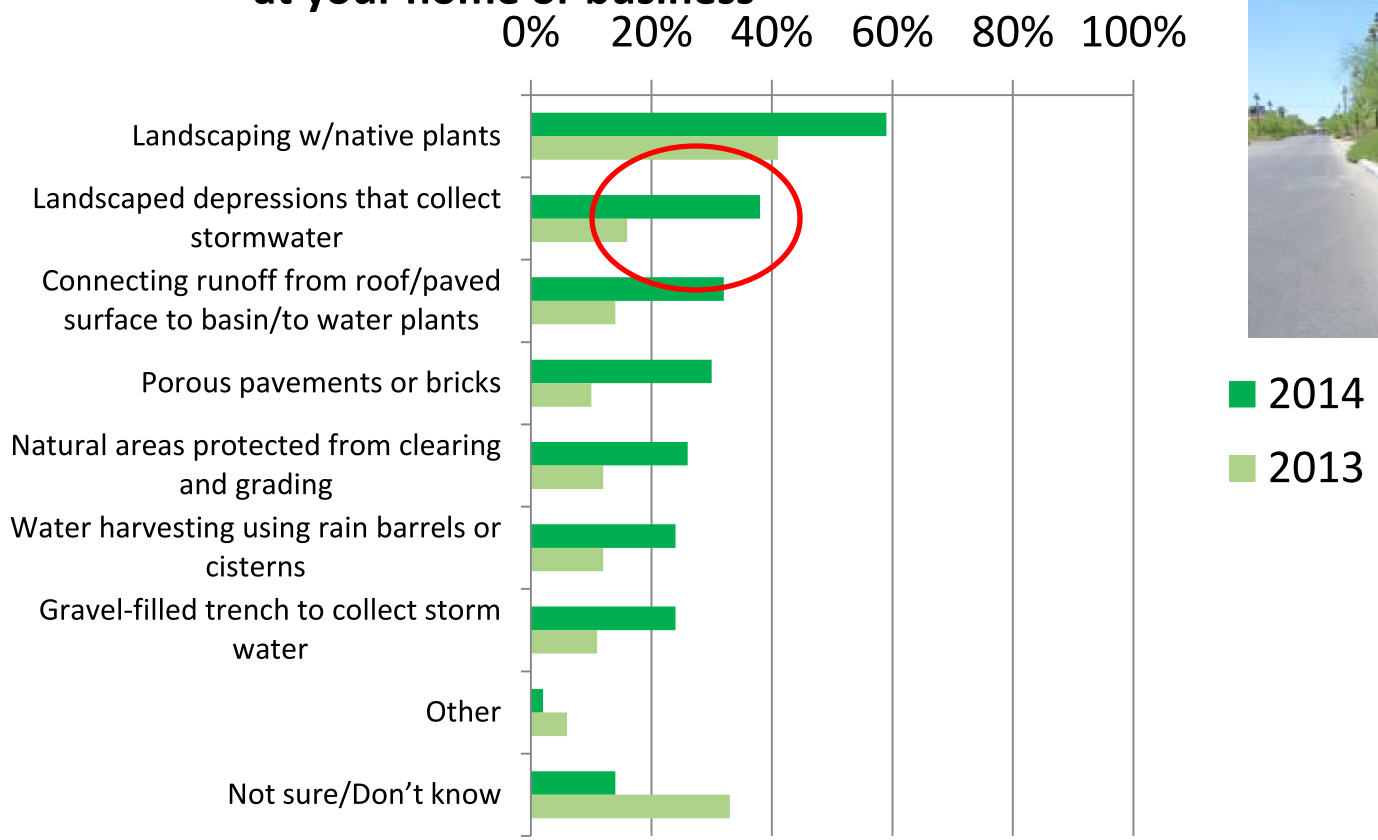
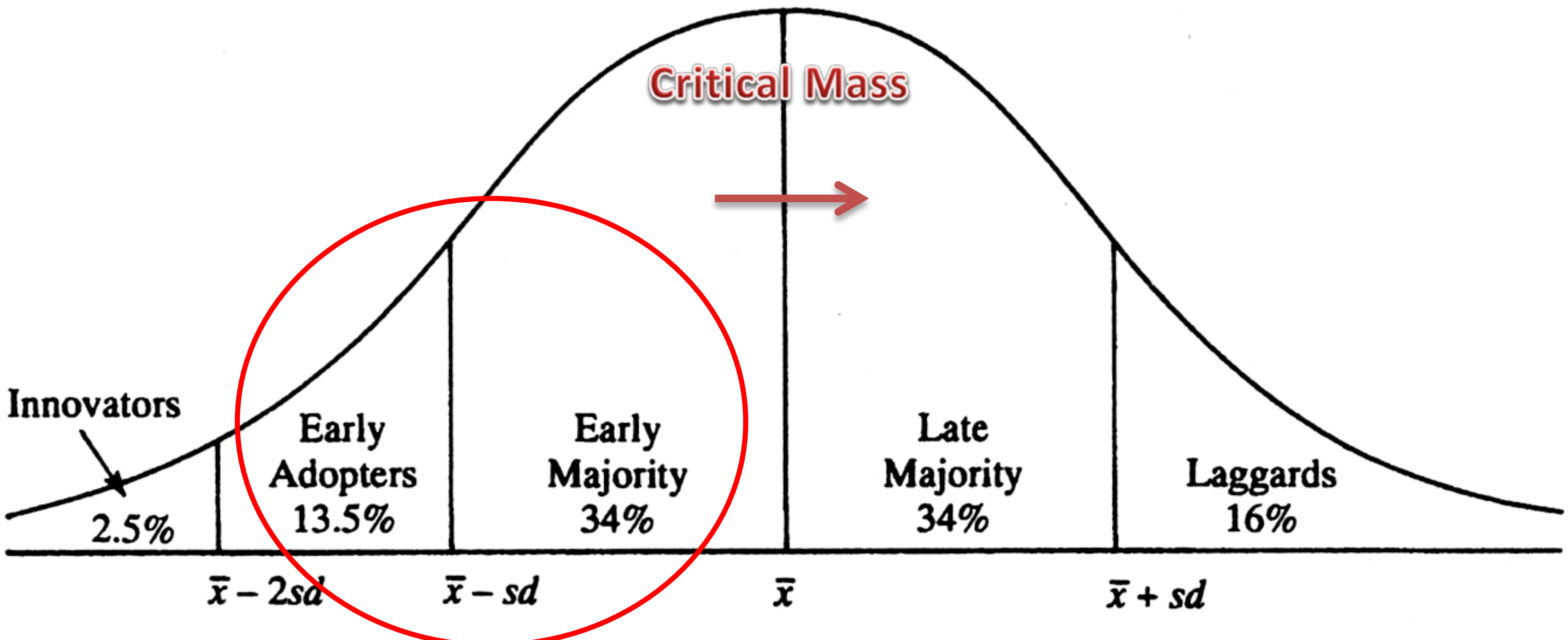


Photo by PAG, Graph by PDEQ

FMR, 2014, Fig. 29

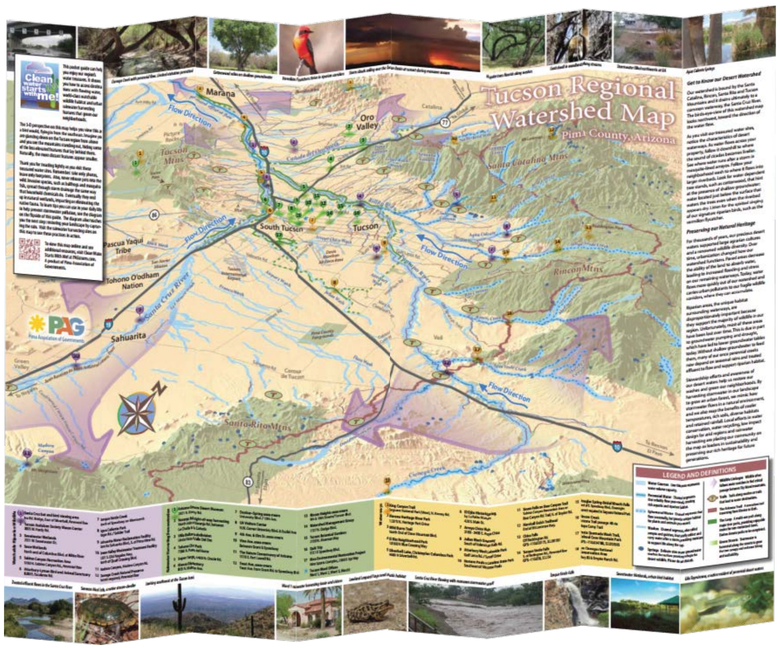
Public Outreach – Social Process

Figure 7-3. Adopter Categorization on the Basis of Innovativeness



The innovativeness dimension, as measured by the time at which an individual adopts an innovation or innovations, is continuous. The innovativeness variable is partitioned into five adopter categories by laying off standard deviations (sd) from the average time of adoption ($\bar{x}$).

Public Outreach, Engagement



- Stormwater Quality (Top Down)
- Tie to Community Momentum
- Preach a new Song to the Choir


A. Community
B. Municipal Staff
C. Communication
D. Political
• Regulation
• Champions
• Recognition
• Funding

Top Down

- The Reasonable and Prudent Alternative (RPA) requires communities to incorporate Low Impact Development (LID) techniques as an element of their stormwater management in the Special Flood Hazard Area (SFHA).

Bothell, WA 98021-9796

FEMA

Local Regulations

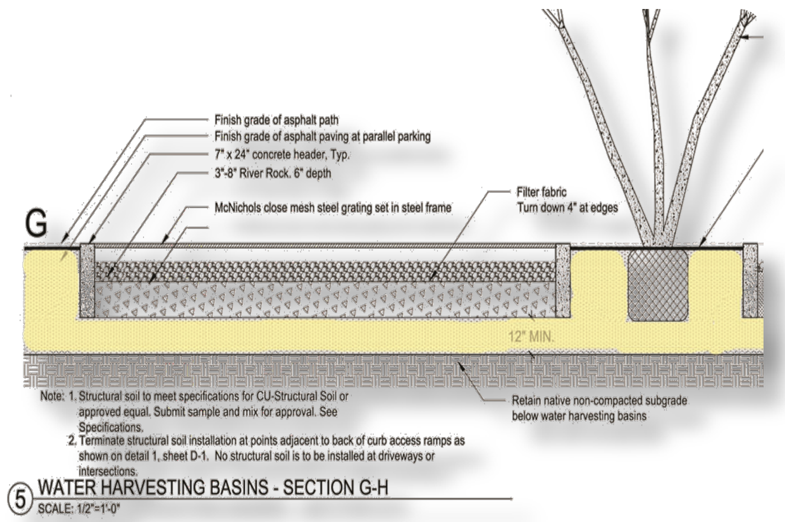
- City of Tucson Commercial Rainwater Harvesting Ordinance (CHAMPIONS!)
- TDOT Green Streets Policy (GRANTS!)

Incentives

- Tucson Water Rebates (CARROTS!)

Plan Tucson

- Staff Level Engagement



Slide content by CoT, Assembled by PAG

Political Leadership

Regional Council Resolutions

Defines shared values

Developer Input- ***Incentives/ Credits***

Provides direction

Pima Association of Governments


Green Infrastructure for Regional Vibrancy

Recognizing the value and continuing potential of Green Infrastructure and Low Impact Development to foster economic vitality, to augment the water resource portfolio and to promote human and ecosystem health.

- *Whereas*, green infrastructure (GI) utilizes stormwater flows to sustain and increase native vegetation and shade trees without increasing potable water use so that societal benefits of connecting people to natural and cultural heritage is realized in urban infill and other built environments, transportation, open space, and natural wash projects; thereby enabling sustainable stormflow irrigation that is resilient to peak drought conditions and outdoor water use restrictions; and
- *Whereas*, low impact development (LID) and the generated vegetation adds shade and beautification resulting in locally and nationally measured economic benefits such as increased home property values, commercial business success, ecotourism, health and fitness, professional expertise, energy efficiency, flood safety, irrigation efficiency, erosion prevention, pavement preservation related to shade, and reduced need for expensive flood control structures; this builds a regional "sense of place" with Sonoran desert branding to enhance investment, business success, and job growth in the region; and
- *Whereas*, trees and vegetation provide health benefits by reducing heat-related illnesses and deaths in vulnerable populations and removing particulates and other pollutants from air; these are strategies recognized by the EPA for cooling, encouraging fitness, improving job access through active and alternative modes of transportation usage, and providing environmental justice benefits to low income, elderly, isolated and minority communities; and
- *Whereas*, GI designs using context-sensitive solutions for transportation projects provide life-cycle returns on investment and safety benefits when used for roadway calming, green buffers, and other safety elements for pedestrians, cyclists, and bus riders; and
- *Whereas*, federal and state transportation funding and guidance, including the TIGER grants (Transportation Investment Generating Economic Recovery), Transportation Alternatives Program funds, ADOT's Draft Smart Transportation Guidebook, and Federal Highway Administration objectives, increasingly identify green infrastructure and beneficial use of stormwater as valued project elements.

Now, therefore, be it recognized that Pima Association of Governments' Regional Council (PAG) commends the region for exceeding recommendations put forth in PAG's 2012 Green Infrastructure/Low Impact Development (GI/LID) Resolution for collaborations, guidance, case studies, incentives, return on investment modeling, policy inventories, and incorporating GI/LID principles into regional planning documents. These efforts helped member jurisdictions receive grants, gain federal technical assistance and achieve top national sustainability rankings.

And may it also be recognized that PAG continues to encourage GI/LID, when feasible and affordable, as a valuable element of context-sensitive roadway design for public and private development providing multimodal benefits for all ages and abilities. PAG strongly encourages a continued emphasis on regional coordination of GI/LID planning including active engagement among departments and partner jurisdictions for development of sample guidance and policy. PAG further recommends seeking new opportunities to implement green infrastructure measuring how these projects benefit our economic vitality, energy demand, long-term water reliability, heat and drought resilience, urban biodiversity and ecosystem connectivity.

This Resolution Made by Pima Association of Governments' Regional Council on March 26, 2015.

Pima Association of Governments

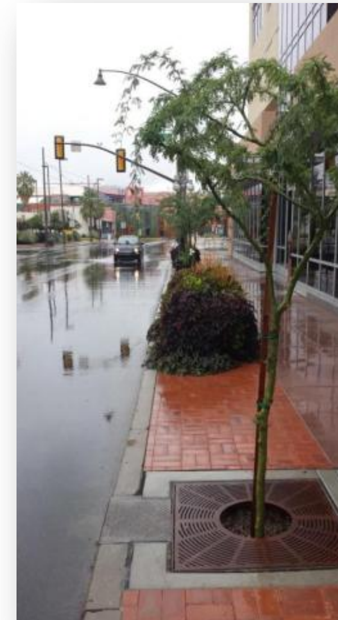
- •2009 Rainwater Harvesting – stormwater as a resource
- •2012 Low Impact Development - flooding, natural corridors
- •2015 Green Infrastructure – economic, transportation, health

Economic Vitality – Winter 2015

Green Infrastructure for Regional Vibrancy **Resolution**

Communicates GI relationship to **economic vitality**

- Increase home property values and commercial business success
- Attract a professional workforce and new business
- Build urban tourism and connect to ecotourism
- Save water, energy, and reduce flooding concerns



Business Vibrancy

Pedestrian and Cyclist Buffers

Sonoran Viewscapes & Branding

Mobility Safety

Heat Resilience Through Shading

Reduced Irrigation

Image sources: PAG

Resolution aids Recognition, Awards, Grants

…In turn, recognition speaks to leaders


United States Environmental Protection Agency

Improving Community Resiliency with Green Infrastructure

What is green infrastructure?

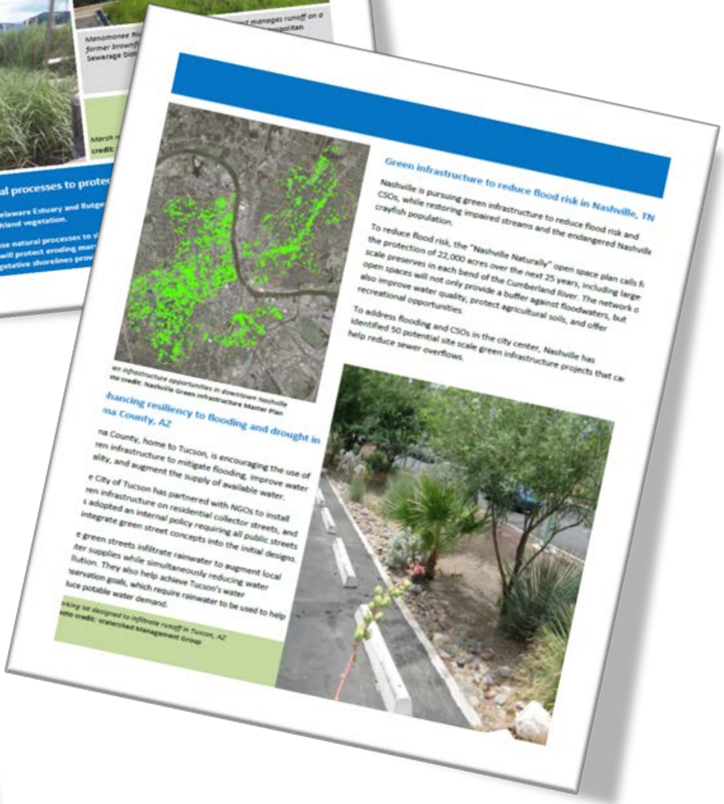
Green infrastructure uses vegetation, soils, and natural processes to manage water and create healthier urban environments. The scale of green infrastructure ranges from urban installations such as rain gardens and green roofs up to large tracts of undeveloped natural lands. The interconnected network of green infrastructure can enhance the resiliency of infrastructure and communities by increasing water supplies, reducing flooding, providing climate adaptability, and improving water quality. Approximately one-third of the estimated growth in the 100-year floodplain over the coming decades is attributed to stormwater impacts of upstream development.

Milwaukee, WI uses green infrastructure to improve water quality and enhance flood control

Milwaukee Metropolitan Sewerage District's (MMSD) green infrastructure program combines site scale practices and large scale open spaces. The *Greenseams* program permanently protects undeveloped properties within upstream watersheds to manage stormwater at its source, keeping water out of the combined sewer and mitigating downstream flooding by infiltrating it on site.

The Menomonee River Industrial Park contains the largest green infrastructure project in the Milwaukee area. Once a contaminated industrial site, this 70-acre stormwater park now manages runoff from adjacent development up to the 100-year storm event, as well as providing a high-value recreational asset.

Living Shoreline Initiative uses natural processes to protect


Green infrastructure to reduce flood risk in Nashville, TN

Nashville is pursuing green infrastructure to reduce flood risk and CSOs, while restoring impaired streams and the endangered Nashville crayfish population.

To reduce flood risk, the "Nashville Naturally" open space plan calls for the protection of 22,000 acres over the next 25 years, including large scale preserves in each bend of the Cumberland River. The network of open spaces will not only provide a buffer against floodwaters, but also improve water quality, protect agricultural soils, and offer recreational opportunities.

To address flooding and CSOs in the city center, Nashville has identified 50 potential site scale green infrastructure projects that can help reduce sewer overflows.

Tucson Receives 4-STAR Sustainability Rating

Receiving Tucson's 4-STAR rating from STAR Communities Executive Director Hilari Varnadore, with Tucson's Sustainability Manager Leslie Ethen

On behalf of the City of Tucson, I was pleased to accept Tucson's 4-STAR rating from STAR Communities Executive Director Hilari Varnadore.

STAR Communities rates cities on various measures of sustainability. Read how Tucson did here.

Tucson's Sustainability Program falls under the Office of Integrated Planning. Congratulations to Sustainability Manager Leslie Ethen and all city staff for the work they do to make this a more livable, resilient community.

Funding

Willingness to Pay Surveys
Public Education - Value
Feasibility Studies
Collection

General Fund/ Property Taxes
Fee for Public Service

Incentives
Credits for Pervious

Property Types
Purpose

Average quarterly $11 / household

Strategic Planning (Critical Mass, Loud Voices)	Need Based (Problem Solving)	Asset Based (Collaborative, Transparent, Empowered)	Market/ Outreach (Top Down)	Community Driven (Bottom Up)

Theories of Change

Stages of Change	Health Belief Model	Social-Cognitive Theory	Diffusion of Innovations	Social Networks
Precontemplation	Susceptibility	Reciprocal determinism	Relative advantage	Opinion leaders
Contemplation	Severity	Behavioral capability	Compatibility	Groups
Preparation	Threat	Expectations	Complexity	Adding or removing members
Action	Perceived benefits	Self-efficacy	Trialability	Bridging groups
Maintenance	Perceived barriers	Observational learning	Observability	Rewiring groups
Decision balance	Cues to action	Reinforcement		Network weaving

Mead Mier

MMier@PAGregion.com

Pima Association of Governments

Pima County Native Plant Program

Julia Fonseca, Pima County Office of Sustainability and Conservation

Pima County, Arizona

- 9,189 Square Miles
  23,800 sq. km.
- Urbanized
- County builds: roads, wastewater treatment, flood control, public buildings
- 7,000 native plants on one recent project

PIMA COUNTY

Native Plants as Aesthetic Icons

Saguaro cactus

Native Plants as Aesthetic Icons

1929 Arizona Native Plant Law salvage and harvest restrictions

Ocotillo, Barrel cactus

Queen-of-the-night cactus

Native Plants as Aesthetic Icons

Queen-of-the-night cactus

Reduced Water Use

Desert willow *(Chilopsis sp)*, Fairy duster *(Calliandra sp)*

1986 Native Plants as Wildlife Habitat?

Fired: Snyder is out as Sun Devils coach / **Sports**

Arizona Daily Star

www.azstarnet.com

SERVING TUCSON SINCE 1877 · THURSDAY, NOVEMBER 16, 2000

U.S. agency questions land-clearing

Pygmy-owl concerns halt Thornydale road widening

By Tony Davis
ARIZONA DAILY STAR

Pima County road crews stopped clearing trees and cacti this week for a Northwest Side road-widening project after federal officials raised concerns about the work in endangered pygmy owl habitat, a county official said.

Halted for now is the $9 million project to widen Thornydale Road from two to four lanes between Ina and Cortaro Farms roads. The county Transportation Department ordered work stopped Tuesday after hearing concerns from the U.S. Fish and Wildlife Service about the clearing of hundreds of ironwood, palo verde and other desert trees, said Brooks Keenan, the department director.

Although county officials asserted that the land-clearing was necessary and legal, arguments that some environmental groups dispute, County Administrator Chuck Huckelberry acknowledged that county communication with federal officials and overall handling of much of the project has been poor.

While exact counts weren't available, Huckelberry estimated that county contractors had cleared 300 ironwood and other trees. He said the county had failed to meet its current and proposed future rules for native plant preservation that it applies to developers, and it had not clearly told federal officials about the amount of environmental effects it expected from

SEE OWL / A17

A lone saguaro *and a pile of composted vegetation are all th*
west corner of Thornydale and Cortaro Farms roads after c
area, scraping off an estimated 300 ironwood and other tree
to 50 feet wide have been cleared along some sections of Thor

Cactus ferruginous pygmy-owl

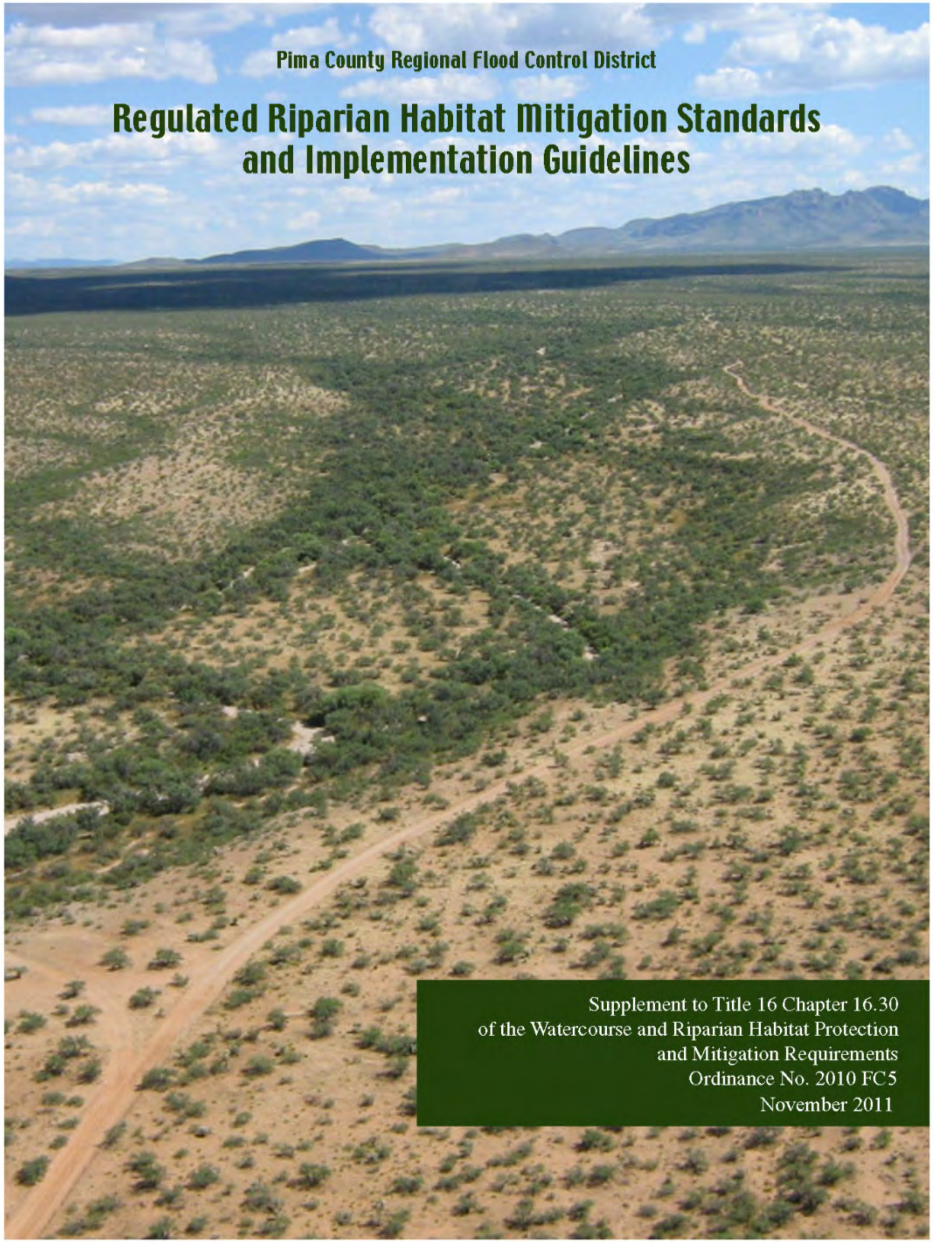
Environmentally sensitive road design standards

Brittlebush,
Globe mallow,
Craycroft Rd.

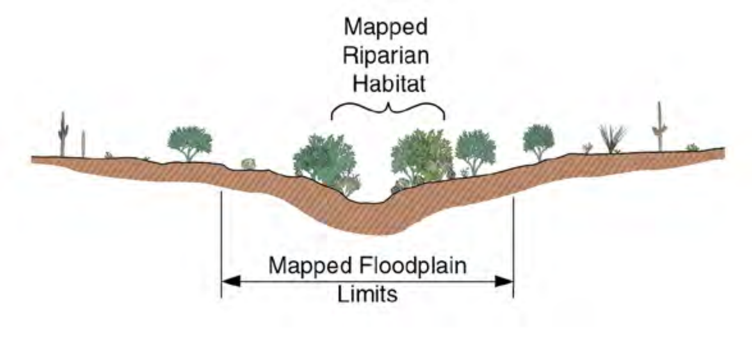
Environmentally sensitive road design standards

Sunrise Road

Native Plants and Floodplains



Excerpted from the Regulated Riparian Habitat Mitigation Standards and Implementation Guidelines



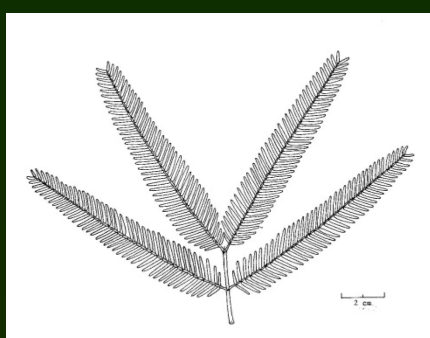
Native Plants and Revegetation

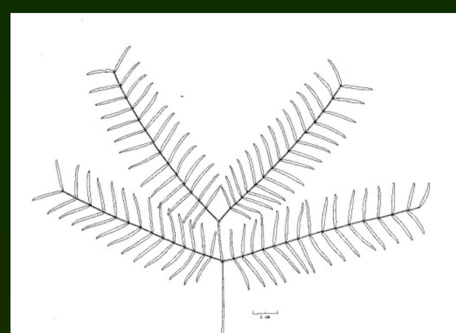
Native Plants and Revegetation

Restoration of disturbed lands: 454 acres

Flood Control Retention Basin

Which mesquites are native?





Velvet Mesquite (*Prosopis velutina*)

UA Cooperative Extension, Pima County Master Gardeners

Andrew Wigg

RANGE: Central and southern Arizona, extreme southwestern New Mexico, and adjacent northern Mexico below 5,000 feet.

FORM: Large shrub or small tree with spreading crown. May be single-stemmed and up to 50 feet tall or grow as an erect, multi-stemmed shrub.

LEAVES: Alternate and bi-pinnately compound; usually about 6 inches long. Each leaflet has ***15 to 20 pairs of minor leaflets,*** less than one half inch long. ***Finely fuzzy surface***; dull green above, and paler below. Deciduous in the winter.

FLOWERS: 2—3 inch ***catkin-like inflorescences of pale yellow flowers***; late spring to early summer.

FRUITS: ***Straight or slightly curved tan pods*** 3—7 inches long; solitary or clustered, ripen mid to late summer and drop in the fall.

TWIGS: Light brown and velvety, slightly zig-zagged with ***paired slender spines at the base of each leaf.*** Bark on young stems can be greenish.

BARK: ***Dark brown, rough and shreddy, sometimes gnarled and twisted.*** Newer bark can be reddish brown.

Andrew Wigg

Carianne Funicelli

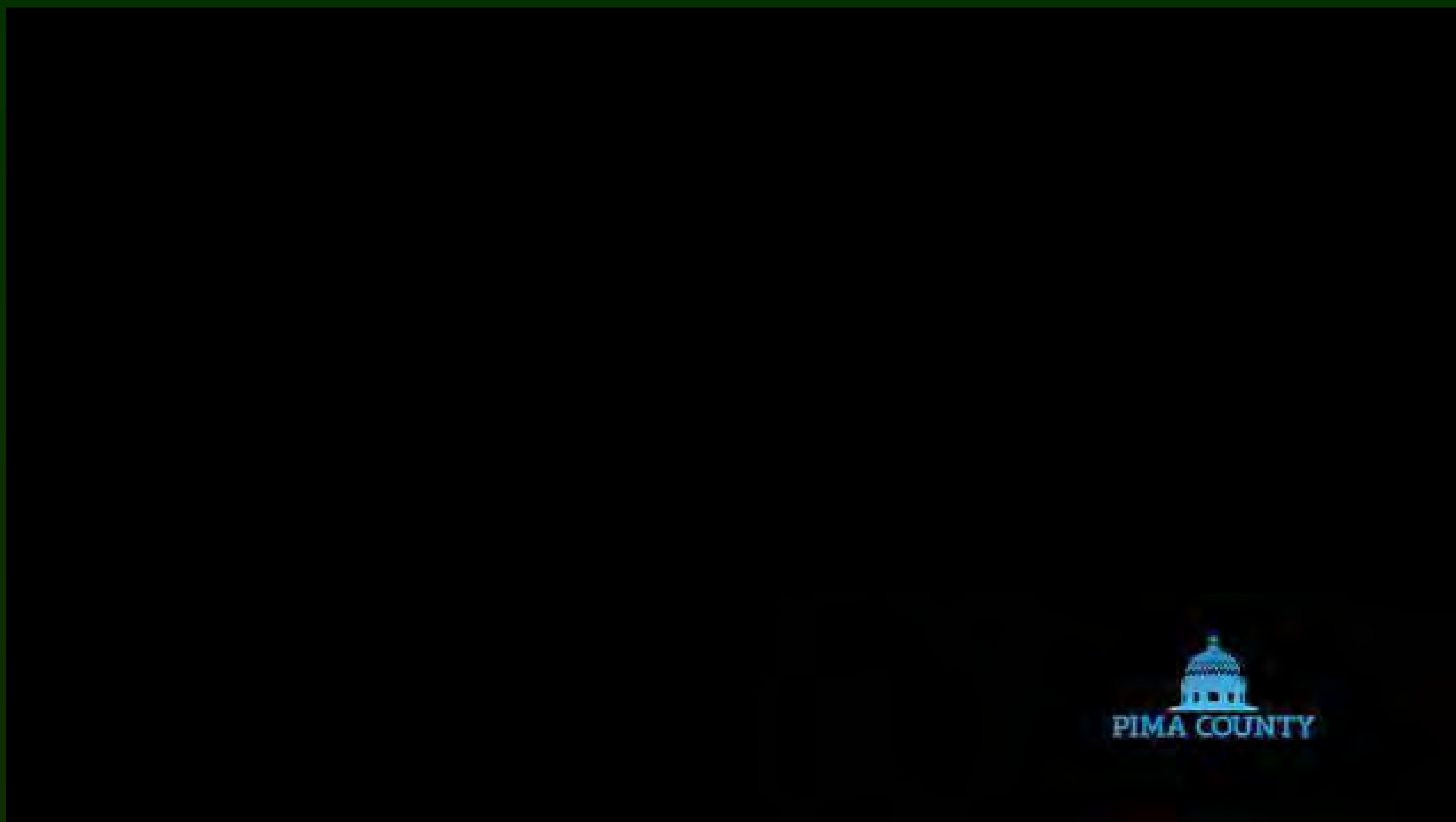
RECON; Matt Johnson

2003 Native Plant Nursery

Pima County Native Plant Nursery

- 20,000 plants
- 11 projects
- various container sizes
- 24 agave types
- 7 milkweed species
- 11 grass species

Pima County Native Plant Nursery



https://www.youtube.com/watch?v=wZHlmPJCnMM

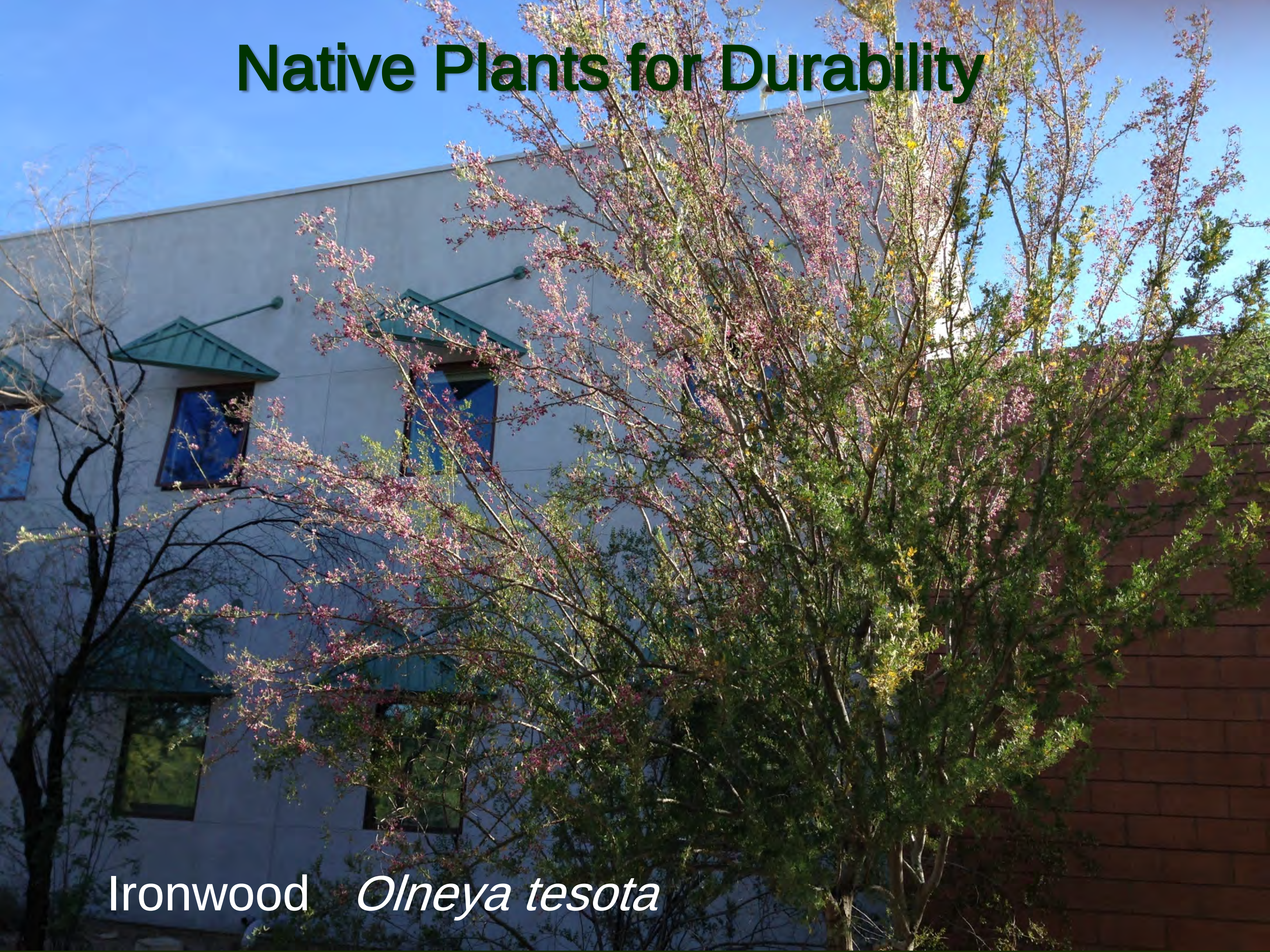
Native Plants for Better Security

Cholla

Native Plants for Durability and Reduced Irrigation

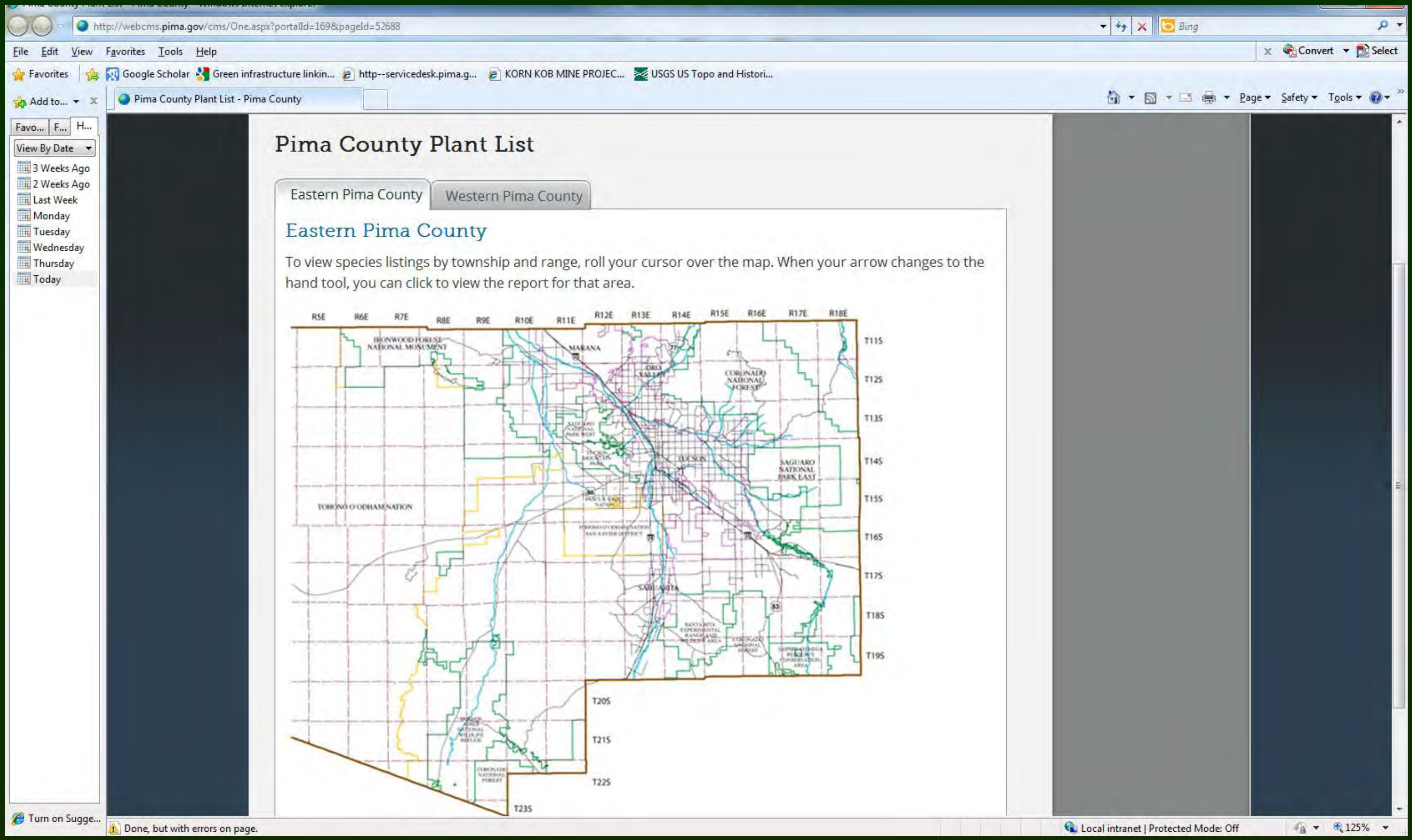



Native Plants for Durability



Ironwood *Olneya tesota*

Native Plant Selection Tool



http://webcms.pima.gov/cms/One.aspx?portalId=169&pageId=52688

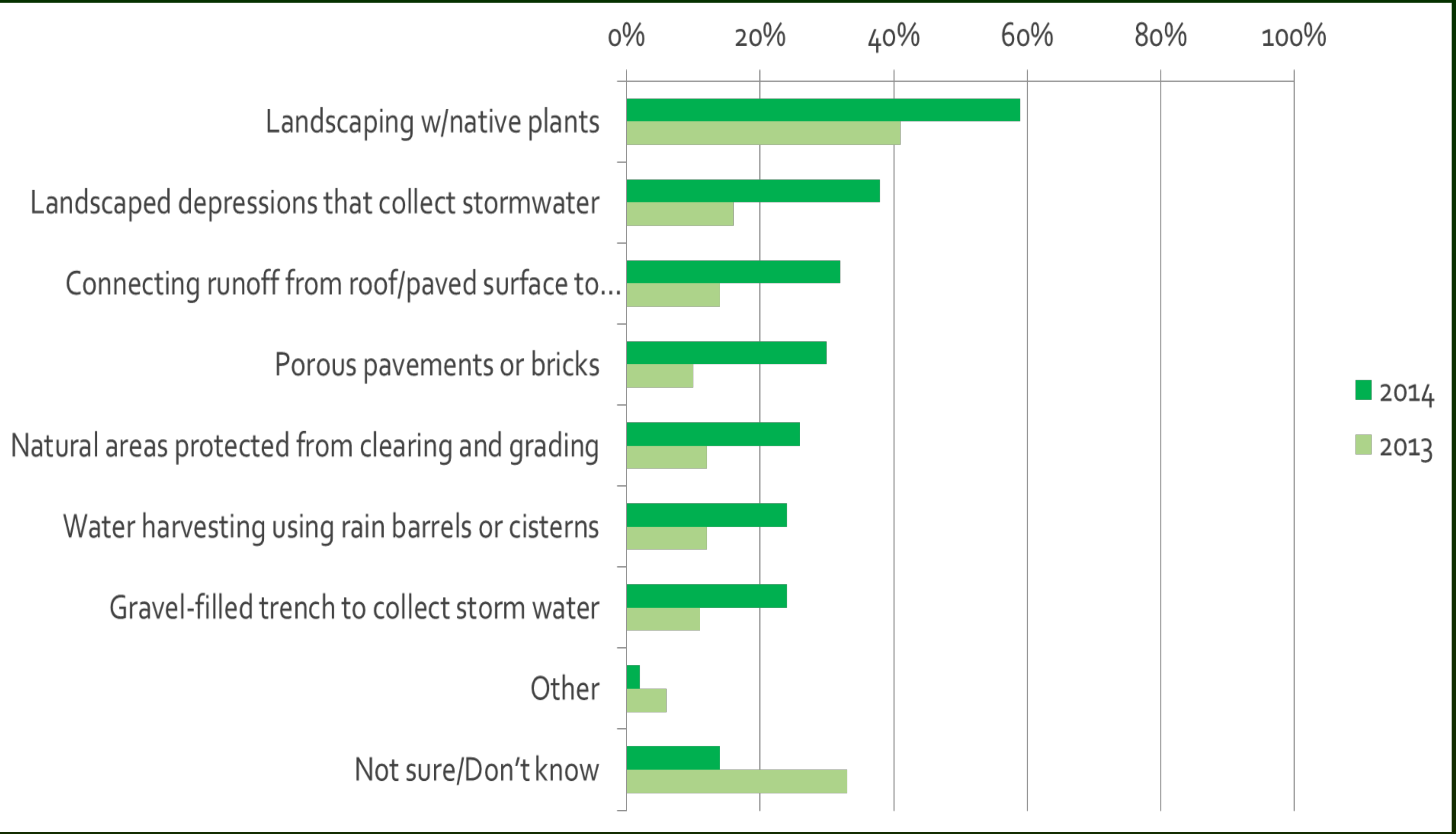
Going Native for Stormwater Quality

Old design: water collects, causing pavement failure

New design

Going Native for Stormwater Quality

Going Native for Stormwater Quality



Pima County DEQ, FMR, 2014

Going Native for Stormwater Quality

Native grasses:

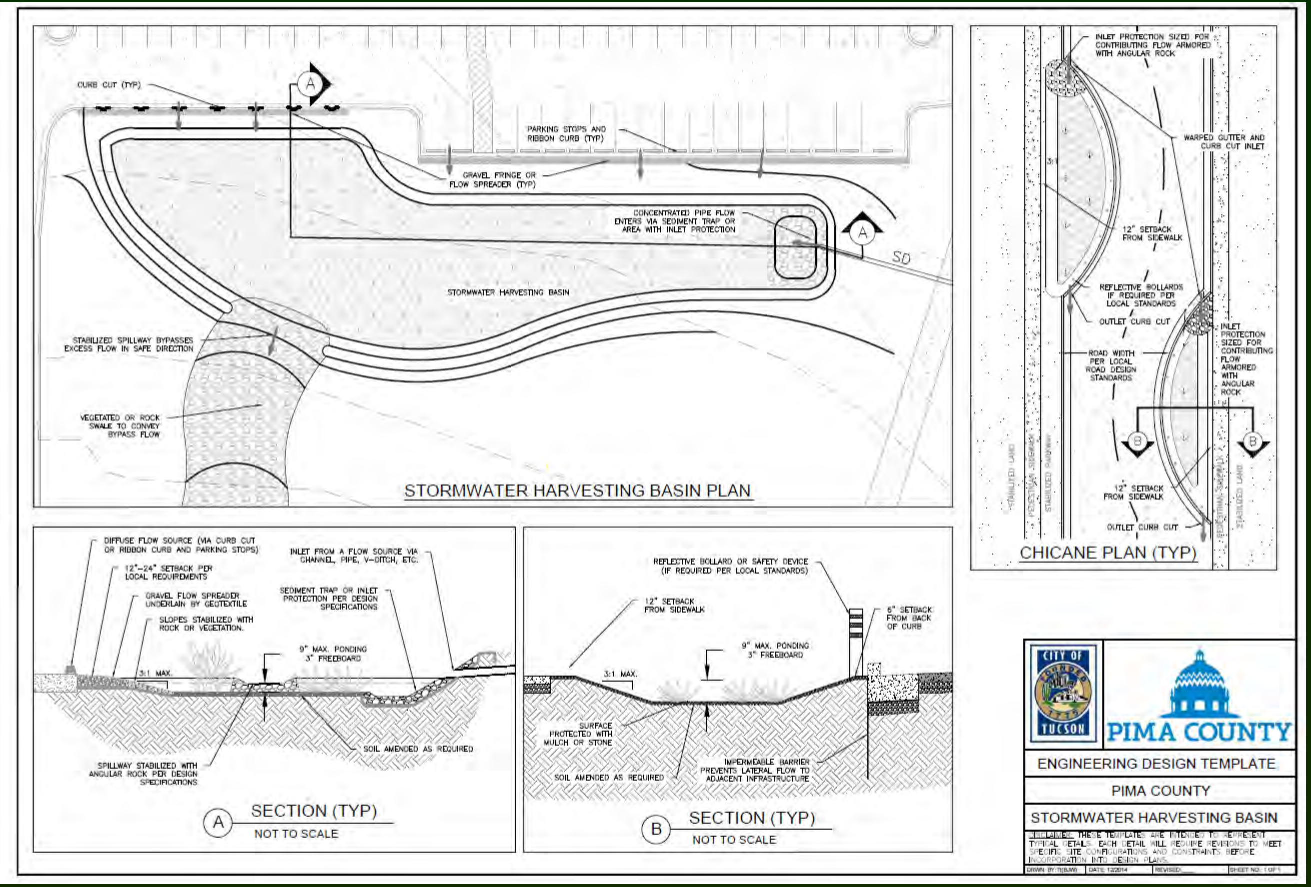
Tolerate drought

Filter pollutants

Build soil carbon

Don’t encroach bike lanes

Going Native for Stormwater Quality



City-County Low Impact Development and Green Infrastructure Guidance Manual

Kino Ecosystem Restoration Project

Kino Ecosystem Restoration Project (KERP)

Pima Prickly Park: A Flood of Plants

Urban Shade: Phoenix versus El Paso

- Velvet mesquite 8%
- Calif. fan palm 8%
- Sweet acacia 7%
- Italian cypress 26%
- Afghan pine 11%
- Mex. fan palm 7%

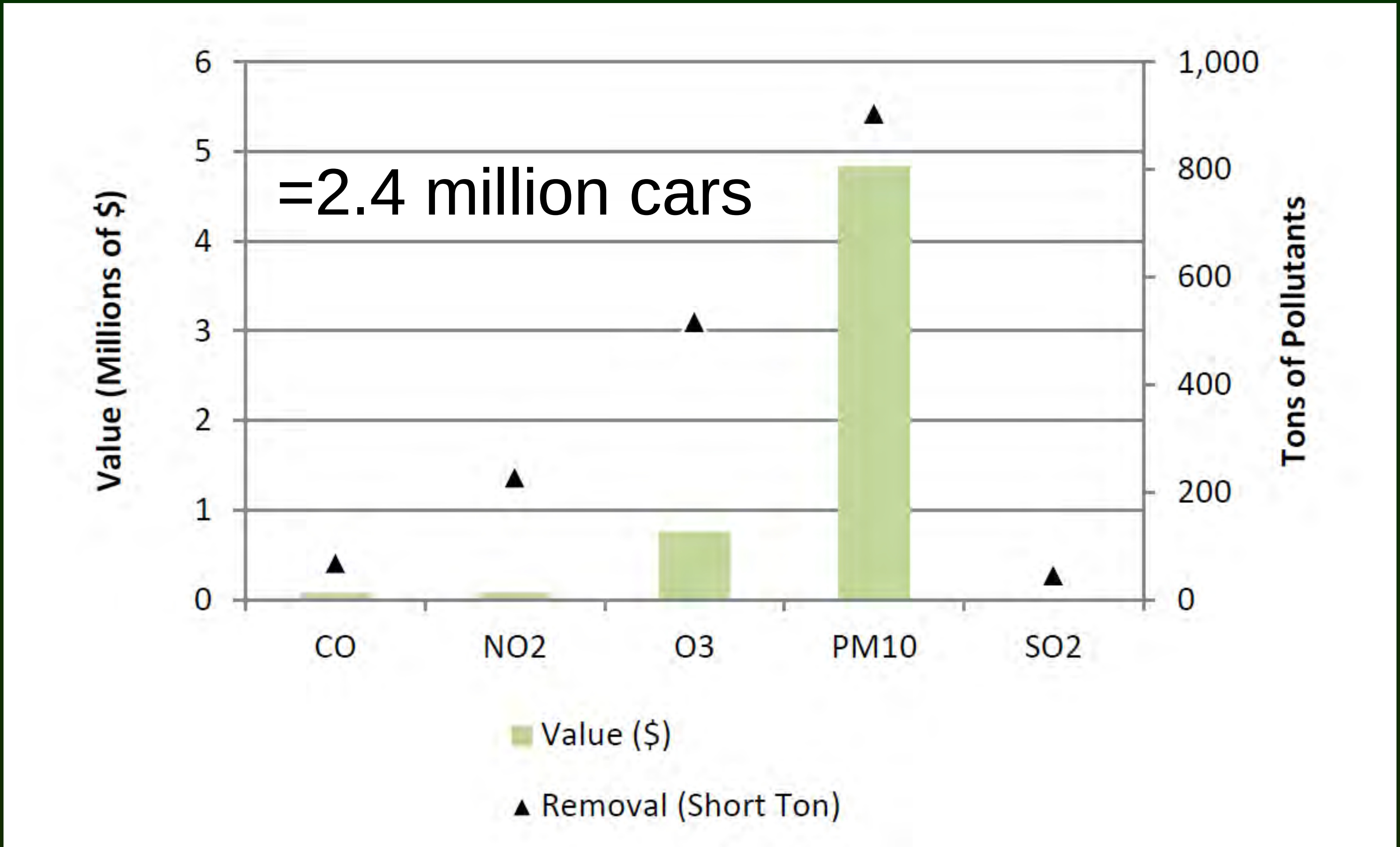
Source: Adkins and Rogstad, 2014

Energy Savings and Reliability

Shading a home can save 20-30% in energy.

Source: Tucson Electric Power

Clean Air: Can Natives Help?



Davey Resource Group 2014

Native Plants for Pollinators

Native Plants and Jobs

Wanted: Native Seeds

Pima County Seed Library

16,000 packets shared last year

Lessons Learned

- Native plants are more useful than we can imagine.
- Tap local plant expertise.
- Be incremental.
- Nurture your plant suppliers.
- Educate!

Thank You and Credit to:

Ellen Alster, Gary Bachmann, Sandy Bolduc, Jessie Byrd, Wendy Burroughs, Neva Connolly, George Kuck, Marie Light, Brian Powell, Iris Rodden, Jim Veomett, at Pima County.

Arizona-Sonora Desert Museum

Carianne Campbell, Sky Island Alliance

Carla Danforth, Pima County Flood Control District

Jillian Cowles, D. Evans,
R. Halliburton, Matt Johnson

Juliet Stromberg, Arizona State University

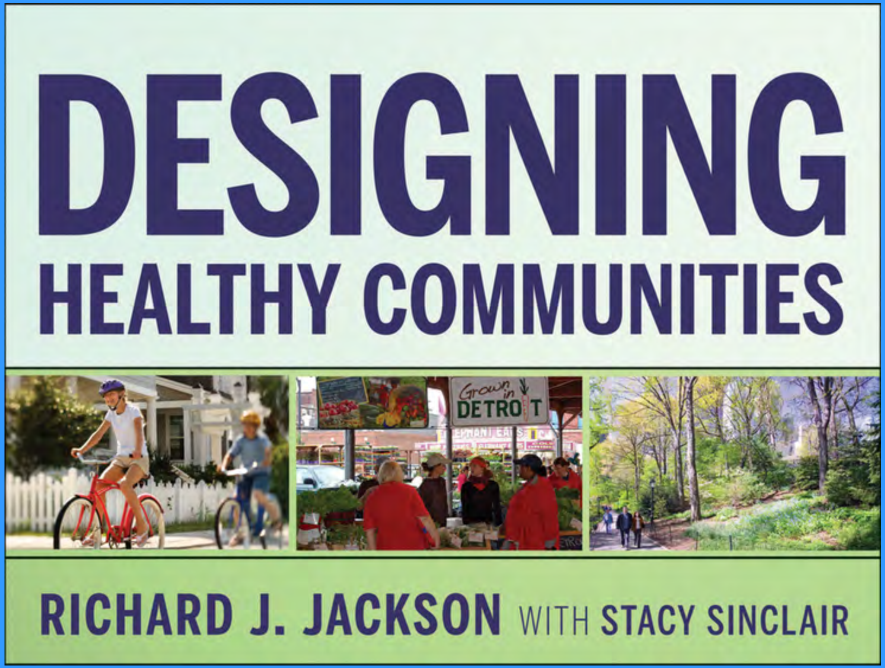
Lori Woods, RECON Environmental

Pima County Native Plant Nursery

https://www.youtube.com/watch?v=wZHlmPJCnMM

LID and Green Infrastructure Guidance Manual

http://webcms.pima.gov/cms/one.aspx?pageId=65263



Green Infrastructure: Benefits for personal and Community Health

Tucson, 21 May 2015

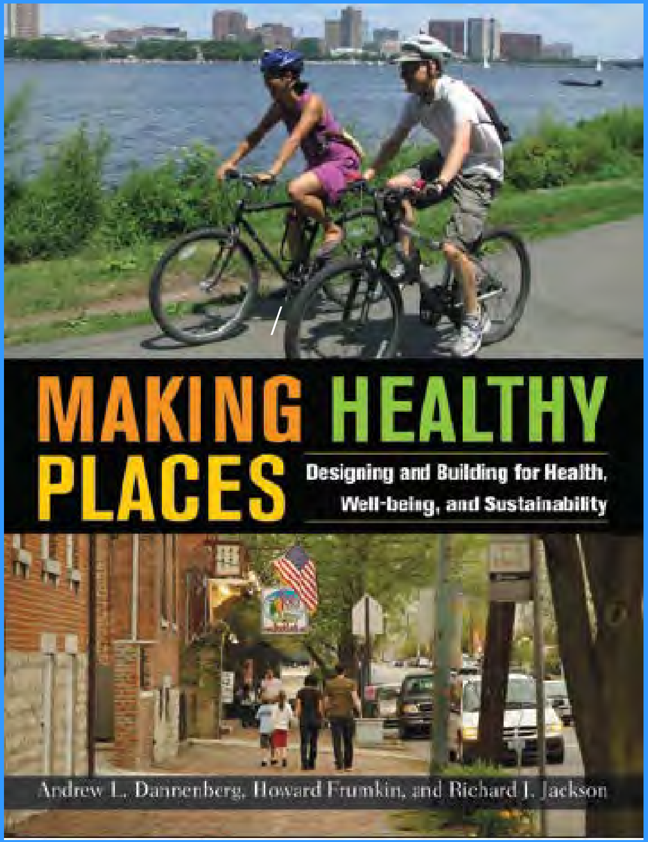
Richard J Jackson

MD MPH

HonAIA HonFASLA

dickjackson@ucla.edu

UCLA Fielding School of Public Health



Border Green Infrastructure Forum

Resiliency and competitiveness for border cities between México-United States

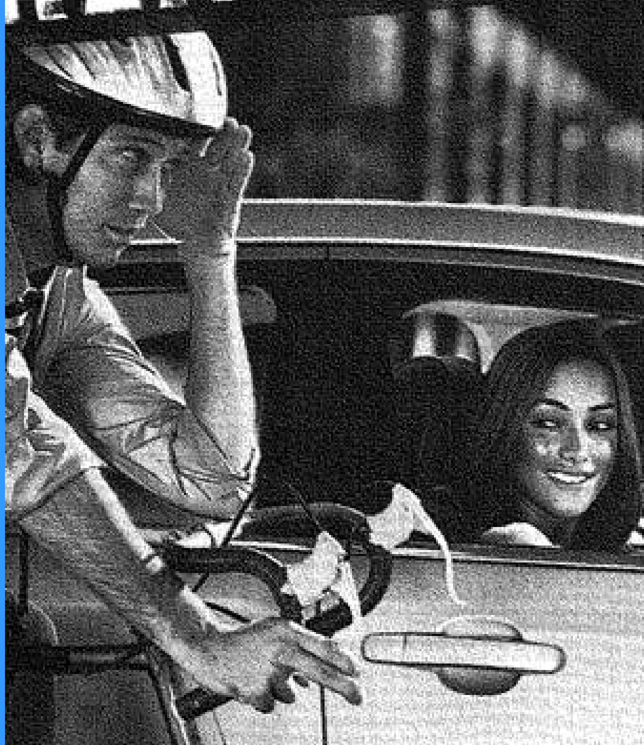
University of Arizona
Tucson, AZ

May 20 and 21, 2015

OBJECTIVE

Build capacities on local authorities, private consultants and professionals' interest in the strategies, technologies and approaches for Green Infrastructure, with the purpose of incorporating these concepts into the urban development public and private projects.

REALITY SUCKS



LUCKILY THE GM COLLEGE DISCOUNT DOESN'T.

GM U COLLEGE DISCOUNT

In fact, it's the best college discount from any car company,[1] and can save you hundreds — even thousands — on an eligible, new Chevrolet,[2] Buick or GMC. If you're in college, a grad program or even a recent grad...take advantage today and get a great deal on a new ride to call your own!

2012 Chevrolet Sonic
(discount example)

Sonic 5-Door LS MSRP starting at	$ 15,395.00
MSRP of Sonic 5-Door 1LT as shown[3]	$ 16,495.00
Preferred Pricing[3]	$ 16,202.07
Your Discount	**$ 292.93**

2012 GMC Sierra 1500
(discount example)

Sierra 1500 Reg. Cab WT 2WD MSRP starting at	$ 22,940.00
MSRP of Sierra 1500 Extended Cab SLE 2WD with optional equipment as shown[3]	$ 32,840.00
Preferred Pricing[3]	$ 31,026.26
Your Discount	**$ 1,813.74**

To save even more, combine your discount with most current incentives.

Stop pedaling...start driving.
Visit gmcollegediscount.com/save

GMC

The 20th Century is So Over

It was about Big, about Quantity

Big Food, and Large Distant Food Production

USDA subsidies for farms in United States totaled $143,835,000,000 from 1995 through 2004.

Farms decline for seventh year

The nation's largest agricultural state continues to lose ground to housing

By Douglas Fischer
STAFF WRITER

San Joaquin County Supervisor Steve Gutierrez has a fear:

That someday all the new tract homes and malls that have sprung up in the fertile bottomlands around Stockton and Tracy will be knocked down and the concrete hauled off to get to the prime soils underneath to feed the populace.

"People laugh at me when I say this," he says.

But a new report released this week by the U.S. Department of Agriculture suggests he has a point.

California, the nation's leading farm state, lost 500 farms and 300,000 acres in 2005, much of that to urban development.

The closures represent less than 1 percent of the state's remaining 76,500 farms and by themselves won't make much of a dent in the $32 billion farmers pulled off the land in 2004, according to the state Department of Food and Agriculture.

But it represents the seventh straight year of decline in the number

Please see **FARMS,** News 11

A TRACTOR sits in front of a new development on Tracy's Chrisman Road. A new report found the state lost 500 farms and 300,000 acres of farmland in 2005.

GINA HILFERTY — Staff

- "…California lost 500 farms and 300,000 acres in 2005, much of that to urban development."
- Oakland Tribune: February 4, 2006

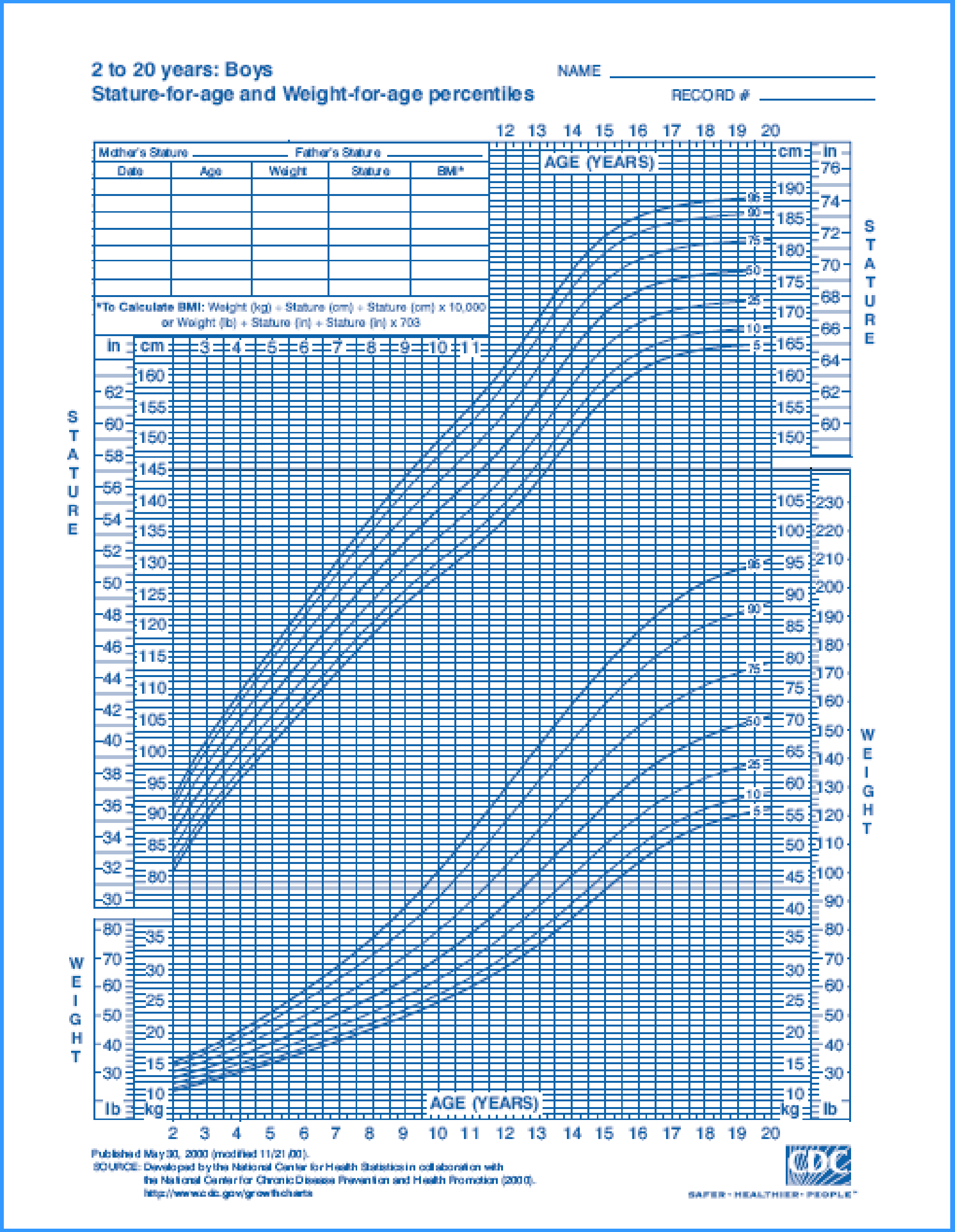
Workers pick strawberries near Camarillo.

State cracks down on poisonous gases that are injected into fields.

By Marla Cone and Gregory W. Griggs, Los Angeles Times January 25, 2008

The Check Up

10 year old boy



“Problem” List

- Physical exam unremarkable
- Ht 54”   (50%)
- Wt 115# (95%)
- BP   140/90
- Blood glucose elevated, urine normal
- Cholesterol   220
- Signs of Depression

Treatment Plan

- Referral to “overweight” clinic
- Weight loss program
- TV out of the bedroom; no soft drinks in the house
- Exercise program; Encourage sports

Two Months Later…

- Lost One pound
- Can’t change the food at school
- Day is already too full
- No Time for exercise; “not good at sports”
- No place to Walk

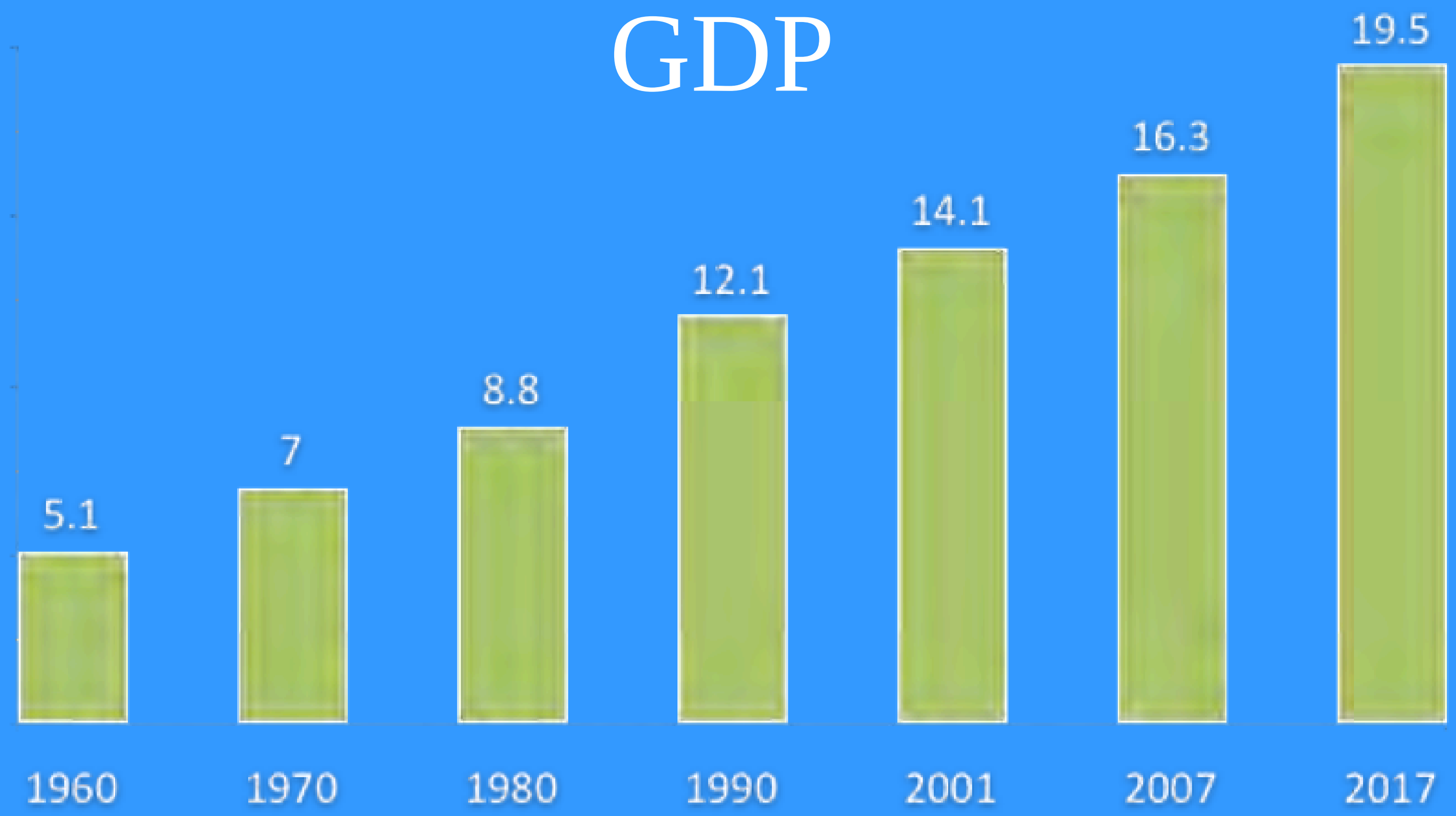
2 months later the patient is taking:

- Antihypertensive medication
- Oral Hypoglycemic agent
- Antidepressant
- Cholesterol lowering agent

- Monthly medication costs:
  - $385

- The “environment” is rigged against the child…
- And the nurse and doctor,
- And the rest of US.

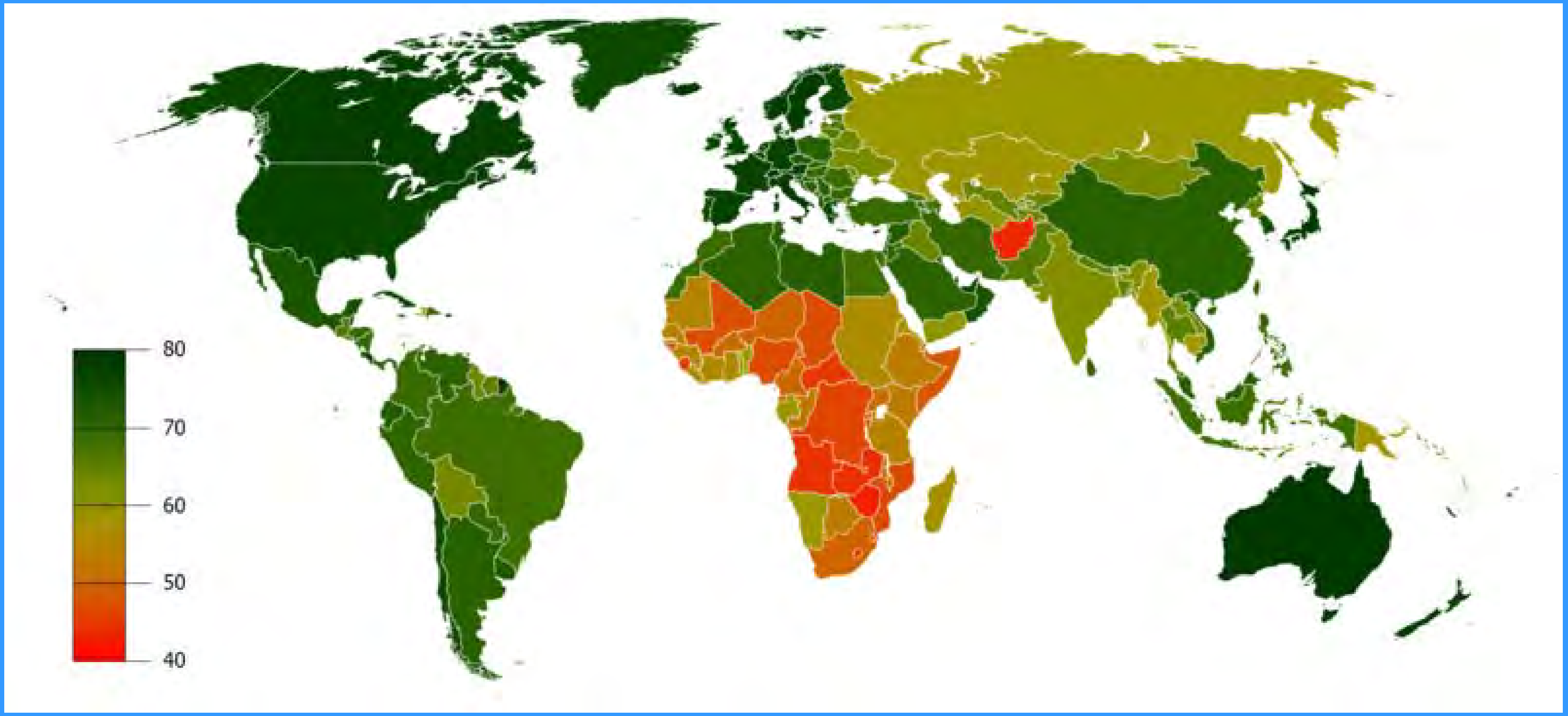
U.S. “Health” Care Expenditures as Percent of GDP



Keehan et al: *Health Affairs*
March/April 2008 27: 145-155

Life Expectancy by Country

Male



US Life Expectancy is #49 Worldwide – CIA Chartbook

- “Even under the most optimistic estimates, of the 30 years of increased life expectancy achieved between the 1890s and 1990s, only 5 years can be attributed to medical care.”

Bunker cited in *Prescription for a Healthy Nation*

Farley and Cohn 2004

CDC Headquarters - Atlanta

July 6, 1999

Disease in the 21st Century

- Diseases and costs of care for Aging Populations.
- Overweight: Diabetes II, Heart Disease
- Mental Disorders: Depression, Anxiety, Developmental, Substance Abuse
- Macro-environment: Climate, Conflict

Creating A Healthy Environment:

The Impact of the Built Environment on Public Health

"In its broadest sense, environmental health comprises those aspects of human health, disease, and injury that are determined or influenced by factors in the environment. This includes not only the study of the direct pathological effects of various chemical, physical, and biological agents, but also the effects on health of the broad physical and social environment, which includes housing, urban development, land-use and transportation, industry, and agriculture."

—Healthy People 2010,
U.S. Department of Health and Human Services [1]

Richard J. Jackson, MD, MPH
Chris Kochtitzky, MSP

Centers for Disease Control and Prevention

SPRAWL WATCH CLEARINGHOUSE MONOGRAPH SERIES

90% of Americans believe that Americans …..

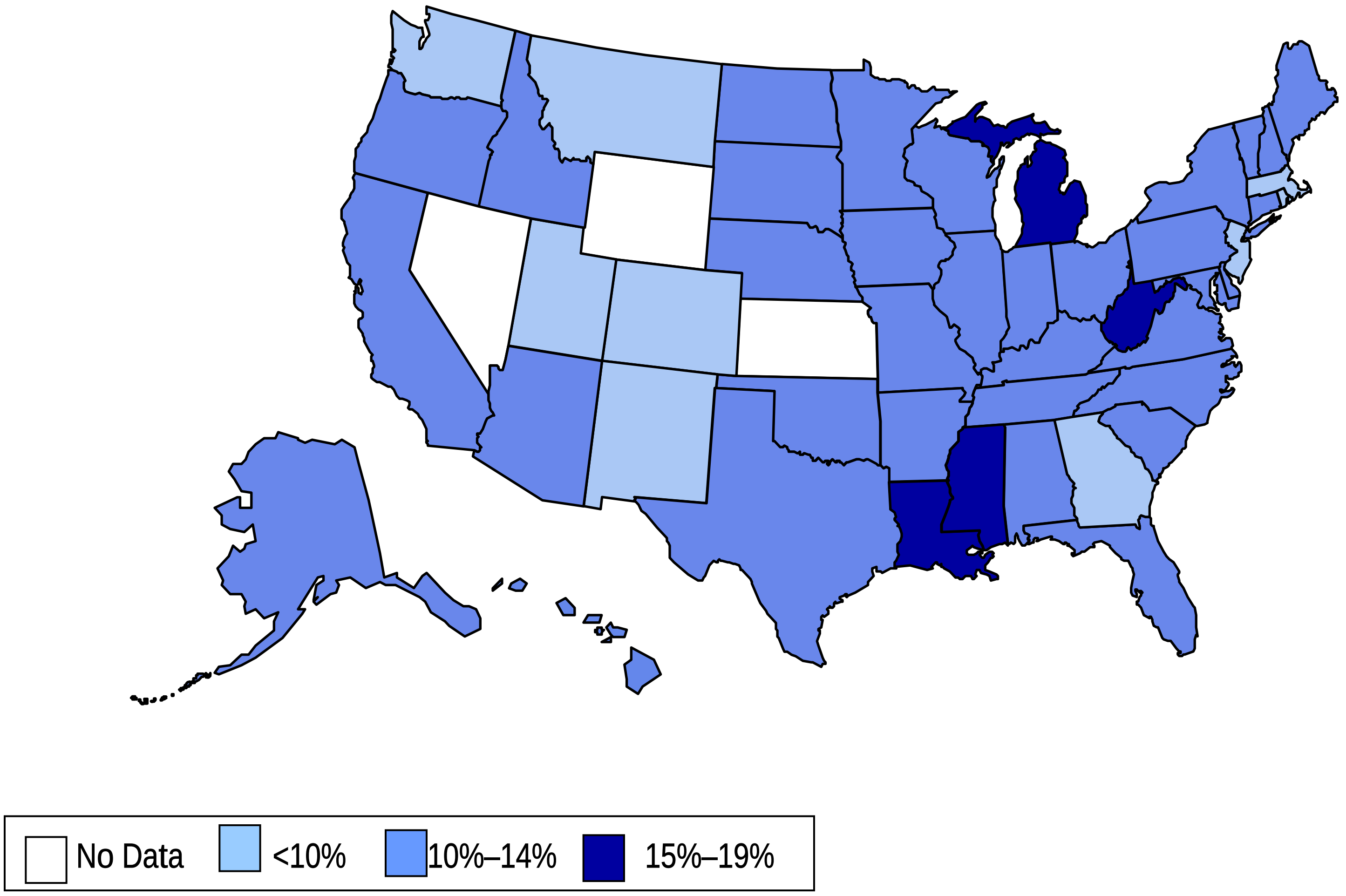
Are Too Fat

Los Angeles Times, 6/6/05

Obesity Trends* Among U.S. Adults

BRFSS, 1991

(*BMI ≥30, or ~ 30 lbs. overweight for 5' 4" person)



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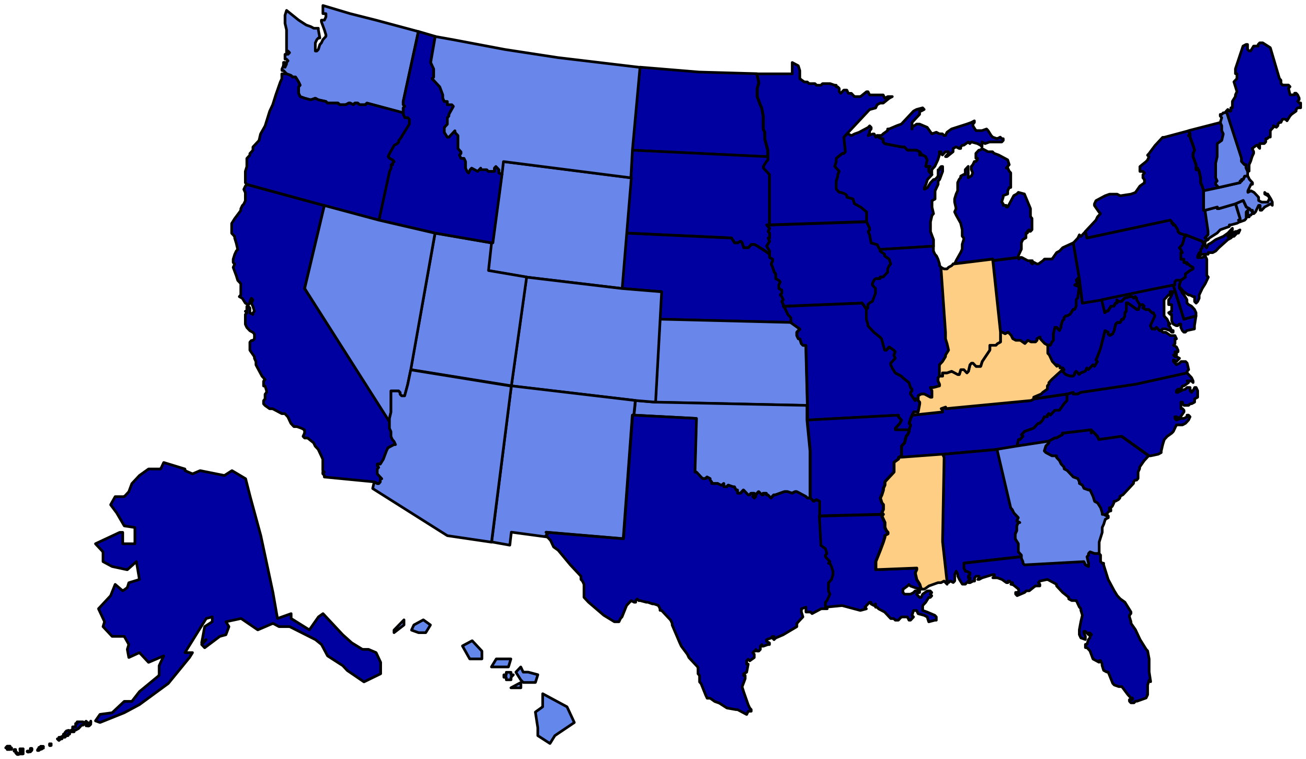

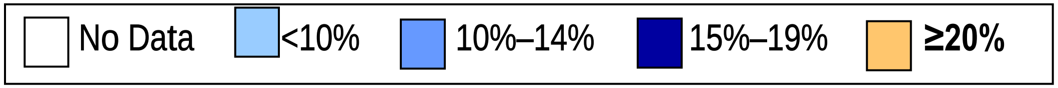

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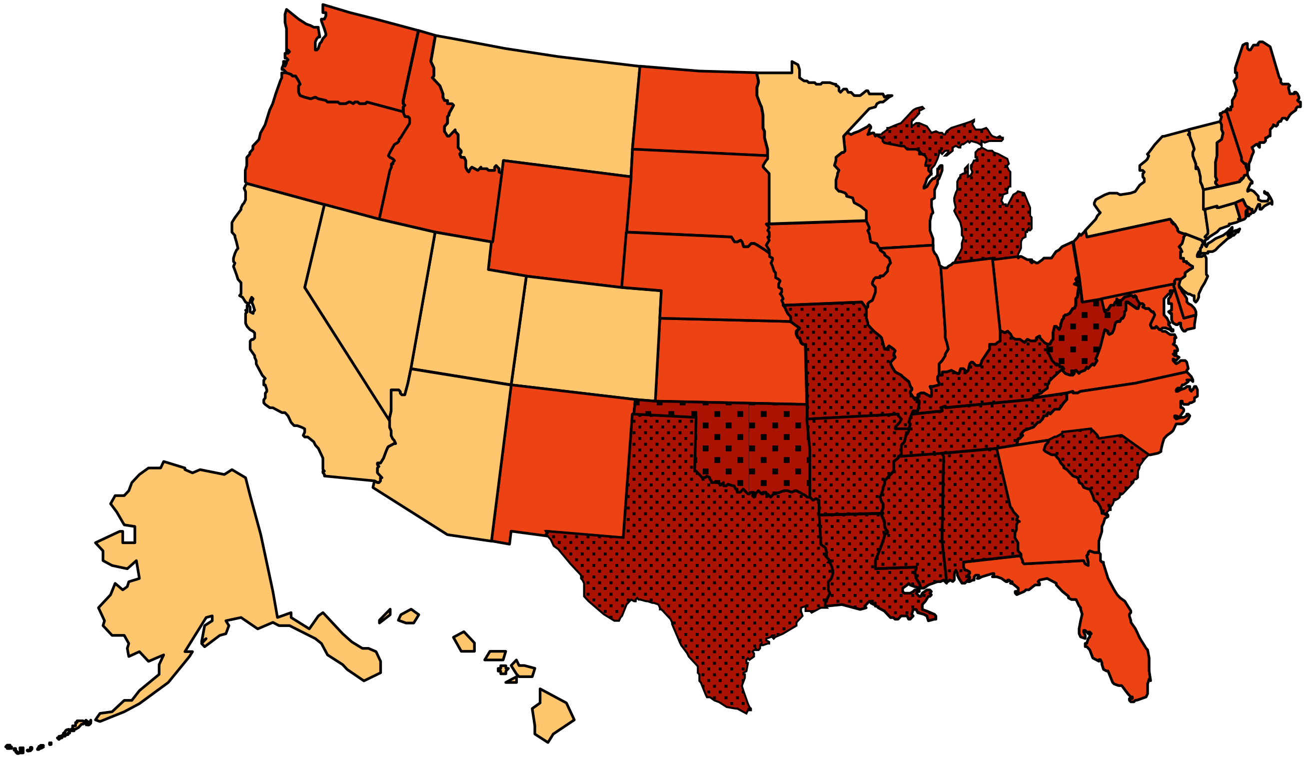
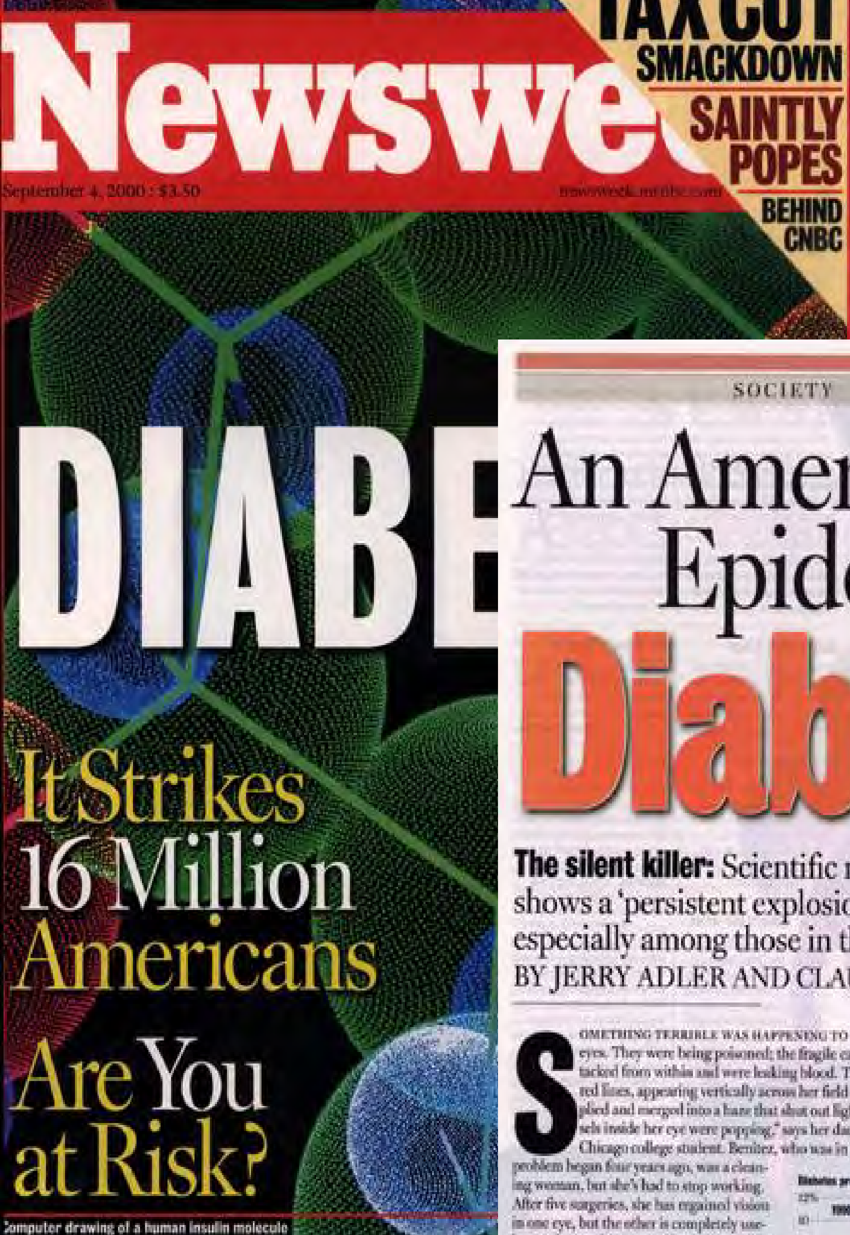


No Data   <10%   10%–14%   15%–19%   20%–24%   25%–**29%**   **≥30%**

Hardee's introduces new
Mega-Calorie
“Monster
Thickburger”

- 1,420 calories
- 107 grams of fat
- 7.1 hours of moderate walking



SOCIETY

An American Epidemic
Diabetes

The silent killer: Scientific research shows a 'persistent explosion' of cases—especially among those in their prime

BY JERRY ADLER AND CLAUDIA KALB

SOMETHING TERRIBLE WAS HAPPENING TO YOLANDA BENITEZ'S eyes. They were being poisoned; the fragile capillaries of the retina attacked from within and were leaking blood. The first symptoms were red lines, appearing vertically across her field of vision; the lines multiplied and merged into a haze that shut out light entirely. "Her blood vessels inside her eye were popping," says her daughter, Jannette Roman, a Chicago college student. Benitez, who was in her late 40s when the problem began four years ago, was a cleaning woman, but she's had to stop working. After five surgeries, she has regained vision in one eye, but the other is completely useless. A few weeks ago, awakening one night in a hotel bedroom, she walked into a door, setting off a paroxysm of pain and nausea that hasn't let up yet. And what caused this catastrophe was nothing as exotic as pesticides or emerging viruses. What was poisoning Benitez was sugar.

Diabetes prevalence, by age

12%, 10, 8, 6, 4, 2, 0

1990 1998

18-29, 30-39, 40-49, 50-59, 60-69, >70

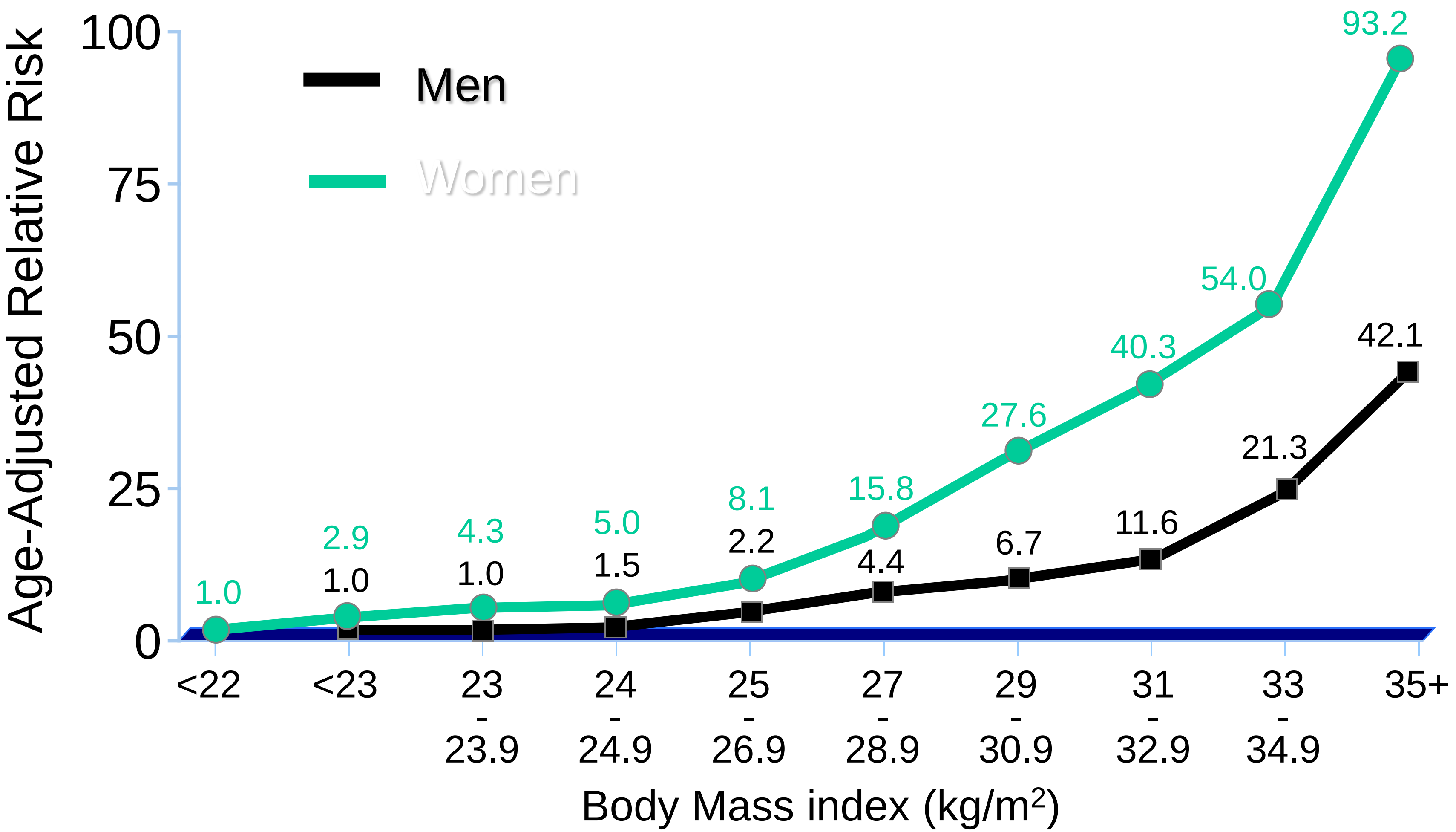
40 NEWSWEEK SEPTEMBER 4, 2000

Heredity

Genes help determine whether you'll get diabetes. In many families, multiple generations are struck. But heredity is not destiny—especially if you eat well and exercise.

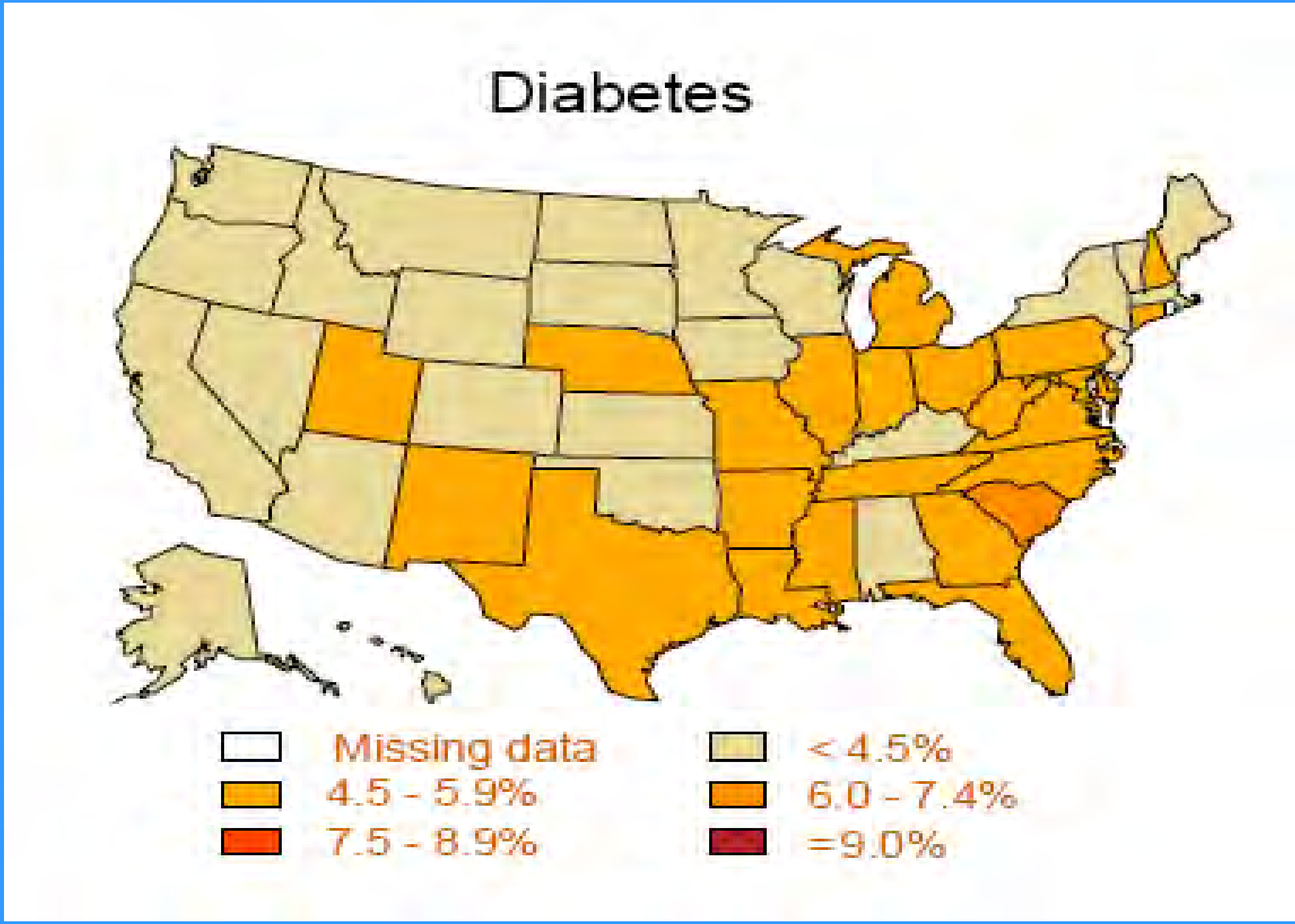
FAMILY PLAGUE: Benitez (left) and Roman. Benitez's mother and two brothers died from complications of the disease.

Relationship Between BMI and Risk of Type 2 Diabetes

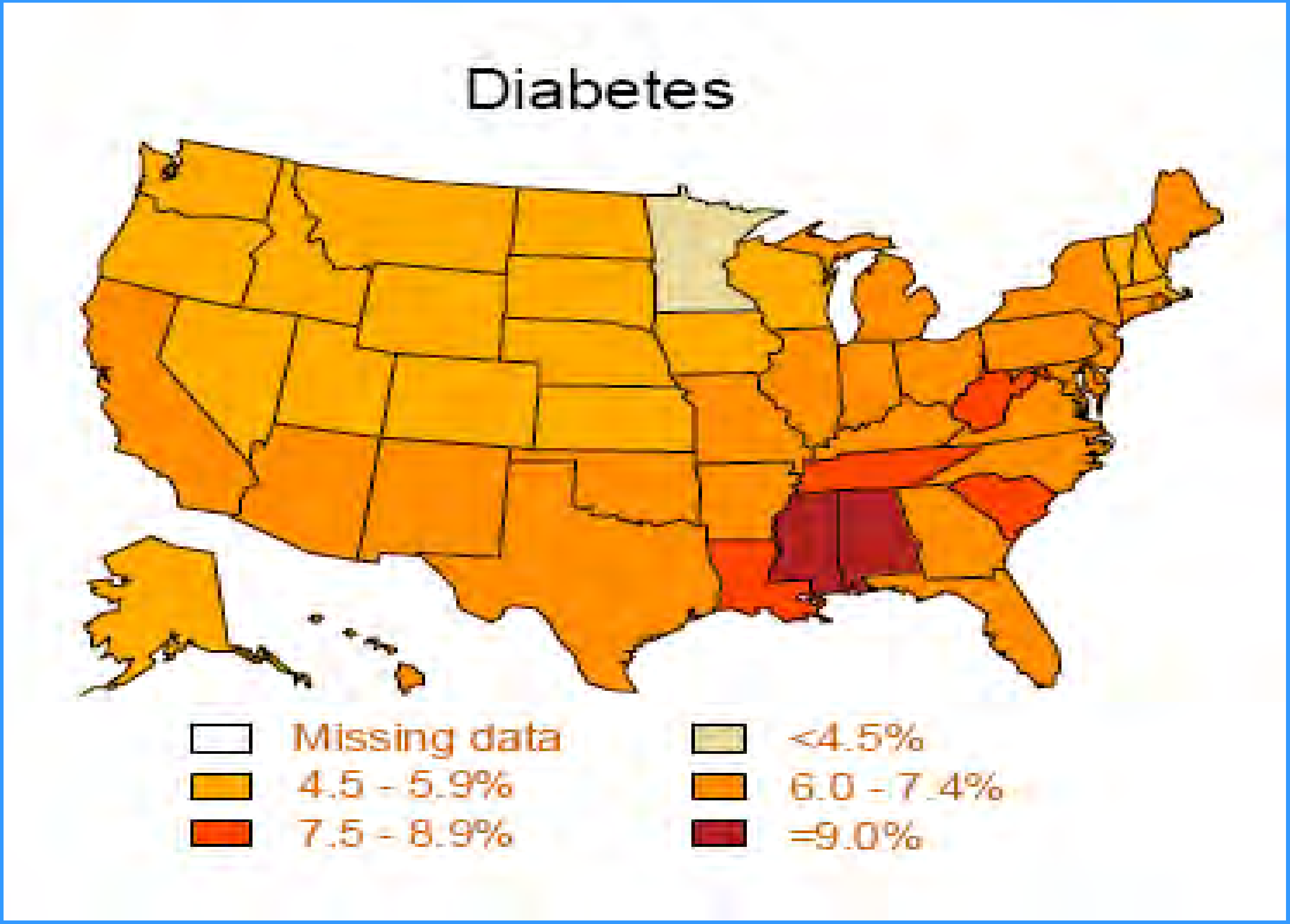


Chan J et al. *Diabetes Care* 1994;17:961.
Colditz G et al. *Ann Intern Med* 1995;122:481.

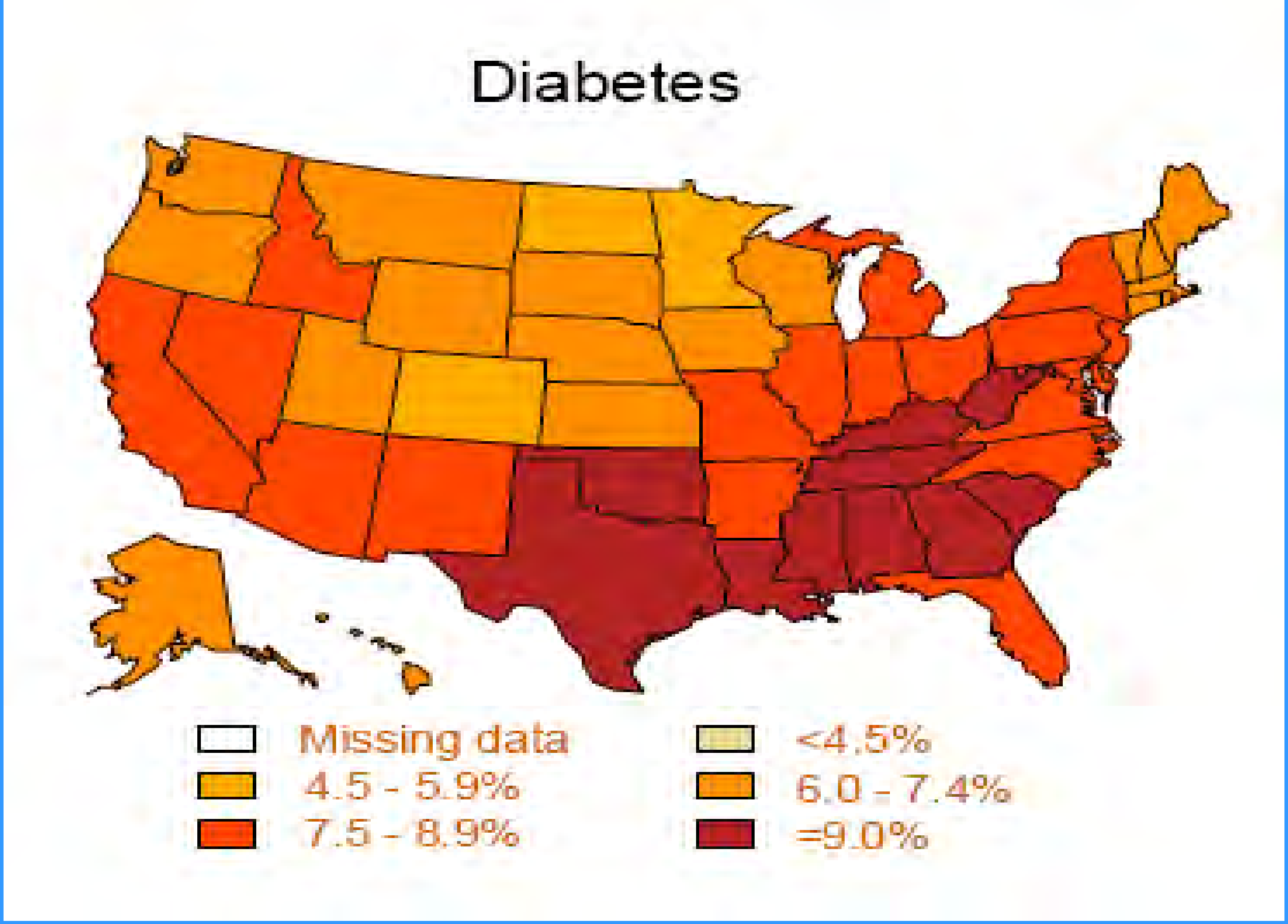
Percentage of US Adults with Diagnosed Diabetes - 1994

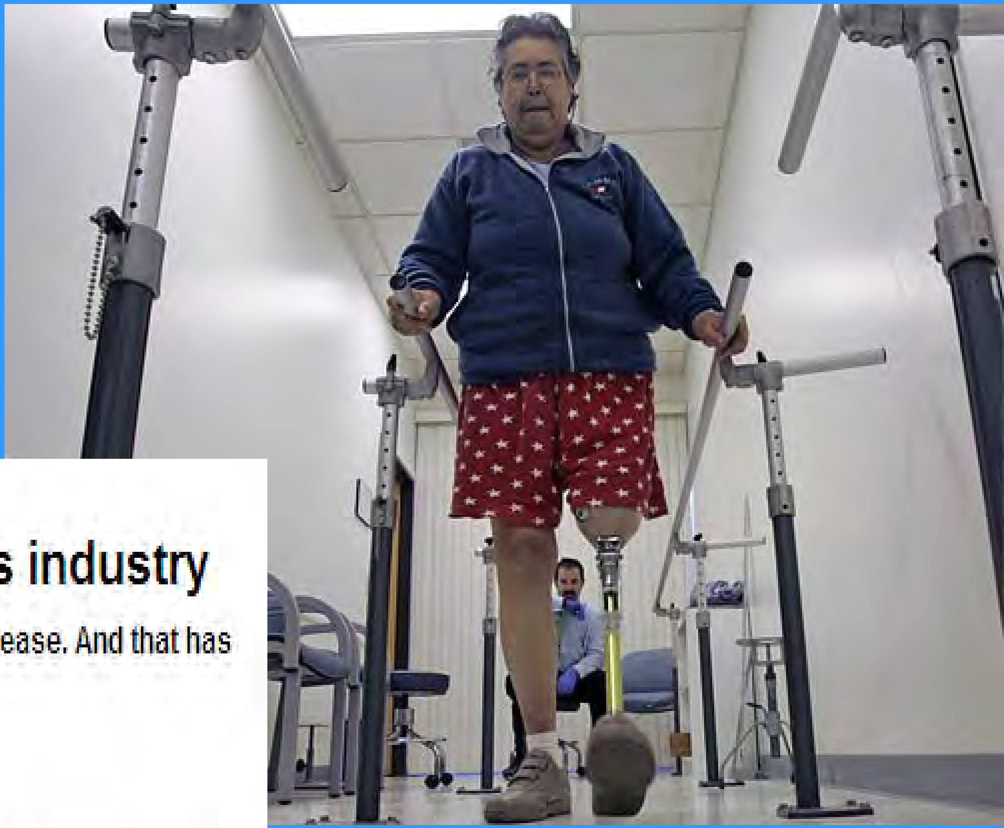


Percentage of US Adults with Diagnosed Diabetes - 2001



Percentage of US Adults with Diagnosed Diabetes - 2007





Soaring diabetes rates wake prosthetics industry

Business is booming largely because of amputations related to the disease. And that has led to advances.

By Daniel Costello, Times Staff Writer
July 4, 2007

PHOTO GALLERY
Prosthetic limbs

The waiting room in William Yule's office is full by the time he arrives each morning.

Throughout the day, Yule sees dozens of patients, bouncing between four sparsely decorated examining rooms on such a tight schedule that he often has no time for lunch.

But Yule is no doctor. He's a prosthetist who fits limbs on recent amputees, and business is booming for one reason: diabetes.

Los Angeles Times

Daniel Costello

July 4, 2007

“Supersizing” a fast-food meal – the real costs

- Paying 67 cents to supersize an order — 73% more calories for only 17% more money
- A Bargain!

University of Wisconsin-Madison, Rachel N. Close and Dale A. Schoeller

"Supersizing" a fast-food meal – the real costs

- Paying 67 cents to supersize an order — 73% more calories for 17% more money
- — adds an average of 36 grams of adipose tissue.
- The future medical costs for that "bargain" would be $6.64 for an obese man and $3.46 for an obese woman.

University of Wisconsin-Madison, Rachel N. Close and Dale A. Schoeller

BILLBOARDS VS. HEALTH: Considering the Impact of Billboards on Health *CASE STUDY: SUNSET BLVD (HOLLYWOOD)*

BILLBOARD TYPES

- ALCOHOL: 12
- ENTERTAINMENT: 26
- FOOD: 1
- PRODUCT: 16
- WEIGHTLOSS: 0
- OTHER: 10

TOTAL 65

Theresa Devine & Amy Vetal

BILLBOARDS VS. HEALTH: Considering the Impact of Billboards on Health

CASE STUDY: LA BREA HAWTHORNE)

BILLBOARD TYPES

- ALCOHOL: 17
- ENTERTAINMENT: 3
- FOOD: 4
- PRODUCT: 3
- WEIGHTLOSS: 4
- OTHER: 4

TOTAL 35

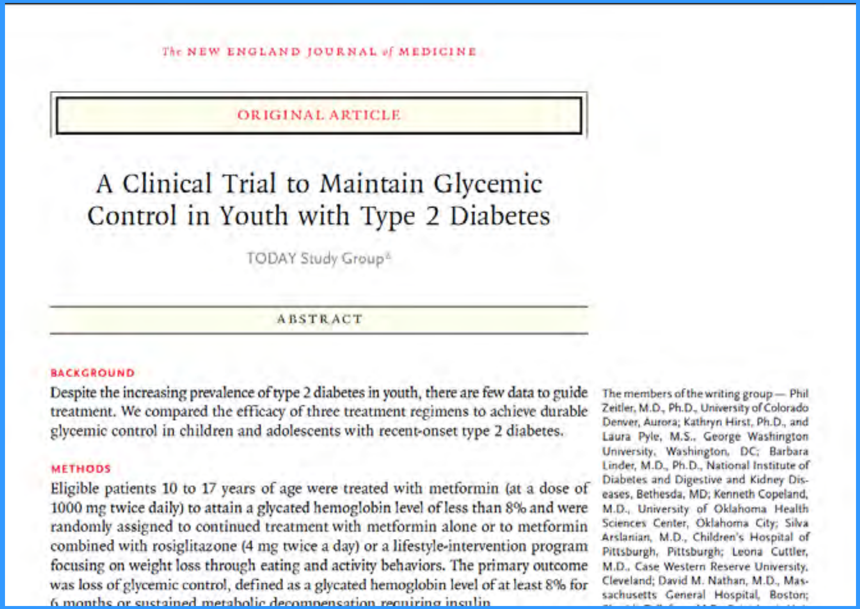
Theresa Devine & Amy Vetal

Food

High Fructose Corn Sugar

- US annual per capita consumption of HFCS
- 63 pounds

“[over 30 years in the Pediatric Diabetes Clinic] the percentage of new-onset type 2 diabetes in adolescence has increased from 3% to ~50% today”.



The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

A Clinical Trial to Maintain Glycemic Control in Youth with Type 2 Diabetes

TODAY Study Group*

ABSTRACT

BACKGROUND

Despite the increasing prevalence of type 2 diabetes in youth, there are few data to guide treatment. We compared the efficacy of three treatment regimens to achieve durable glycemic control in children and adolescents with recent-onset type 2 diabetes.

METHODS

Eligible patients 10 to 17 years of age were treated with metformin (at a dose of 1000 mg twice daily) to attain a glycated hemoglobin level of less than 8% and were randomly assigned to continued treatment with metformin alone or to metformin combined with rosiglitazone (4 mg twice a day) or a lifestyle-intervention program focusing on weight loss through eating and activity behaviors. The primary outcome was loss of glycemic control, defined as a glycated hemoglobin level of at least 8% for 6 months or sustained metabolic decompensation requiring insulin.

The members of the writing group — Phil Zeitler, M.D., Ph.D., University of Colorado Denver, Aurora; Kathryn Hirst, Ph.D., and Laura Pyle, M.S., George Washington University, Washington, DC; Barbara Linder, M.D., Ph.D., National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD; Kenneth Copeland, M.D., University of Oklahoma Health Sciences Center, Oklahoma City; Silva Arslanian, M.D., Children's Hospital of Pittsburgh, Pittsburgh; Leona Cuttler, M.D., Case Western Reserve University, Cleveland; David M. Nathan, M.D., Massachusetts General Hospital, Boston;

David B Allen MD

New England Journal of Medicine

April 29, 2012

“The Status of Baby Boomers’ Health in the United States: The Healthiest Generation?”

JAMA Internal Medicine

February 4, 2013

RESEARCH LETTER

ONLINE FIRST

The Status of Baby Boomers' Health in the United States: The Healthiest Generation?

From 1946 through 1964, 78 million children ("baby boomers") were born in the United States. In 2010, baby boomers made up 26.1% of the US population.[1] Medicine has improved significantly during baby boomers' lifetimes. Although these advantages have led to a progressively increasing life expectancy,[2] previous studies have shown mixed results regarding whether baby boomers are healthier than prior generations.[3,4] The present study examined the health status of aging baby boomers relative to the previous generation to provide a vitally important context for health workforce and policy planning in the coming years.

Methods. We analyzed data from the National Health and Nutrition Examination Survey (NHANES), including NHANES III (1988-1994) (for previous generation) and the NHANES for 2007 to 2010 (for baby boomers), focusing on respondents who were aged 46 to 64 years during either period. The 2 cohorts were compared with regard to health status, functional and work disability, healthy lifestyle characteristics, and presence of chronic disease. Further details of the methods can be found in the eAppendix (http://www.jamainternalmed.com).

Results. The demographic characteristics of the cohorts were very similar except for the proportions in each racial/ethnic group, with greater proportions of non-Hispanic blacks (11.3% vs 9.4%) and Hispanics (9.8% vs 3.7%) in the 2007-2010 group compared with the 1988-1994 group ($P < .001$). The mean (SD) ages were 54.1 (0.03) years in the 2007-2010 group and 54.3 (0.03) years in the 1988-1994 group; there was no difference in sex between the 2 cohorts (49.1% male [2007-2010 group] vs 47.3% male [1988-1994 group]). Overall health status was lower in baby boomers, with 13.2% reporting "excellent" health compared with 32% of individuals in the previous generation ($P < .001$). Of the sampled baby boomers, compared with the previous generation, 6.9% vs 3.3% used a walking assist device ($P < .001$), 13.8% vs 10.1% were limited in work ($P = .003$), and 13.7% vs 8.8% had a functional limitation ($P < .001$).

With regard to healthy lifestyle factors, obesity was more common among baby boomers (38.7% obese vs 29.4% [previous generation]; $P < .001$) (**Figure**), and regular exercise was significantly less frequent (35.0% vs 49.9% exercise >12 times per month; $P < .001$); more than half of baby boomers reported no regular physical activity (52.2% vs 17.4%; $P < .001$). Moderate drinking was higher in the baby boomer cohort compared with the previous generation (67.3% vs 57.2%; $P < .001$). There were fewer current smokers in the baby boomer cohort than in the previous generation (21.3% vs 27.6%; $P < .001$).

The percentage of individuals with hypertension (Figure) was more common among baby boomers than among individuals from the previous generation (43.0% vs 36.4%; $P < .001$), as was the percentage of individuals who take medication for hypertension (33.4% vs 23.2%; $P < .001$). Among baby boomers, hypercholesterolemia was more common (73.5% vs 33.8%; $P < .001$ [Figure]), and medication use for hypercholesterolemia was more than 10 times greater (23.9% vs 1.5%; $P < .001$). Baby boomers were also more likely to have diabetes (15.5% vs 12.0%; $P = .003$ [Figure]) and take medication for diabetes (11.3% vs 6.2%; $P < .001$). The slight trend toward higher prevalence of cancer in baby boomers vs the previous generation was not significant (10.6% vs 9.5%; $P = .23$). The frequency of emphysema decreased in the baby boomer generation (2.3%) relative to the previous generation (3.3%) ($P = .03$). Baby boomers were also less likely to have had a myocardial infarction (3.6%) compared with the previous generation (5.3%) ($P = .004$).

A logistic regression was conducted to control for changes in demographic characteristics (age, sex, race,

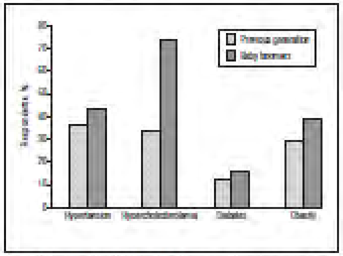


Figure. Proportion of each cohort (baby boomers and previous generation at age 46-64 years) with hypertension, hypercholesterolemia, diabetes, or obesity in the 1988-1994 and 2007-2010 NHANES. The difference between cohorts was statistically significant for prevalence of hypertension ($P < .001$), hypercholesterolemia ($P < .001$), diabetes ($P = .003$), and obesity ($P < .001$). Obesity is defined as the proportion of individuals who exceeded a body mass index of 30 (calculated as weight in kilograms divided by height in meters squared). NHANES indicates National Health and Nutrition Examination Survey.

Overall Health Status US

Persons Aged 46-64

	NHANES 1988-1994	NHANES 2007-2010
Report “excellent” health	32%	13%
Limitations to Life Functions	9%	14%
Using Walking Assist (wheelchair, cane, etc)	3%	7%

“Lifestyle Factors” US

Persons Aged 46-64 (NHANES)

	1988-1994	2007-2010
Smoking	28%	21%
Obesity	29%	39%

"Lifestyle Factors" US

Persons Aged 46-64 (NHANES)

1988-1994	2007-2010

No Regular Physical Activity

17%	52%

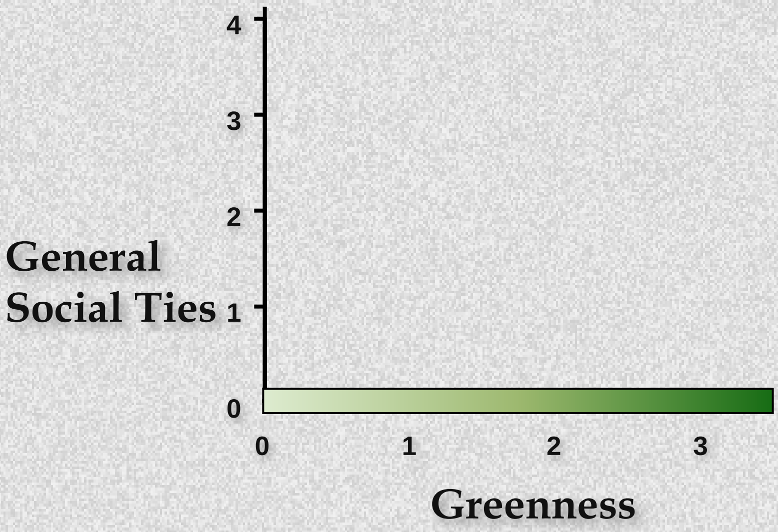
60,000 square miles

And Photosynthesis is our friend!

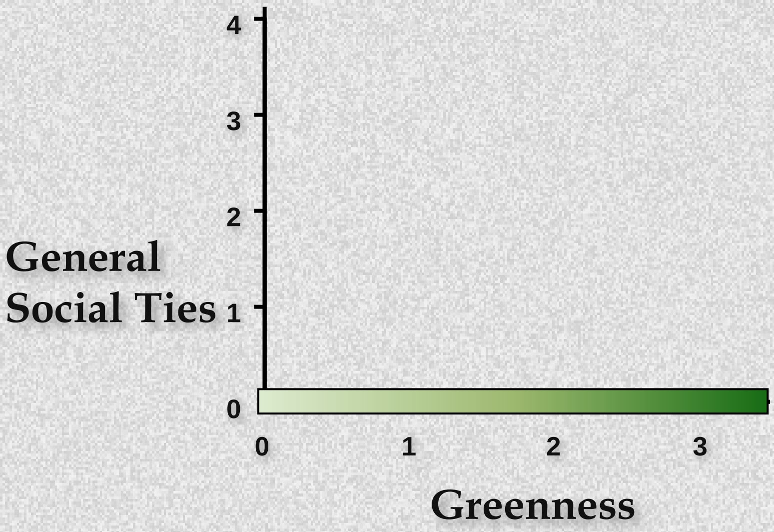
The United States has now paved over the equivalent area of the entire state of Georgia

Does Presence of Landscaping Affect Neighborhood Social Ties?

A study at Robert Taylor Homes in Chicago
by Virginia Kuo and William Sullivan



General
Social Ties
4
3
2
1
0
0
1
2
3
Greenness



General Social Ties
4
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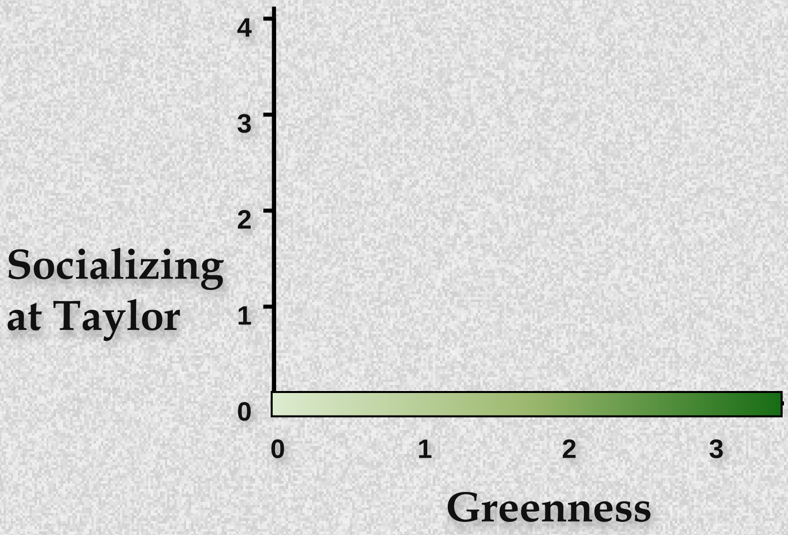
Greenness



Socializing at Taylor
4
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2
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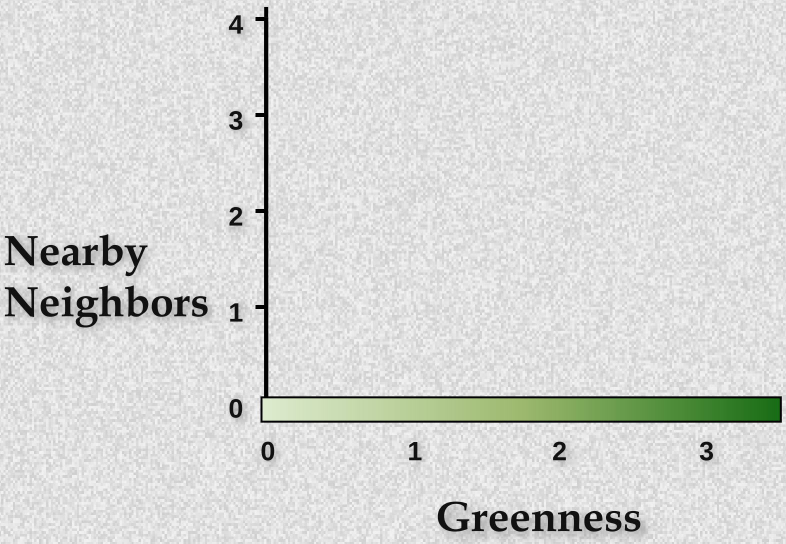
Greenness



Nearby Neighbors
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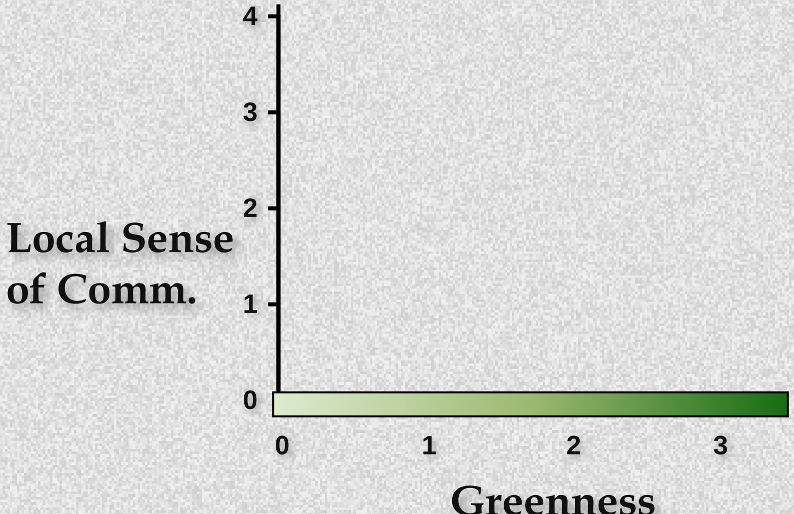
3
Greenness



Local Sense of Comm.
4
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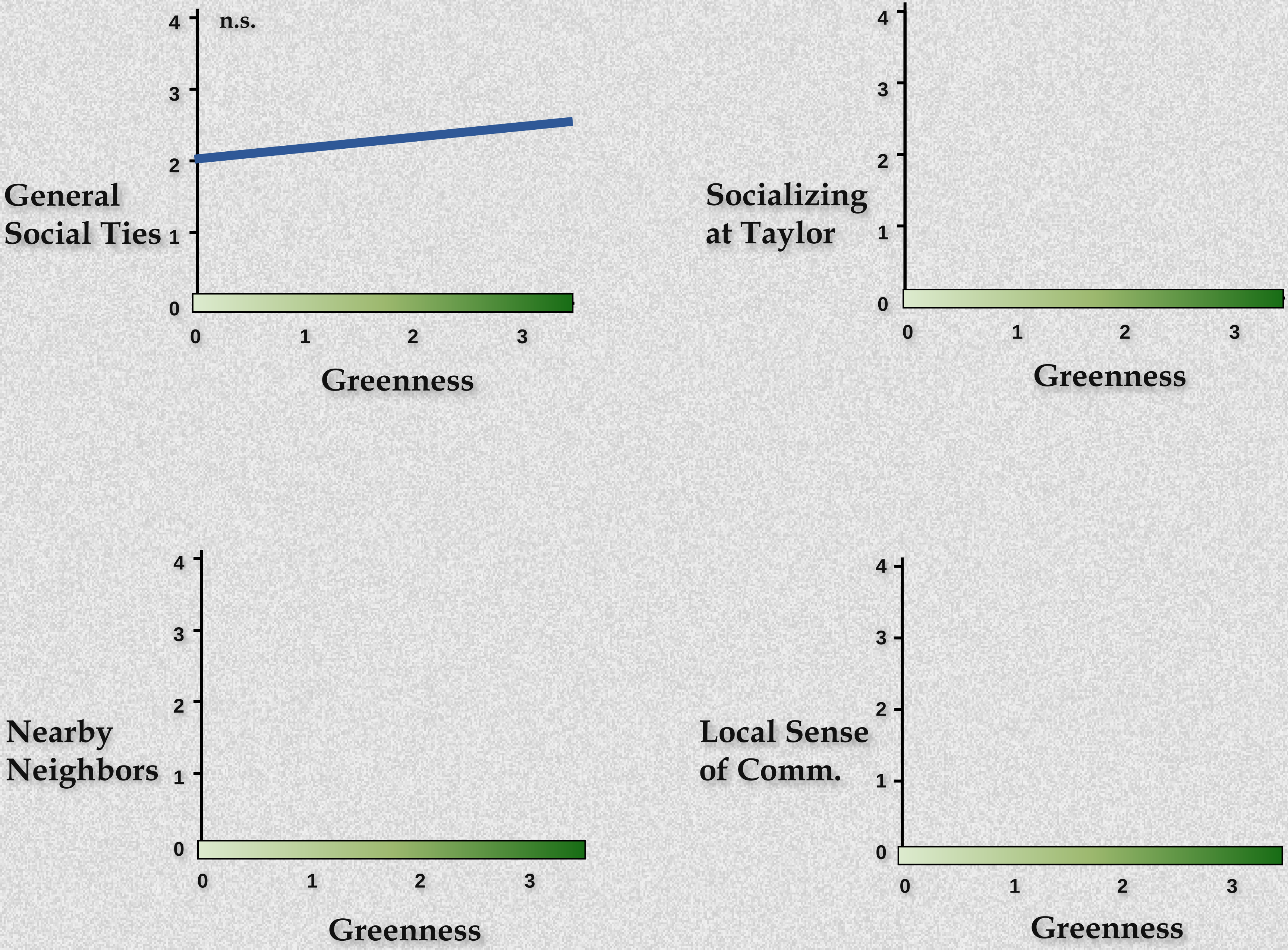
n.s.
General Social Ties
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Socializing at Taylor
Greenness
Nearby Neighbors
Greenness
Local Sense of Comm.
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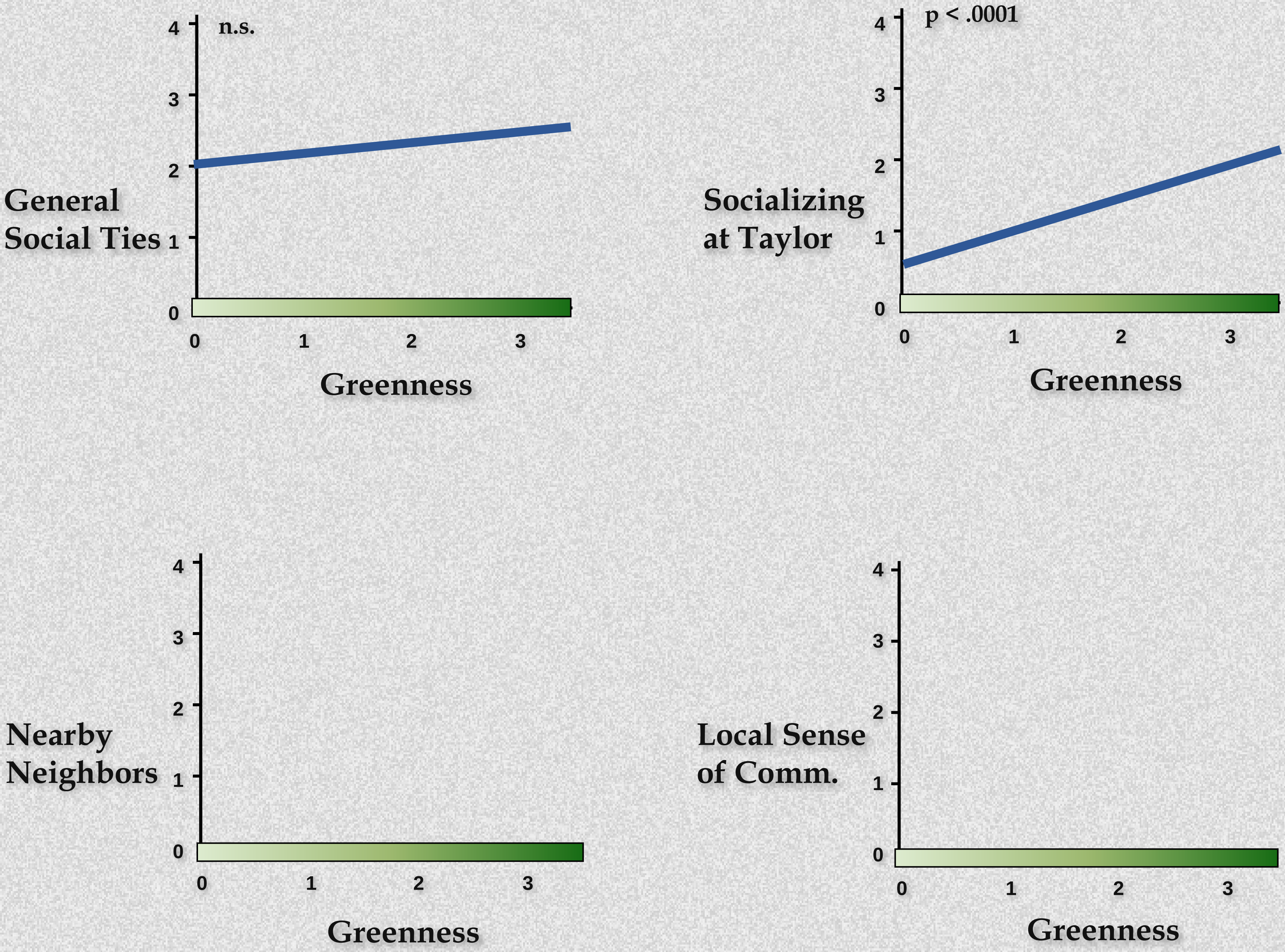

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Greenness
p < .0001
Socializing at Taylor
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Greenness
Nearby Neighbors
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Local Sense of Comm.
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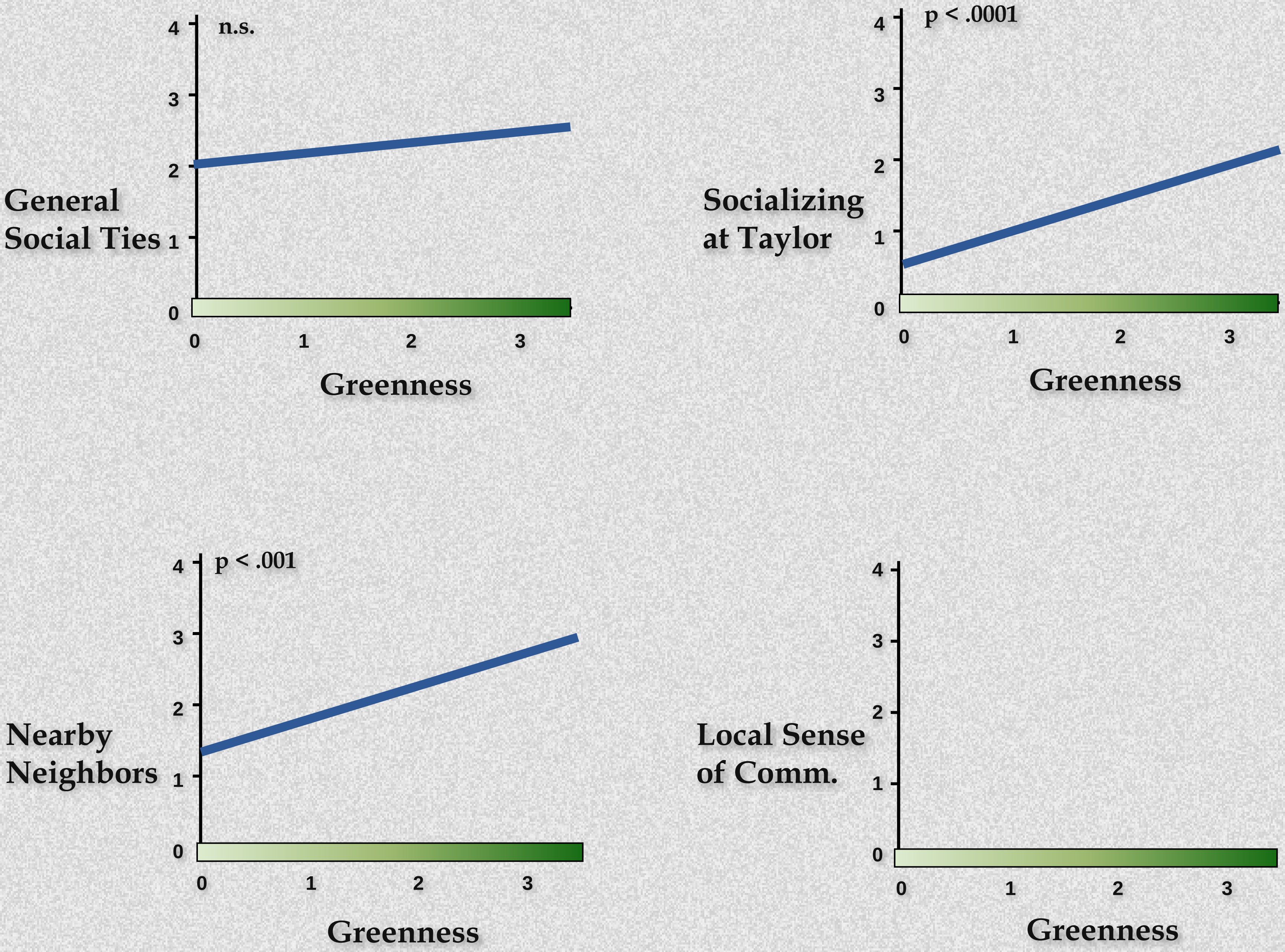
Greenness


General Social Ties
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Greenness
Socializing at Taylor
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Greenness
Local Sense of Comm.
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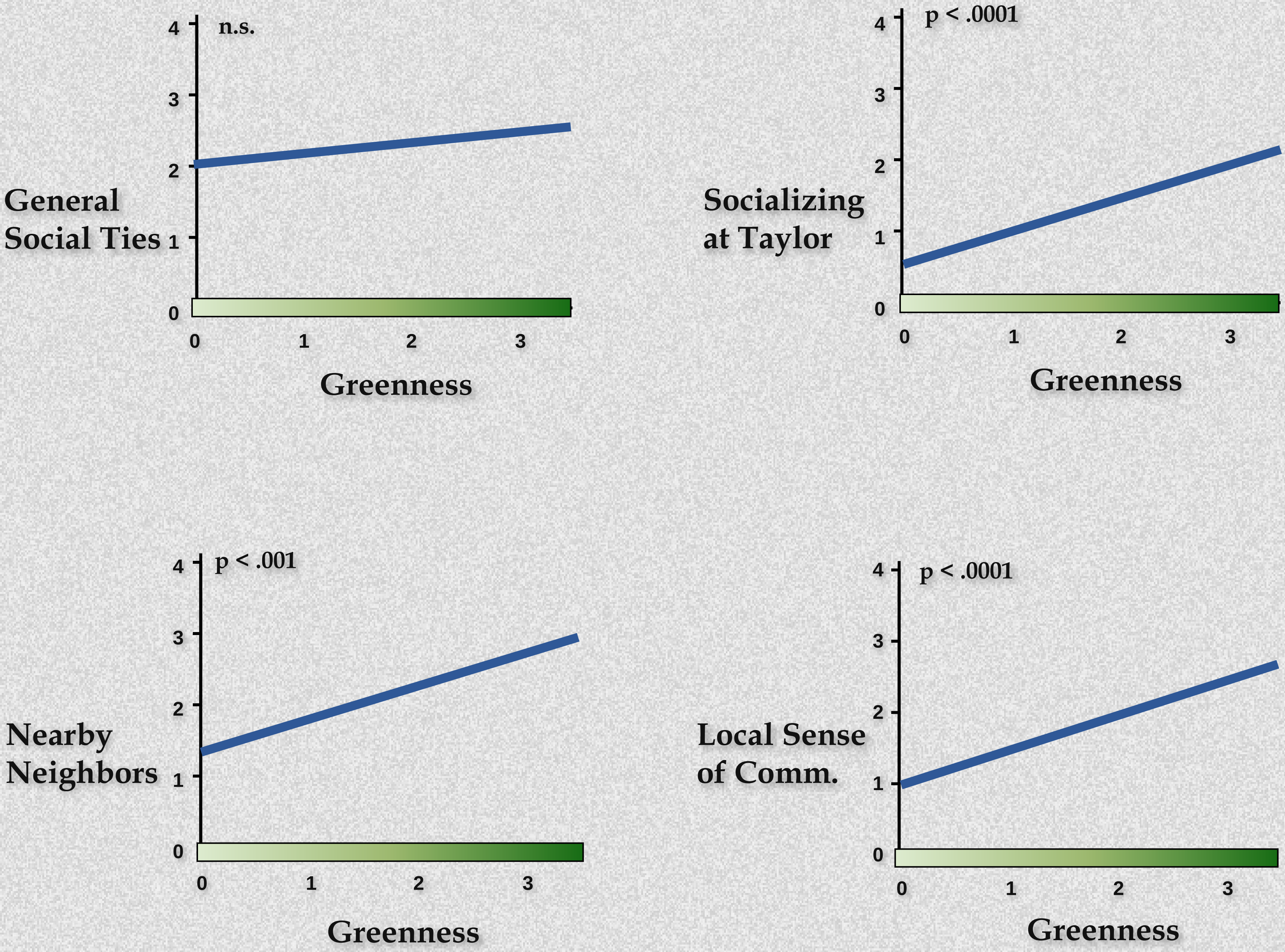

General Social Ties
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Socializing at Taylor
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Nearby Neighbors
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Greenness
Local Sense of Comm.
p < .0001
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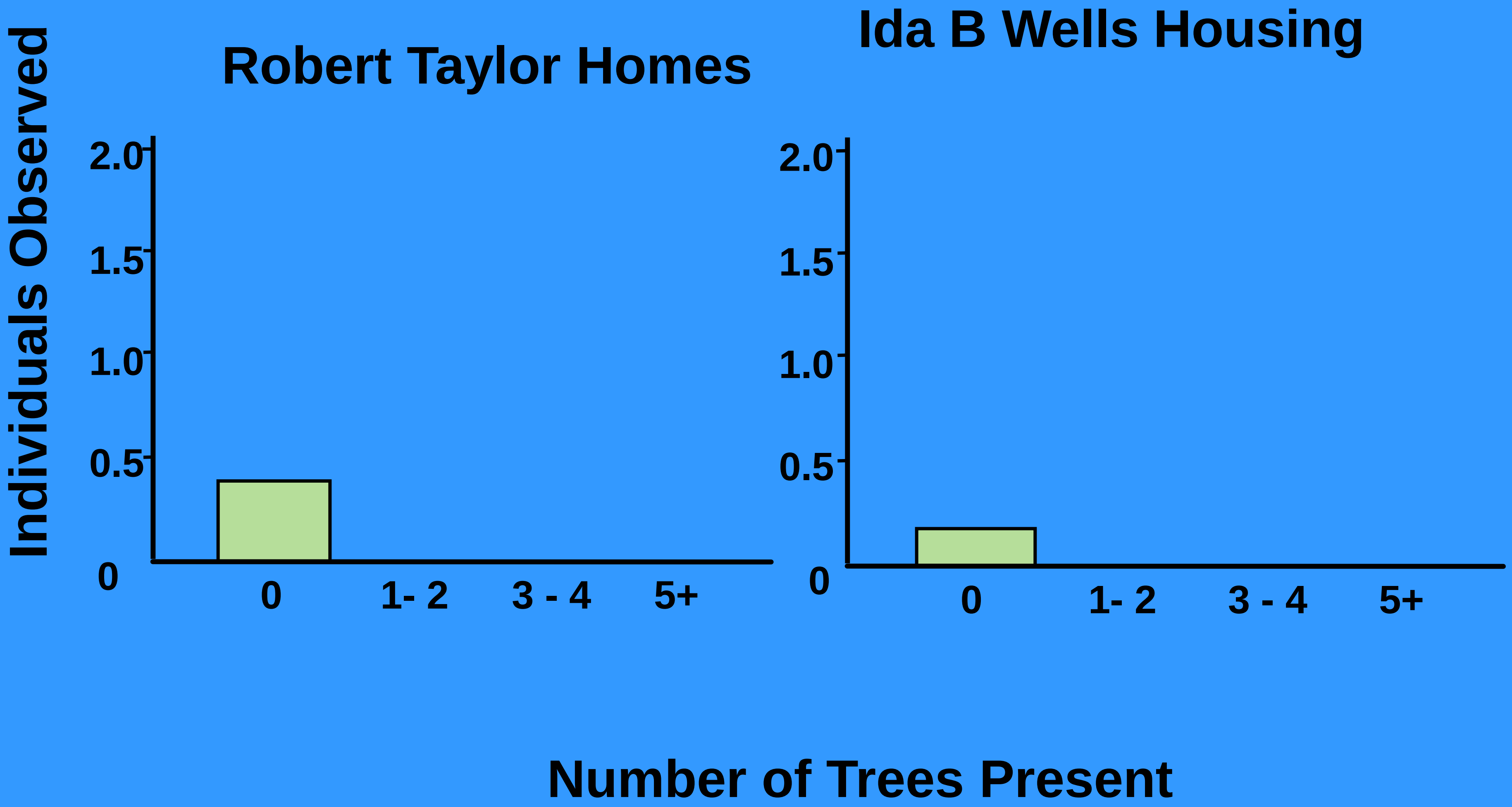
Greenness

Trees & Crime

Do Trees Attract People?

Two Housing Projects in Chicago

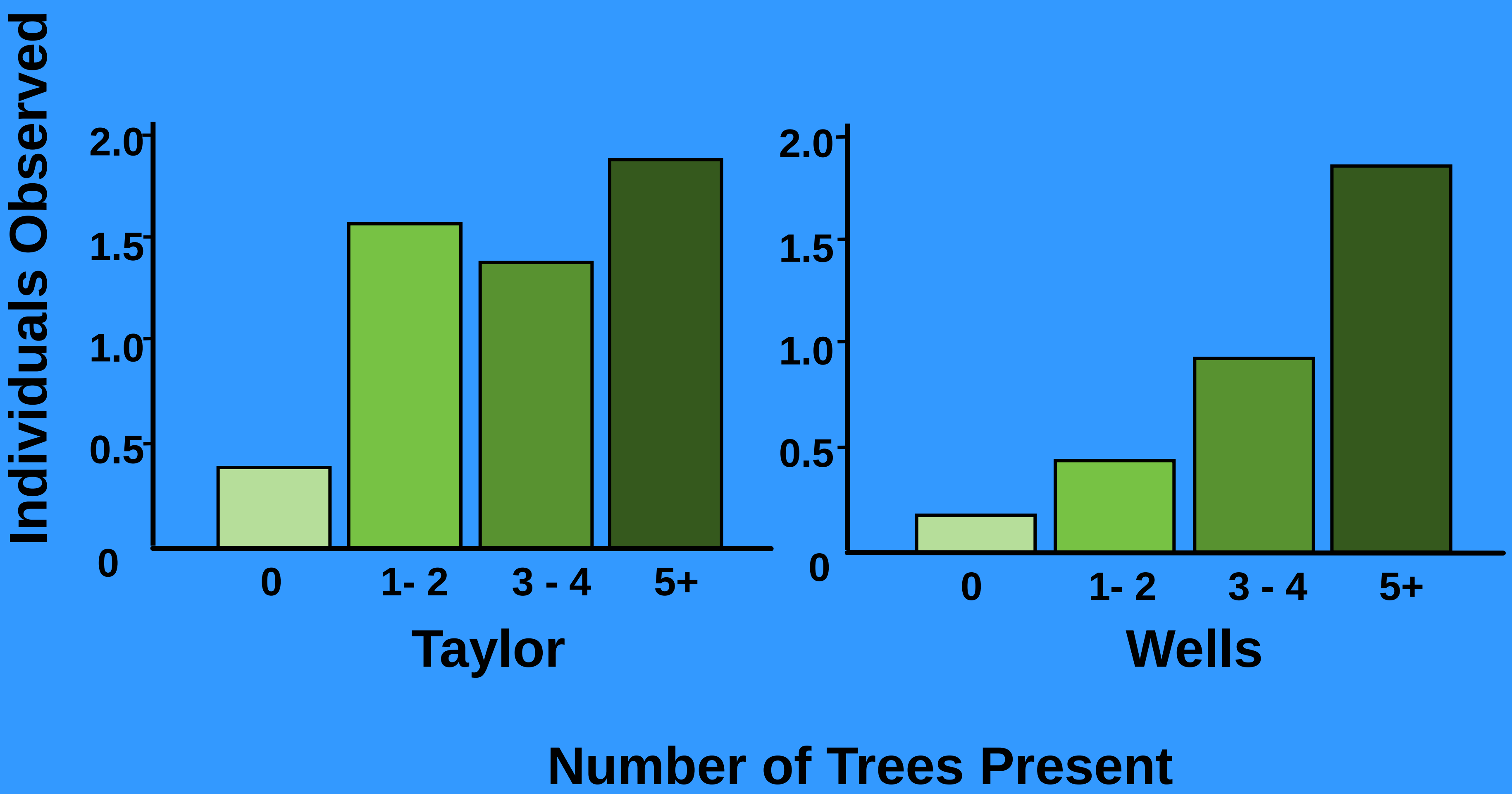
Coley, Kuo, & Sullivan (1997)




FedEx

As Trees Increase, So do people

Coley, Kuo, & Sullivan (1997)



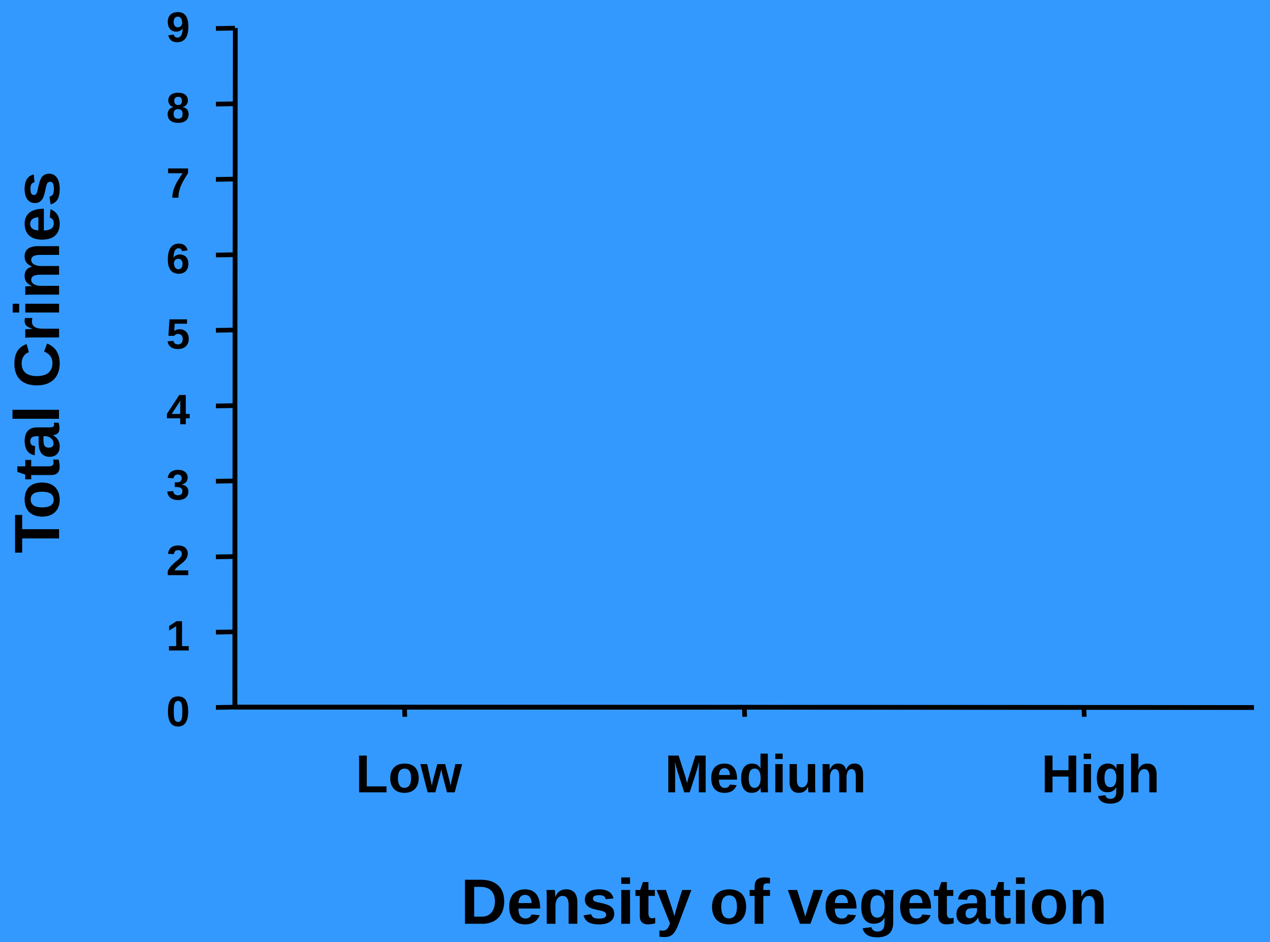
Trees & Crime

An archival study

- 98 buildings
- Measure vegetation
- FBI Part I crime statistics

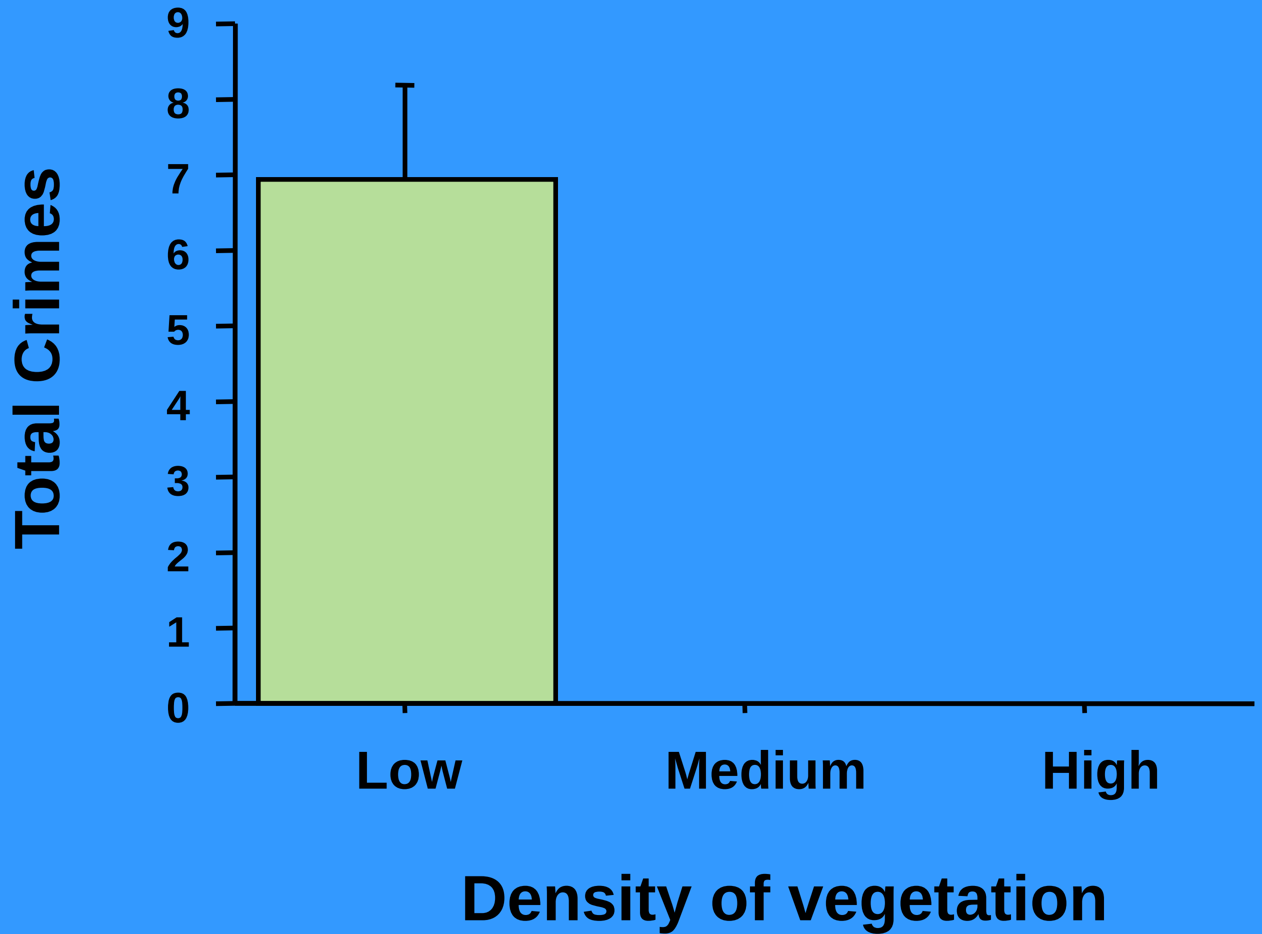

4331

Trees & Crime



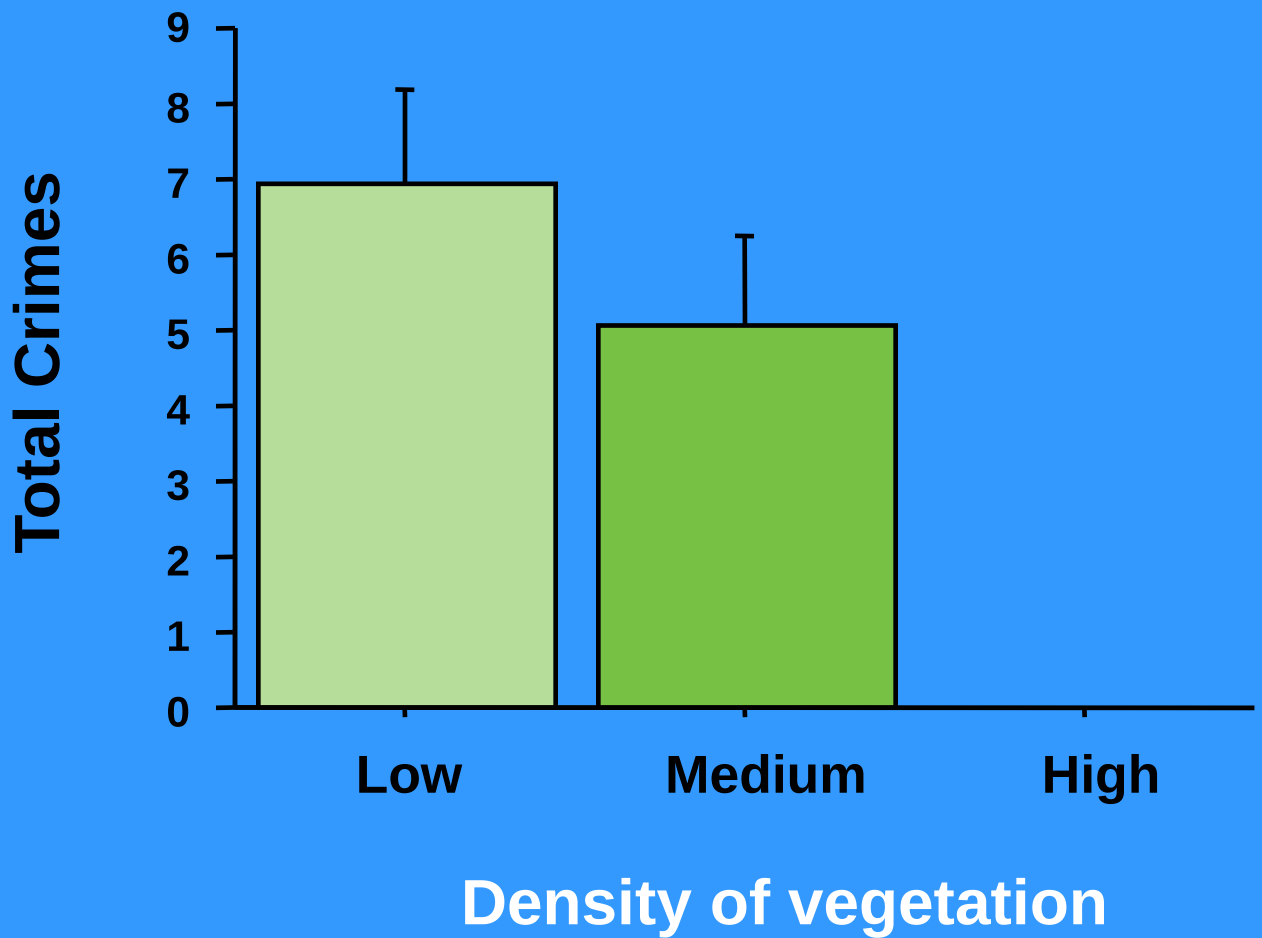
Kuo & Sullivan, 2001b

Trees & Crime



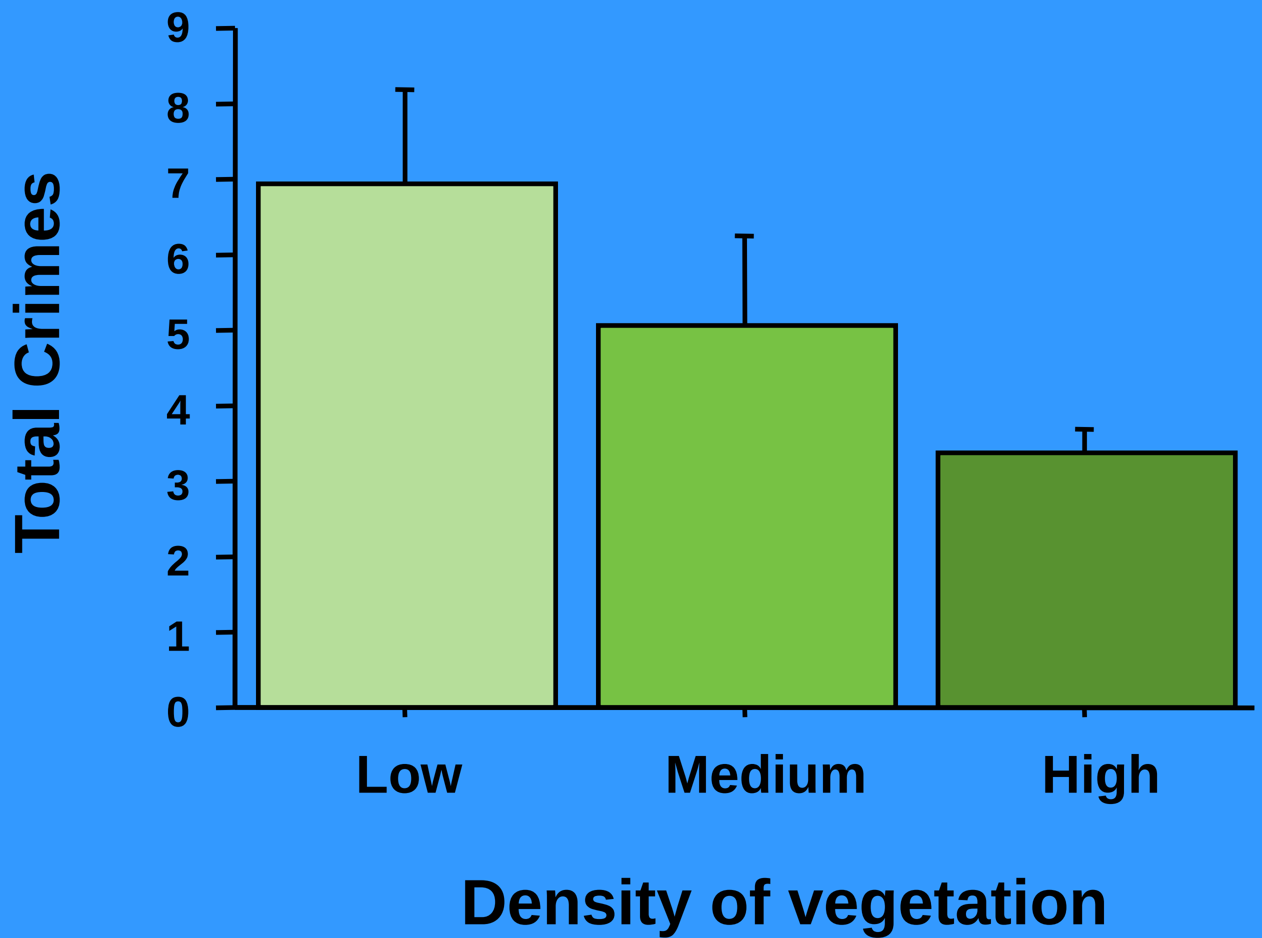
Kuo & Sullivan, 2001b

Trees & Crime



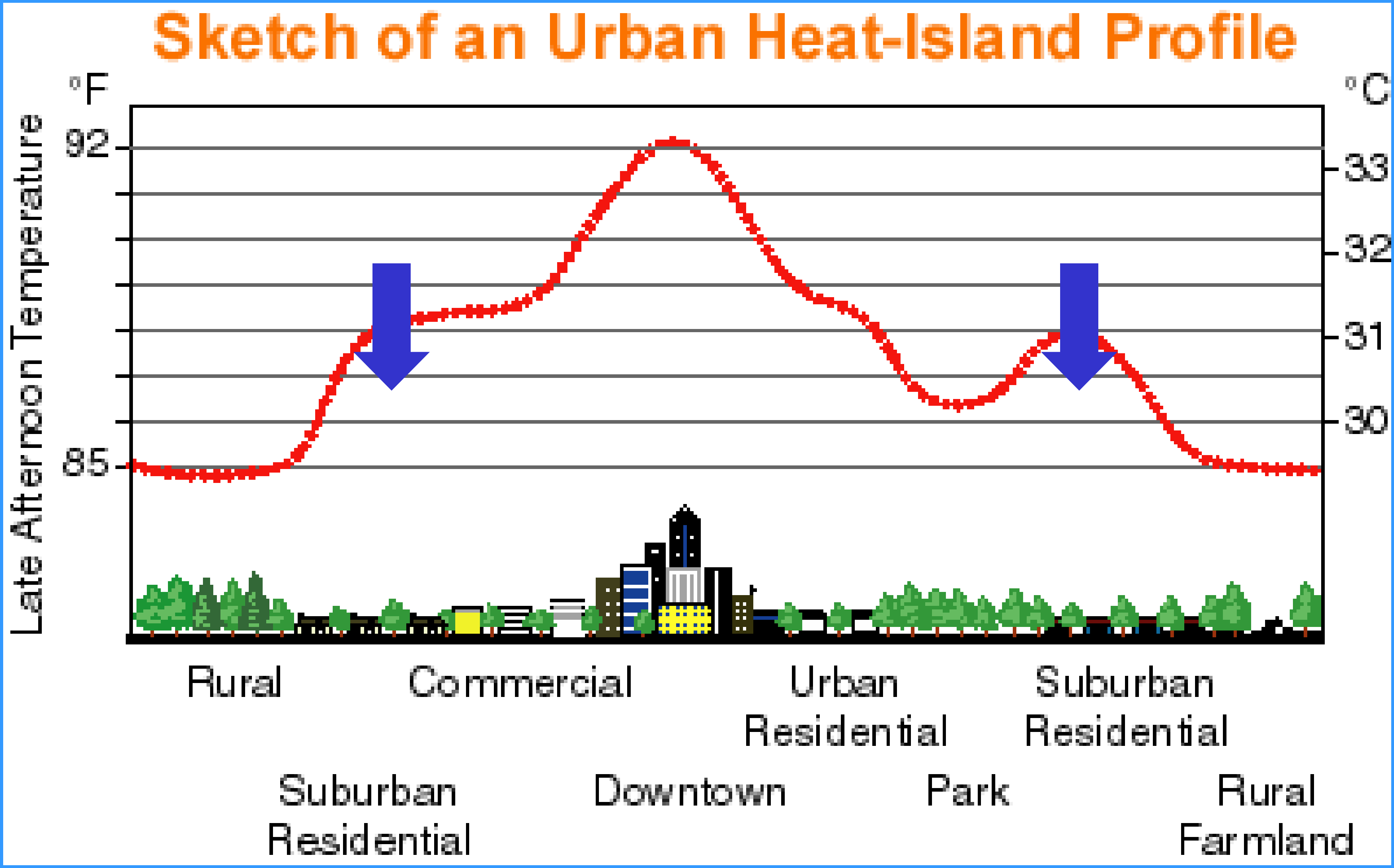
Kuo & Sullivan, 2001b

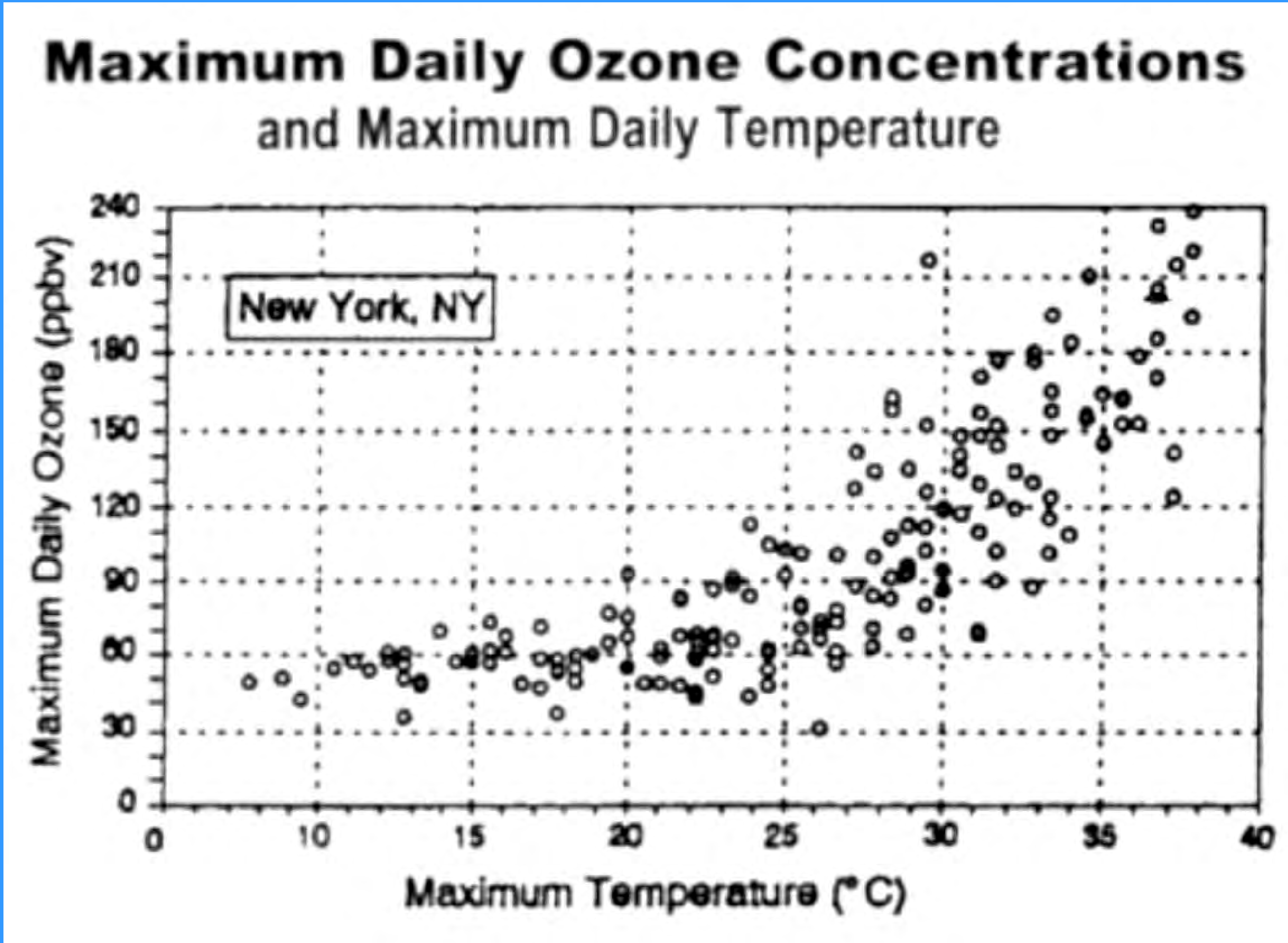
Trees & Crime



Kuo & Sullivan, 2001b

The Heat Island




Maximum Daily Ozone Concentrations
and Maximum Daily Temperature
New York, NY
Maximum Daily Ozone (ppbv)
0
30
60
90
120
150
180
210
240
0
10
15
20
25
30
35
40
Maximum Temperature (°C)

Asthma outbreak hits kids

RISKS OF THE 'RED ZONE'

JENNI GIRTMAN / Staff

Asthma sufferer Tyrone Johnson, 2, breathes fresh air Friday as his aunt Susan Thomas tends him at Atlanta's Hughes Spalding Children's Hospital. Sky-high smog readings in metro Atlanta have produced a flare-up of asthma cases, especially among children.

The Atlanta Journal-Constitution SATURDAY, AUG. 19, 2000

Impact of Changes in Transportation and Commuting Behaviors During the 1996 Summer Olympic Games in Atlanta on Air Quality and Childhood Asthma

Michael S. Friedman, MD
Kenneth E. Powell, MD, MPH
Lori Hutwagner, MS
LeRoy M. Graham, MD
W. Gerald Teague, MD

Context Vehicle exhaust is a major source of ozone and other air pollutants. Although high ground-level ozone pollution is associated with transient increases in asthma morbidity, the impact of citywide transportation changes on air quality and childhood asthma has not been studied. The alternative transportation strategy implemented during the 1996 Summer Olympic Games in Atlanta, Ga, provided such an opportunity.

Objective To describe traffic changes in Atlanta, Ga, during the 1996 Summer Olympic Games and concomitant changes in air quality and childhood asthma events.

Design Ecological study comparing the 17 days of the Olympic Games (July 19–August 4, 1996) to a baseline period consisting of the 4 weeks before and 4 weeks after the Olympic Games.

Setting and Subjects Children aged 1 to 16 years who resided in the 5 central counties of metropolitan Atlanta and whose data were captured in 1 of 4 databases.

Main Outcome Measures Citywide acute care visits and hospitalizations for asthma (asthma events) and nonasthma events, concentrations of major air pollutants, meteorological variables, and traffic counts.

Results During the Olympic Games, the number of asthma acute care events decreased 41.6% (4.23 vs 2.47 daily events) in the Georgia Medicaid claims file, 44.1% (1.36 vs 0.76 daily events) in a health maintenance organization database, 11.1% (4.77 vs 4.24 daily events) in 2 pediatric emergency departments, and 19.1% (2.04 vs 1.65 daily hospitalizations) in the Georgia Hospital Discharge Database. The number of nonasthma acute care events in the 4 databases changed −3.1%, +1.3%, −2.1%, and +1.0%, respectively. In multivariate regression analysis, only the reduction in asthma events recorded in the Medicaid database was significant (relative risk, 0.48; 95% confidence interval, 0.44-0.86). Peak daily ozone concentrations decreased 27.9%, from 81.3 ppb during the baseline period to 58.6 ppb during the Olympic Games ($P<.001$). Peak weekday morning traffic counts dropped 22.5% ($P<.001$). Traffic counts were significantly correlated with that day's peak ozone concentration (average $r=0.36$ for all 4 roads examined). Meteorological conditions during the Olympic Games did not differ substantially from the baseline period.

Conclusions Efforts to reduce downtown traffic congestion in Atlanta during the Olympic Games resulted in decreased traffic density, especially during the critical morning period. This was associated with a prolonged reduction in ozone pollution and significantly lower rates of childhood asthma events. These data provide support for efforts to reduce air pollution and improve health via reductions in motor vehicle traffic.

JAMA. 2001;285:897-905

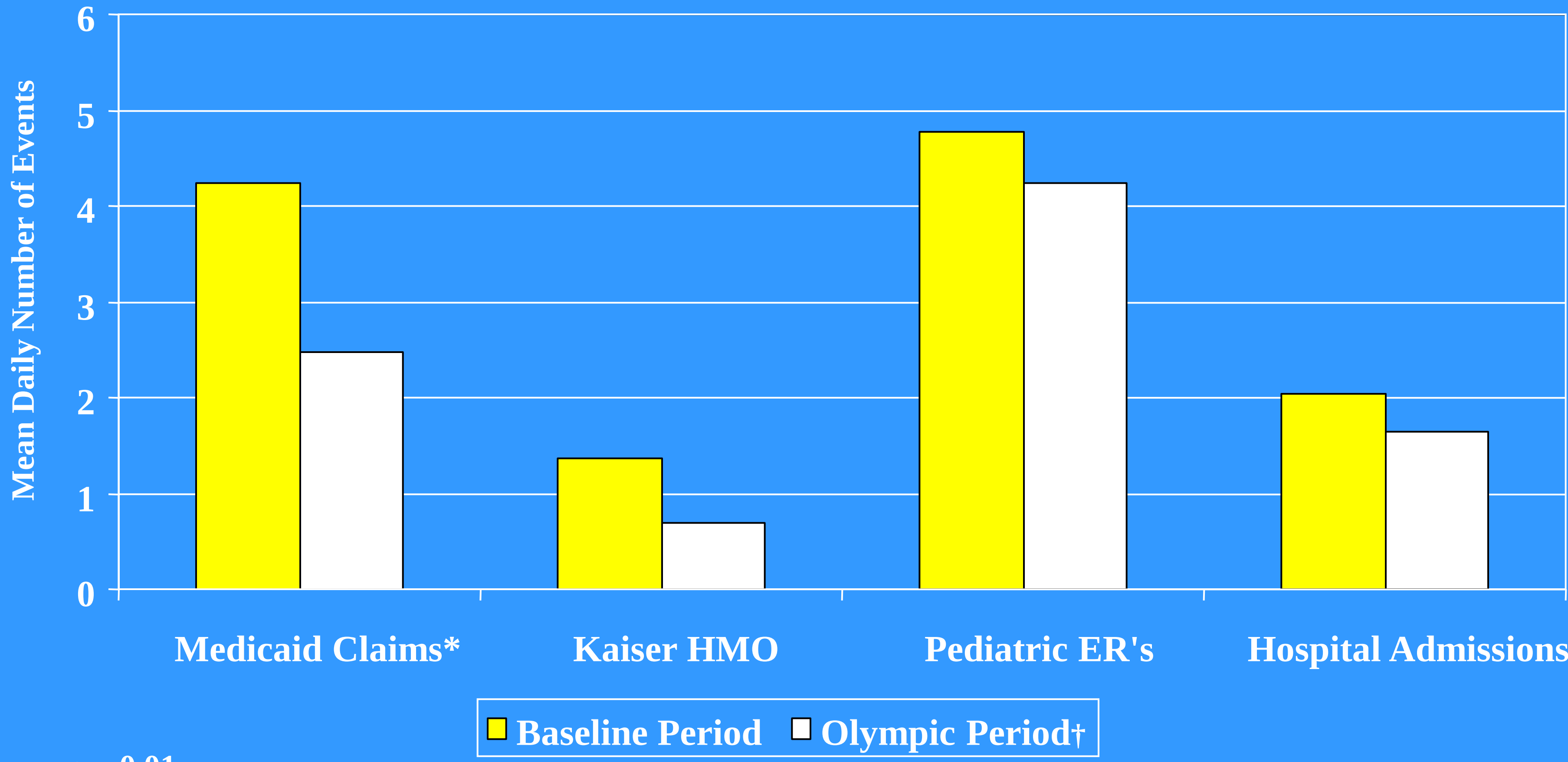
www.jama.com

DESPITE ADVANCES IN ASTHMA therapy, asthma remains a substantial public health problem. In the United States, asthma is a leading cause of childhood morbidity, with an estimated prevalence of 6.9% in children and youth younger than 18 years.[1] Numerous studies have documented a rise in the morbidity, mortality, and prevalence of asthma in different populations.[2-8] The cause or causes of this trend remain controversial.[9-11]

Experimental, laboratory, and epidemiologic studies in the last several years have linked high concentrations of known air pollutants to respiratory health problems, most notably exacerbations of asthma.[12-23] However, opportunities to study the health effects of anthropogenic improvements in air quality are rare. One study found a decrease in particulate pollution and respiratory hospital admissions associated with the closure of an industrial factory in that community.[24] To our knowledge, no study has examined the impact of improved ozone pollution for an extended period of time on asthma exacerbations or other markers of asthma morbidity. Also, the extent to which moderate concentrations of ozone (ie, daily peak of 50-100 ppb) during various exposure lengths affects asthma morbidity remains controversial.[12-16]

Author Affiliations are listed at the end of this article.
Corresponding Author and Reprints: Michael S. Friedman, MD, Air Pollution and Respiratory Health Branch, National Center for Environmental Health, Centers for Disease Control and Prevention, Atlanta, GA 30333 (e-mail: mff7@cdc.gov).

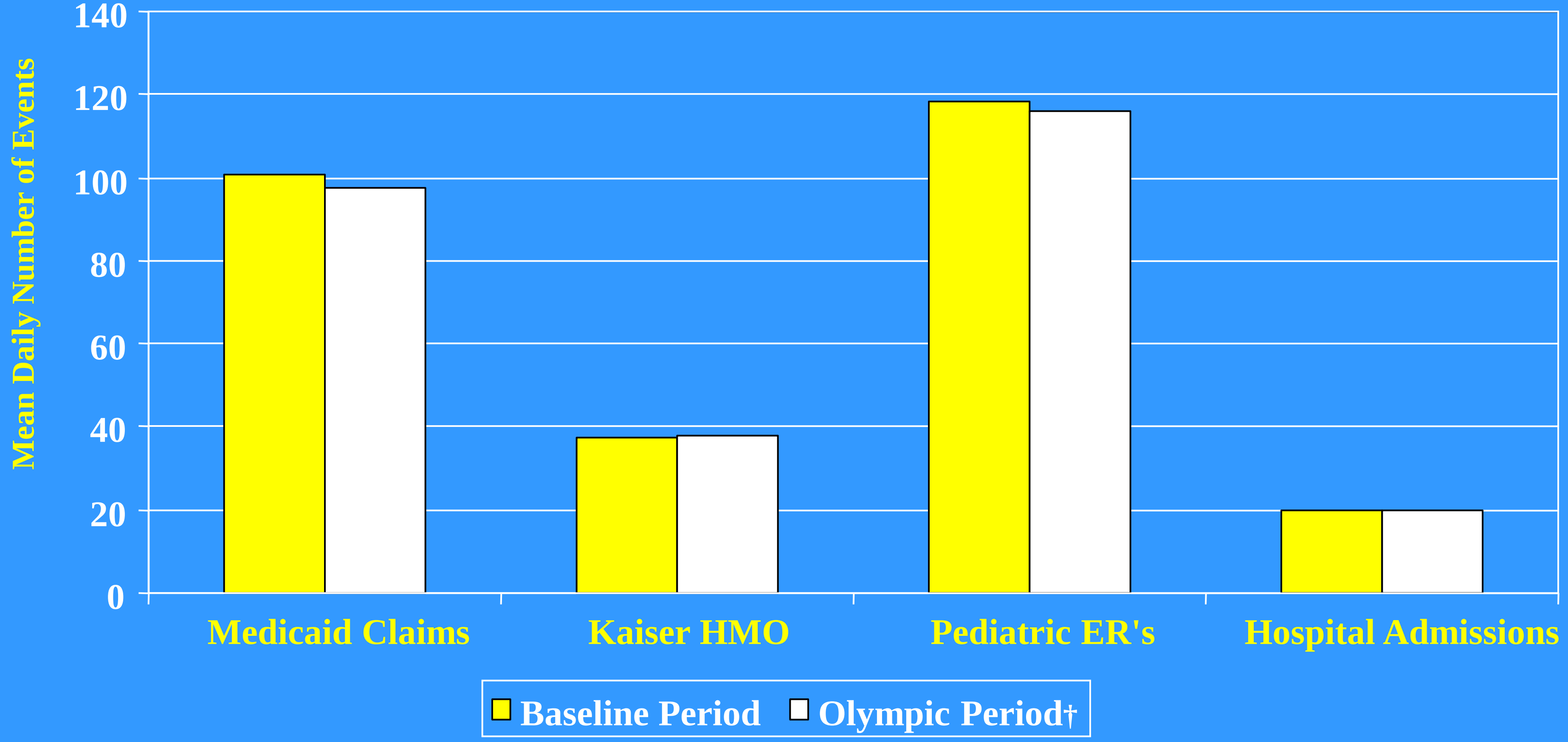
Acute Care Visits for Asthma
1-16 year old residents of Atlanta



•p = 0.01
† July 19 –August 4, 1996
Source: Friedman, et al, *JAMA*, 2001

Total Non-Asthma Related Acute Care Visits

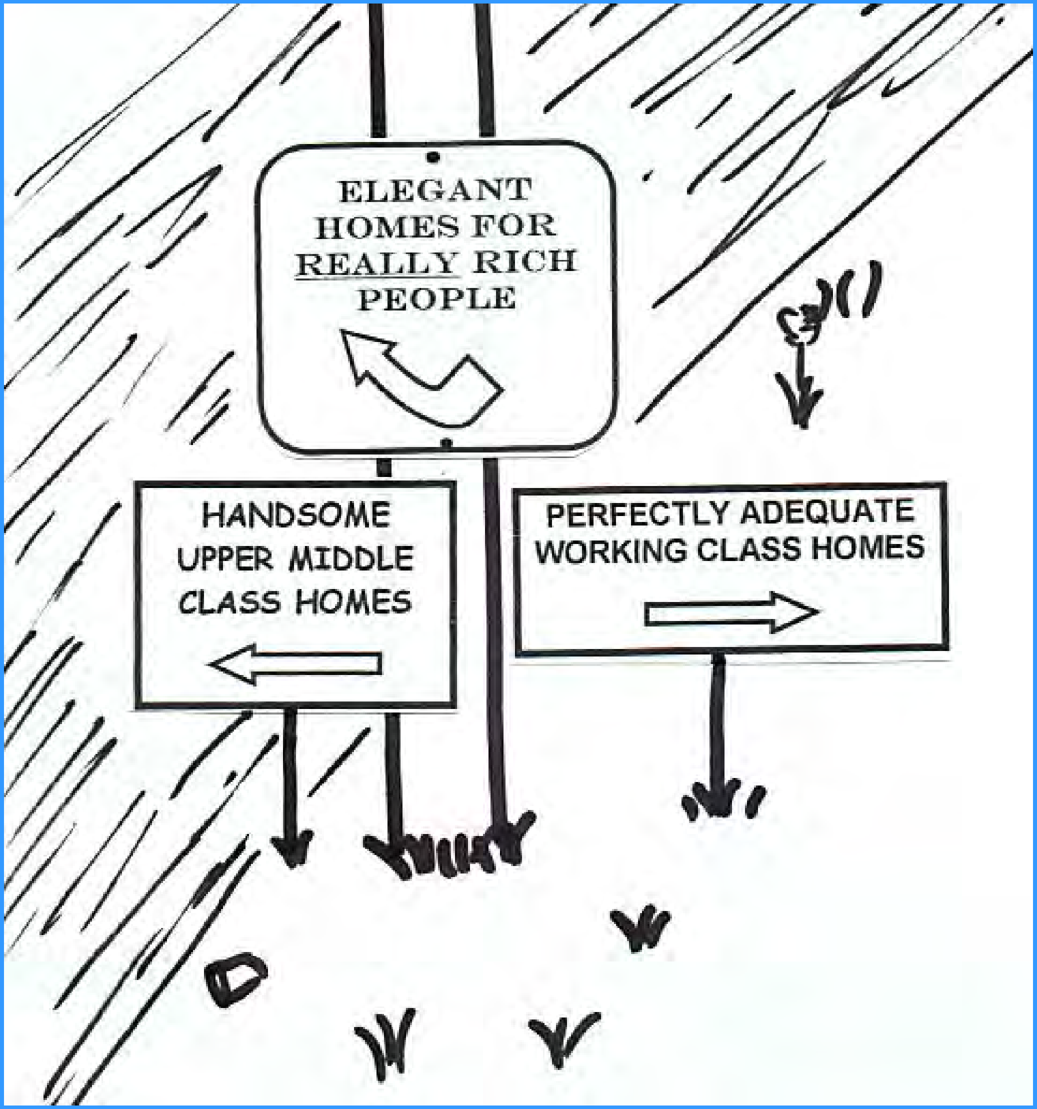
1-16 year old residents of Atlanta



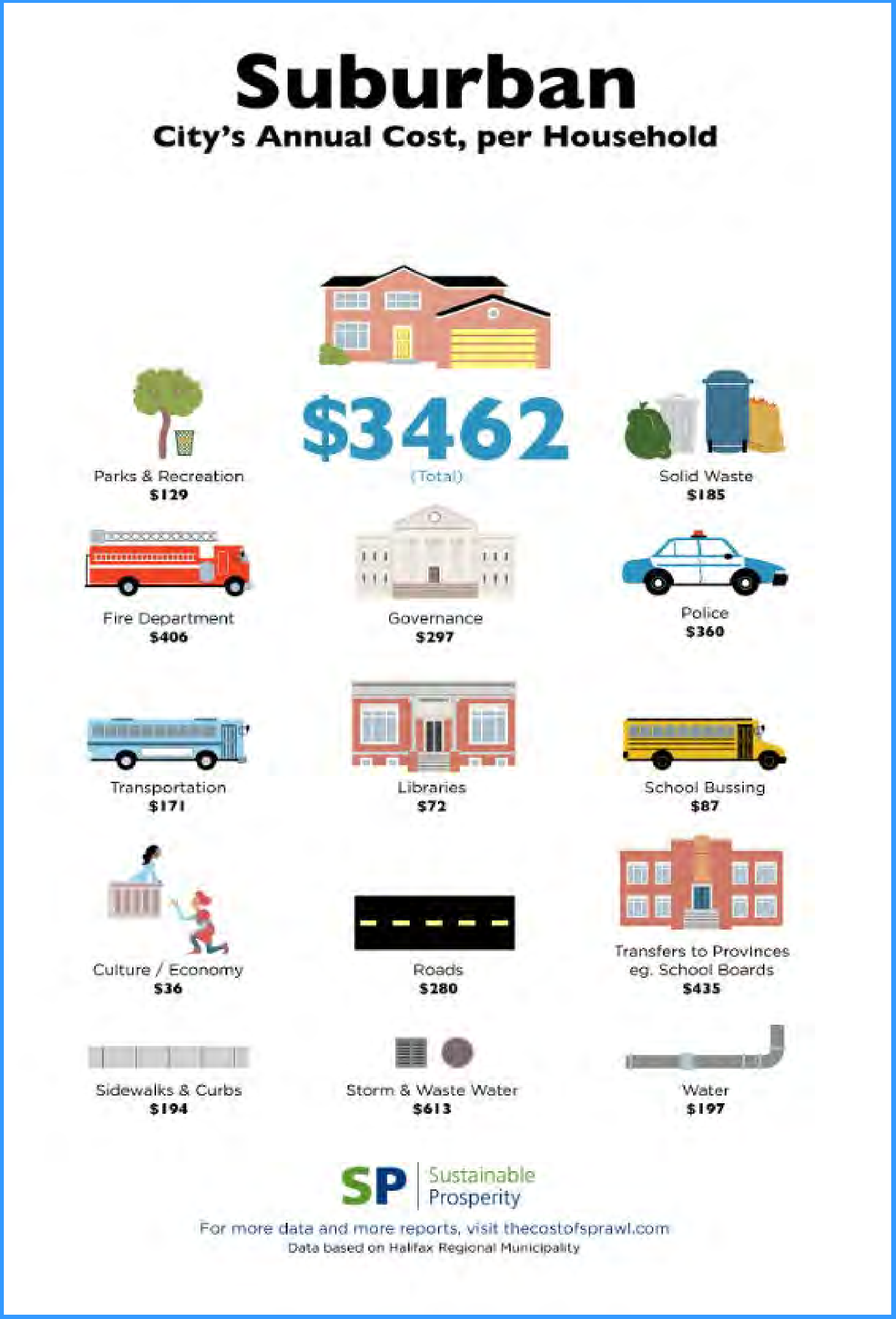
† July 19 –August 4, 1996

Source: Friedman, et al, *JAMA*, 2001

We Used to Build Real Towns and Neighborhoods but Now…

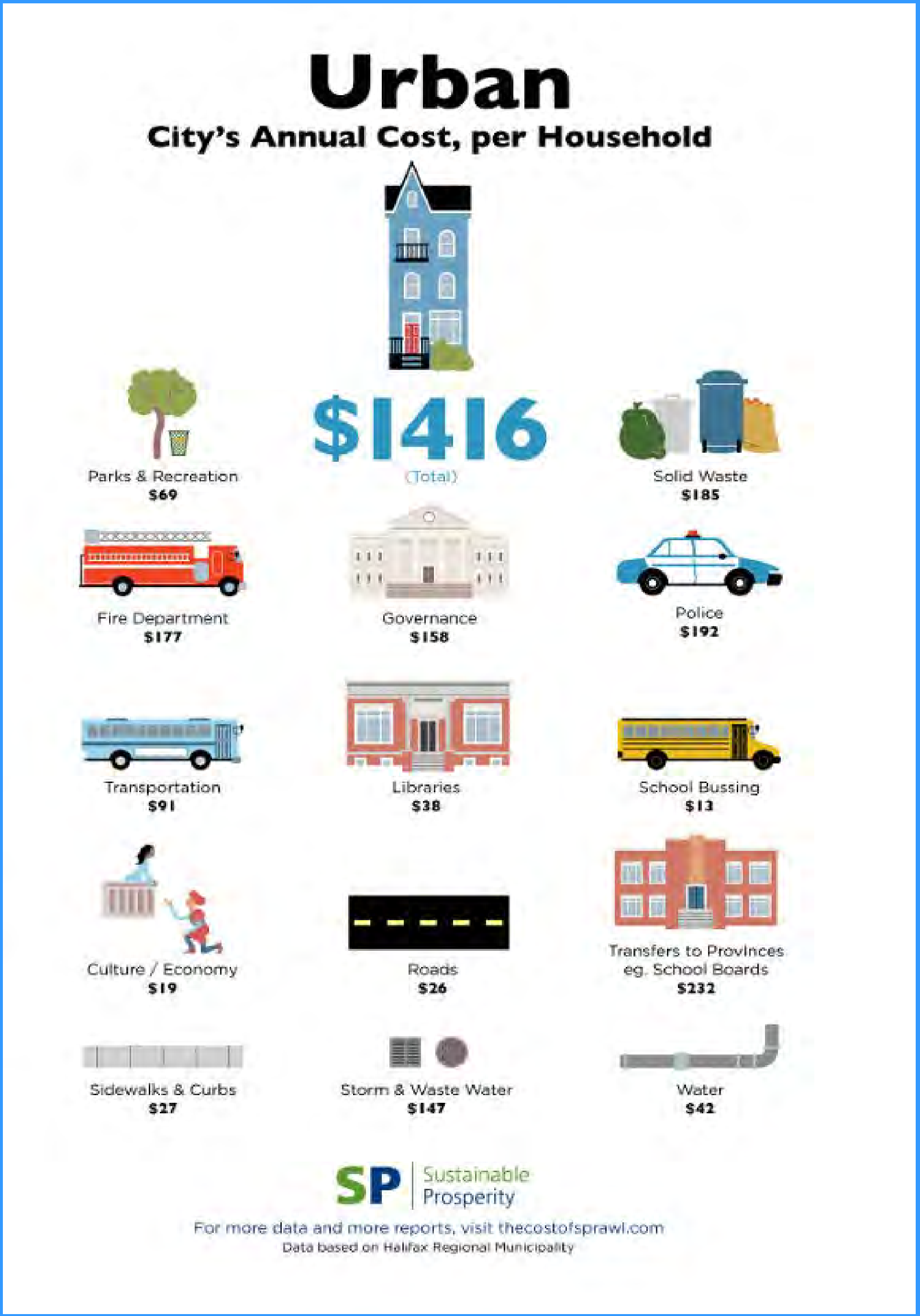


Nature Does Not Tolerate Monocultures for long…



Annual Cost of Living per household In the Suburbs

Annual Cost of Living per household In a City



Suburban

City's Annual Cost, per Household

$3462
(Total)

Parks & Recreation
$129

Solid Waste
$185

Fire Department
$406

Governance
$297

Police
$360

Transportation
$171

Libraries
$72

School Bussing
$87

Culture / Economy
$36

Roads
$280

Transfers to Provinces
eg. School Boards
$435

Sidewalks & Curbs
$194

Storm & Waste Water
$613

Water
$197

SP Sustainable Prosperity

For more data and more reports, visit thecostofsprawl.com
Data based on Halifax Regional Municipality

Urban

City's Annual Cost, per Household

$1416
(Total)

Parks & Recreation
$69

Solid Waste
$185

Fire Department
$177

Governance
$158

Police
$192

Transportation
$91

Libraries
$38

School Bussing
$13

Culture / Economy
$19

Roads
$26

Transfers to Provinces
eg. School Boards
$232

Sidewalks & Curbs
$27

Storm & Waste Water
$147

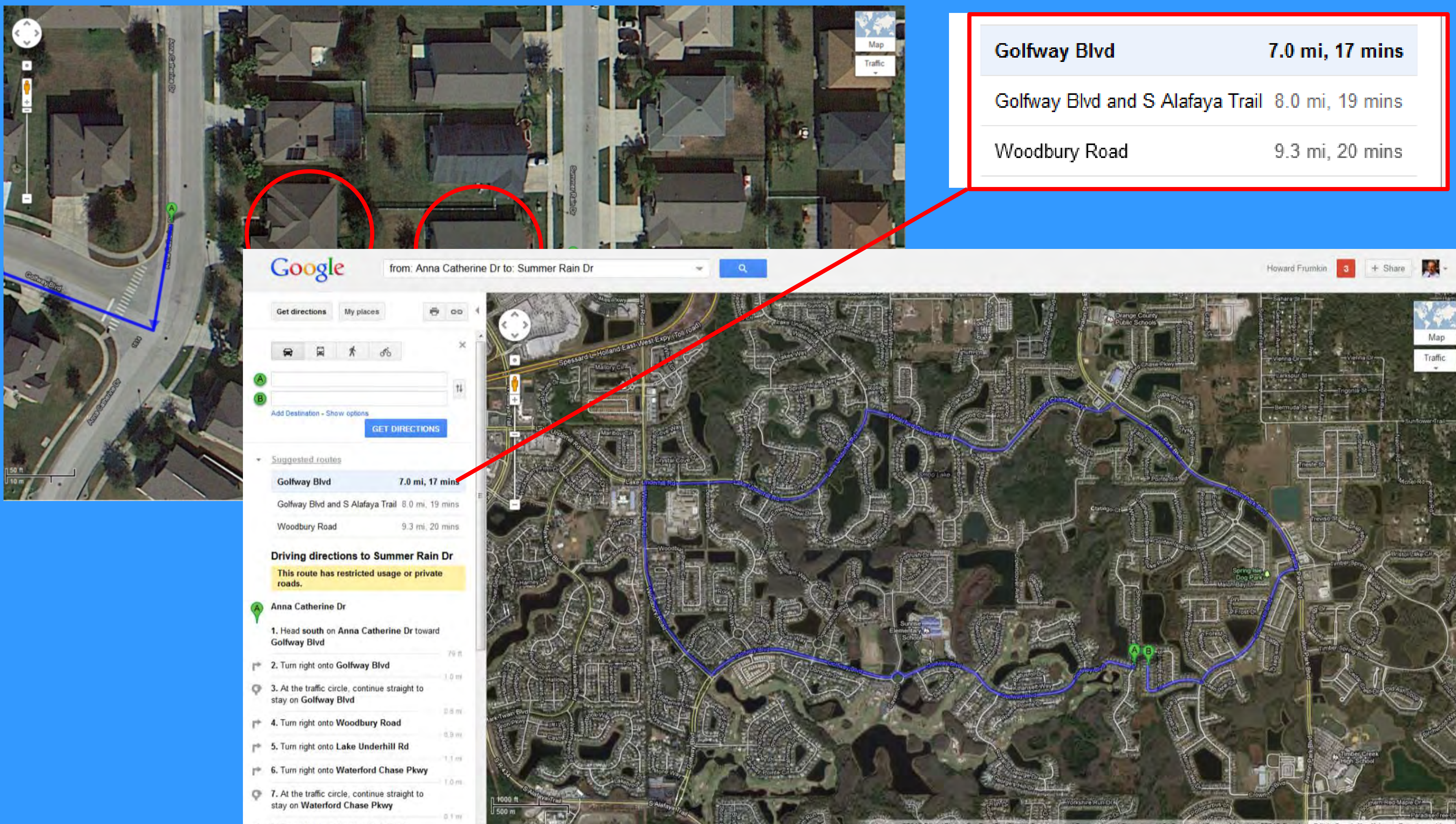
Water
$42

SP Sustainable Prosperity

For more data and more reports, visit thecostofsprawl.com
Data based on Halifax Regional Municipality

Two houses, adjoining back yards

(From Streetsblog, 02/28/2013)




SPEED
LIMIT
40

Canine constitutional

A brisk walk in the park keeps Marev B in shape between dog shows. His owner, Columbus resident Cathy Stumbo, got up early to give her 3-year-old Doberman his regular workout. They typically jog 15 miles in Berliner Park.

“Old” Schools

Credit: Hummel Architects, Boise, ID

“Modern” Schools

Credit: South Carolina Coastal Conservation League

Credit: Constance E. Beaumant, NTHP

We have changed how much we walk or bike

- Percent of children who walk or bike to school:
- 1974 → **66%**
- 2000 → **13%**

(CDC, 2000)

Fittest Cities in the United States

ten most and ten least fit

The annual American Fitness Index ranks the 50 largest metro areas in the U.S. according to factors like preventative health behaviors, levels of disease and community resources that support physical activity.

1 Washington/Arlington/Alexandria
2 Minneapolis/St. Paul/Bloomington
3 San Diego/Carlsbad
4 San Francisco/Oakland-Hayward
5 Sacramento/Roseville/Arden/Arcade
6 Denver/Aurora/Lakewood
7 Portland/Vancouver/Hillsboro
8 Seattle/Tacoma/Bellevue
9 Boston/Cambridge/Newton
10 San Jose/Sunnyvale/Santa Clara

41 Dallas/Fort Worth/Arlington
42 New Orleans/Metairie
43 Charlotte/Concord/Gastonia
44 Birmingham/Hoover
45 Nashville/Davidson/Murfreesboro/Franklin
46 Louisville/Jefferson County
47 San Antonio/New Braunfels
48 Oklahoma City
49 Memphis
50 Indianapolis/Carmel/Anderson

SOURCE: American College of Sports Medicine (ACSM), Anthem Foundation

http://americanfitnessindex.org/report/

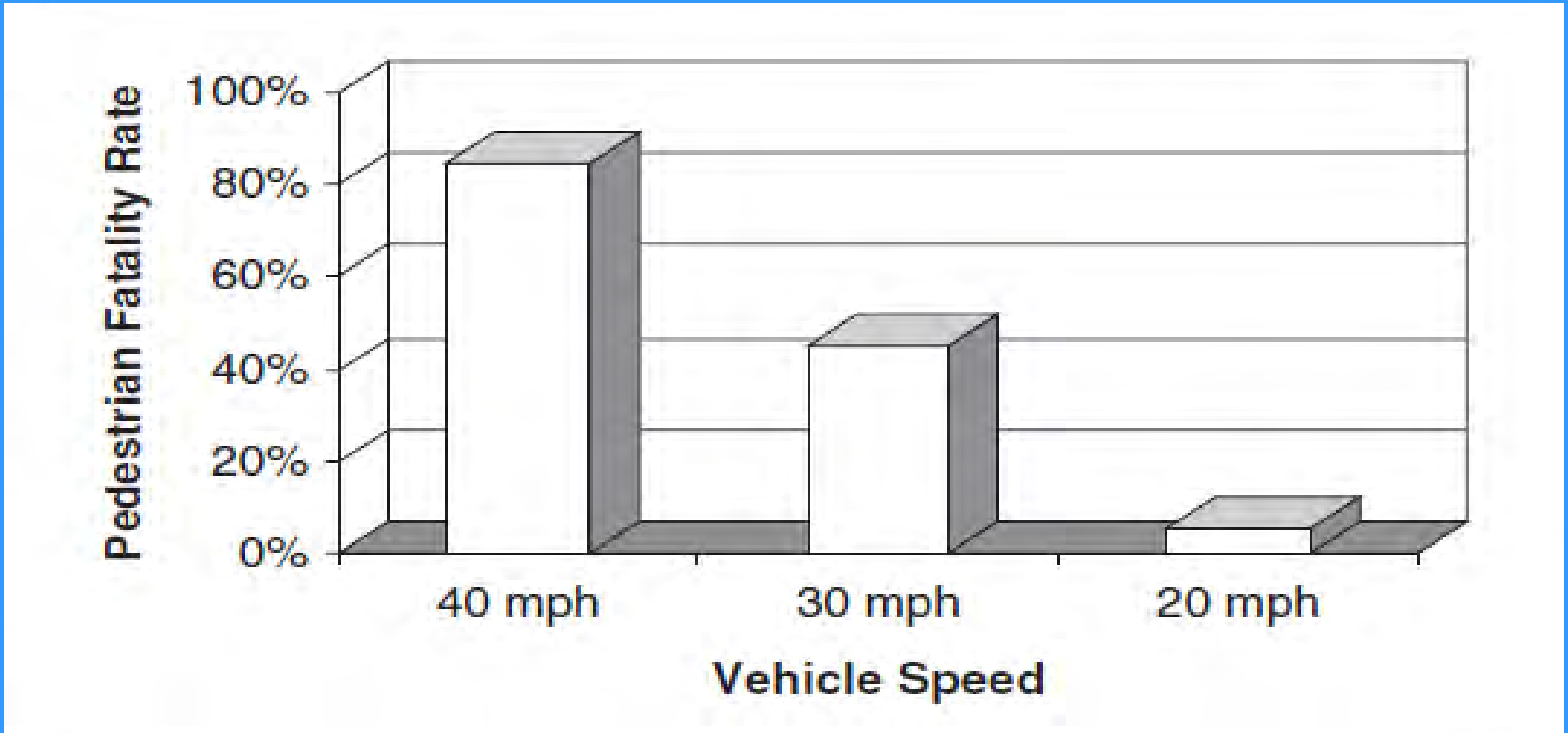
Educational Benefits of Walking and Biking to School

- Increases concentration
- Improves mood and ability to be alert
- Improves memory and learning
- Enhances creativity

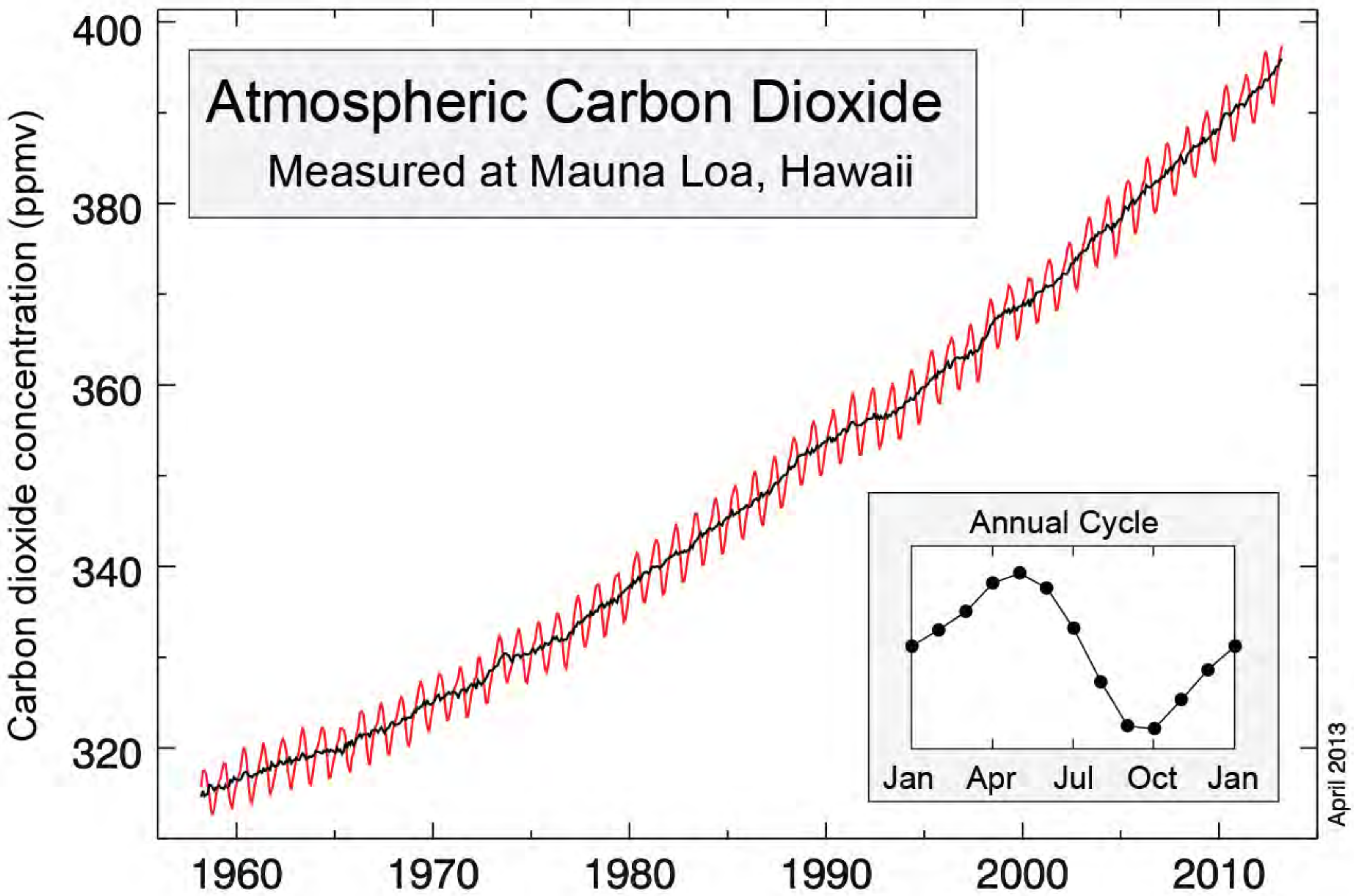
RANK	Under 1	1-3	4-7	8-15	16-20	21-24	Other Adults 25-34	35-44	45-64	65+
	Cause and Number of Deaths									
1	Perinatal Period	Congenital Anomalies	**MV Traffic Crashes**	**MV Traffic Crashes**	**MV Traffic Crashes**	**MV Traffic Crashes**	**MV Traffic Crashes**	Malignant Neoplasms	Malignant Neoplasms	
2	Congenital Anomalies	**MV Traffic Crashes**	Malignant Neoplasms	Malignant Neoplasms	Homicide	Homicide	Suicide	Heart Disease		
3	Heart Disease	Accidental Drowning	Congenital Anomalies	Suicide	Suicide	Suicide	Homicide	**MV**		
4	Homicide	Homicide	Accidental Drowning	Homicide	Malignant Neoplasms	Accidental Poisoning	M			
5	Septicemia	Malignant Neoplasms	Exposure to Smoke/Fire	Congenital Anomalies	Acciden Poisoni	Ma				
6	Influenza/ Pneumonia	Exposure to Smoke/Fire	Homicide	Accidental Drowning						
7	Nephritis/ Nephrosis	Heart Disease	Hea							
8	**MV Traffic Crashes**	In								

For every age group from 3 through 34--crashes were the No. 1 cause of death

Pedestrian Fatality Rates for Collisions at Different Speeds



Zegeer et al 2002


Atmospheric Carbon Dioxide
Measured at Mauna Loa, Hawaii
Carbon dioxide concentration (ppmv)
400
380
360
340
320
1960
1970
1980
1990
2000
2010
Annual Cycle
Jan
Apr
Jul
Oct
Jan
April 2013

Earth's CO2 Home Page

CLICK HERE *for daily CO2Now data updates.*

397.13 ppm

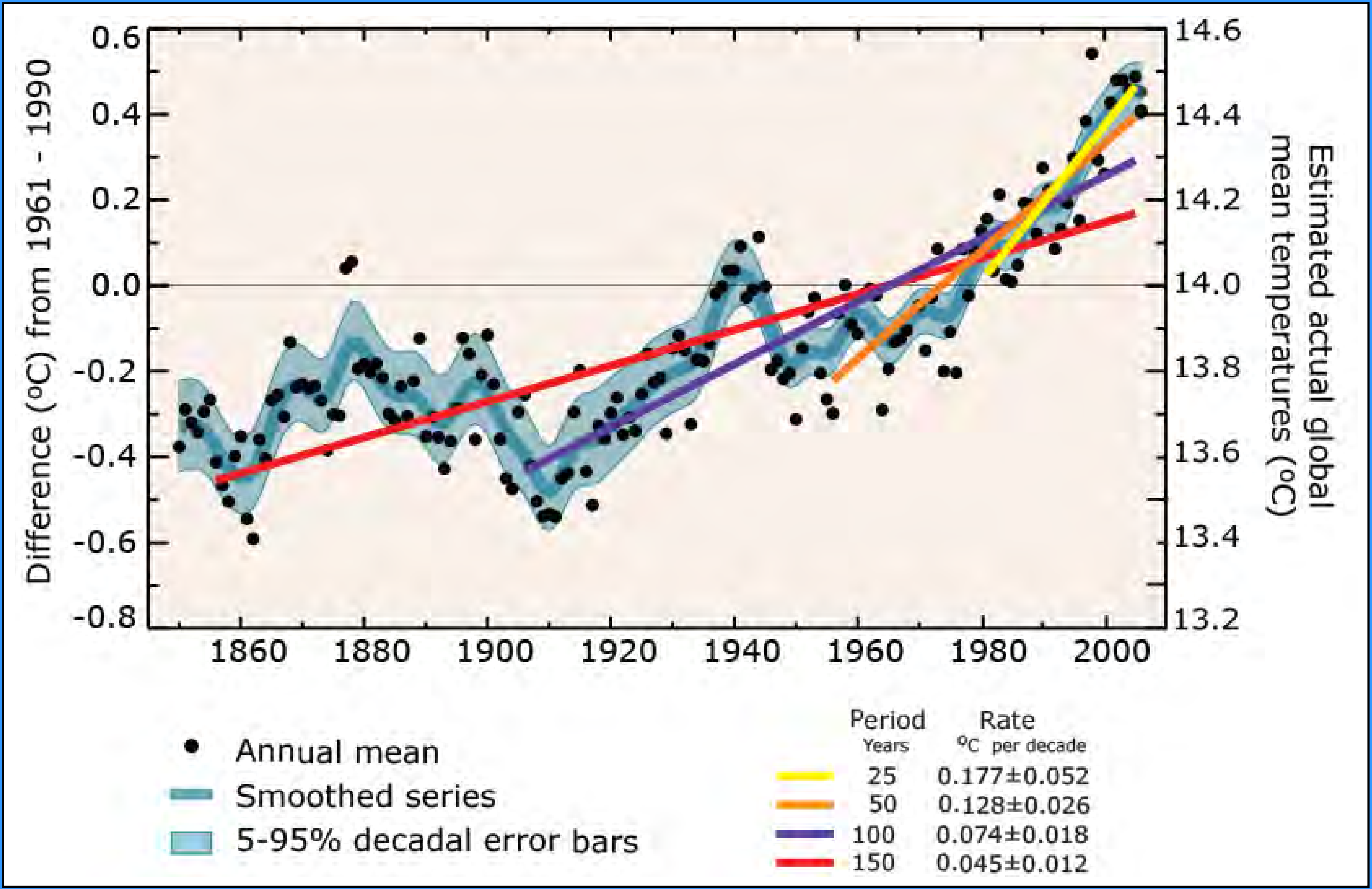
Atmospheric CO_2 for November 2014

Preliminary monthly average as of December 5, 2014

(Mauna Loa Observatory: NOAA-ESRL)

NOTE: On May 10, 2013, *NOAA* & *Scripps first reported daily averages that temporarily reached 400 ppm.*

Global average temperature



Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Injury Prevention & Control : Division of Violence Prevention

Child Maltreatment: Definitions

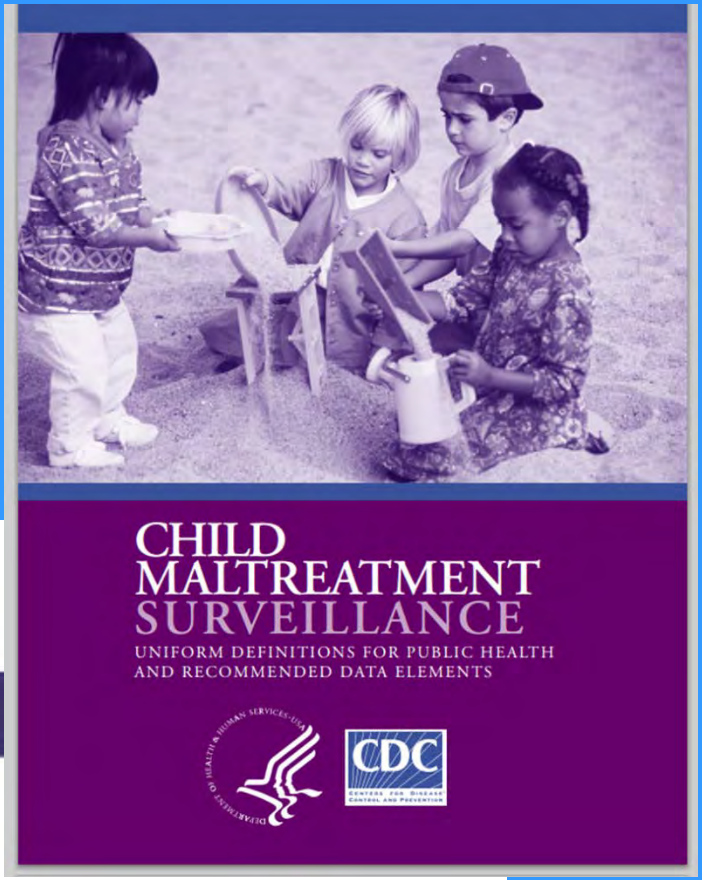
Recommend Tweet Share

Any act or series of acts of commission or omission by a parent or other caregiver (e.g., clergy, coach, teacher) that results in harm, potential for harm, or threat of harm to a child.

Acts of Commission (Child Abuse)

Words or overt actions that cause harm, potential harm, or threat of harm to a child. Acts of commission are deliberate and intentional; however, harm to a child may or may not be the intended consequence. Intentionality only applies to the caregivers' acts-not the consequences of those acts. For example, a caregiver may intend to hit a child as punishment (i.e., hitting the child is not accidental or unintentional) but not intend to cause the child to have a concussion. The following types of maltreatment involve acts of commission:

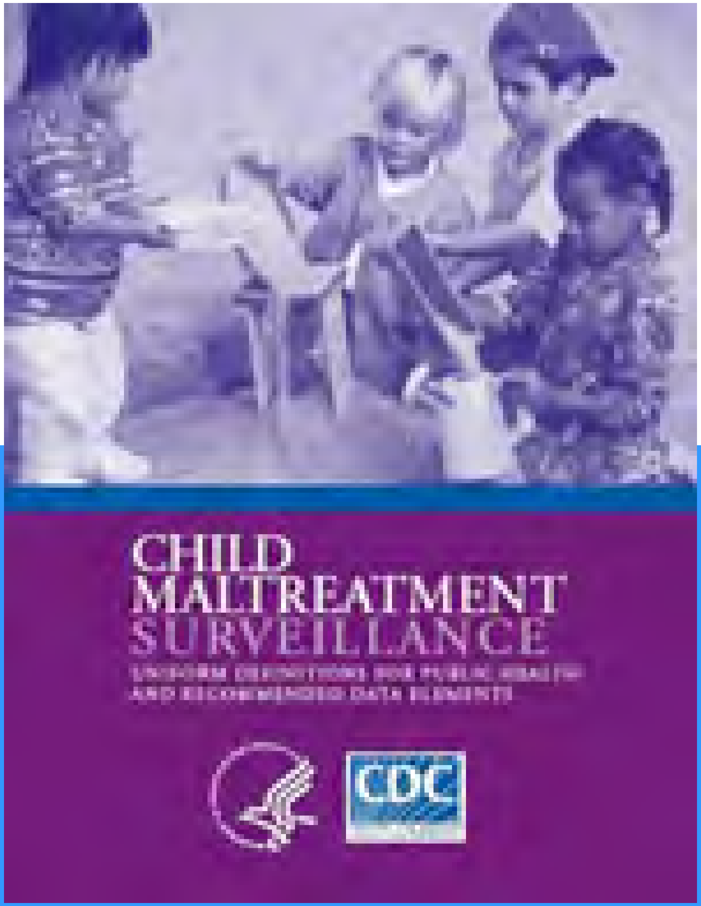
- Physical abuse
- Sexual abuse
- Psychological abuse



Acts of Omission (Child Neglect)

The failure to provide for a child's basic physical, emotional, or educational needs or to protect a child from harm or potential harm. Like acts of commission, harm to a child may or may not be the intended consequence. The following types of maltreatment involve acts of omission:

- Failure to provide
  - Physical neglect
  - Emotional neglect
  - Medical/dental neglect
  - Educational neglect
- Failure to supervise
  - Inadequate supervision
  - Exposure to violent environments



CUMULATIVE greenhouse emissions in 2002, by country

Density-equalizing cartogram;

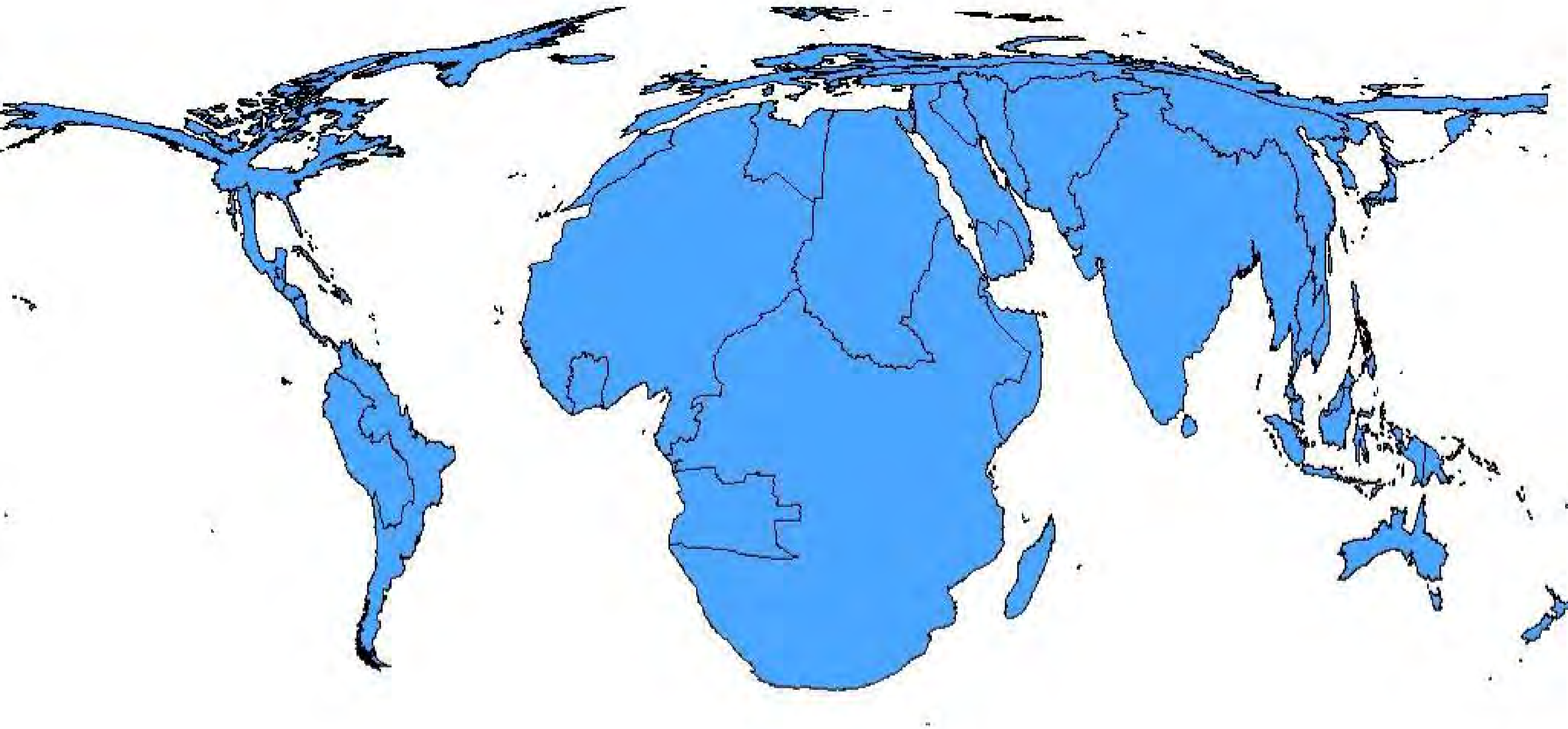
WHO region size proportional to mortality

Jonathan Patz,

University of Wisconsin

Climate-related mortality (per 10^6 population), 2000

Density-equalizing cartogram; WHO region size proportional to mortality



Jonathan Patz

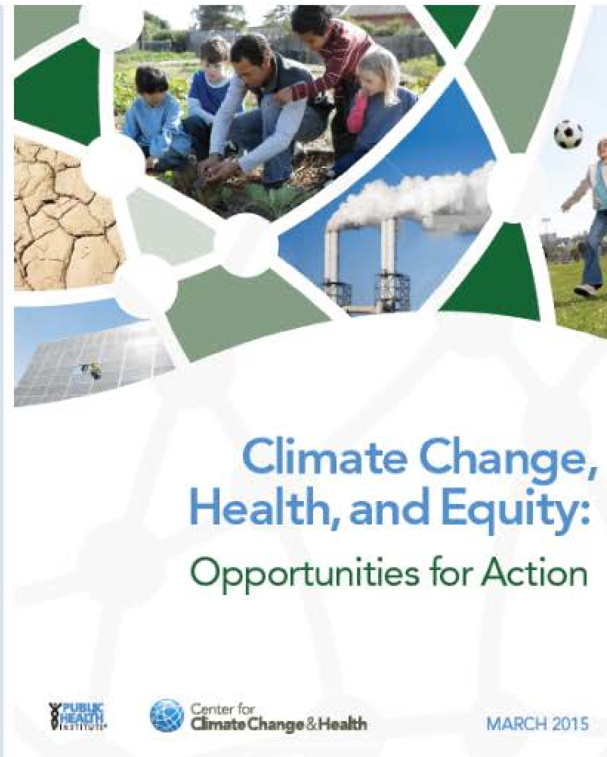
University of Wisconsin

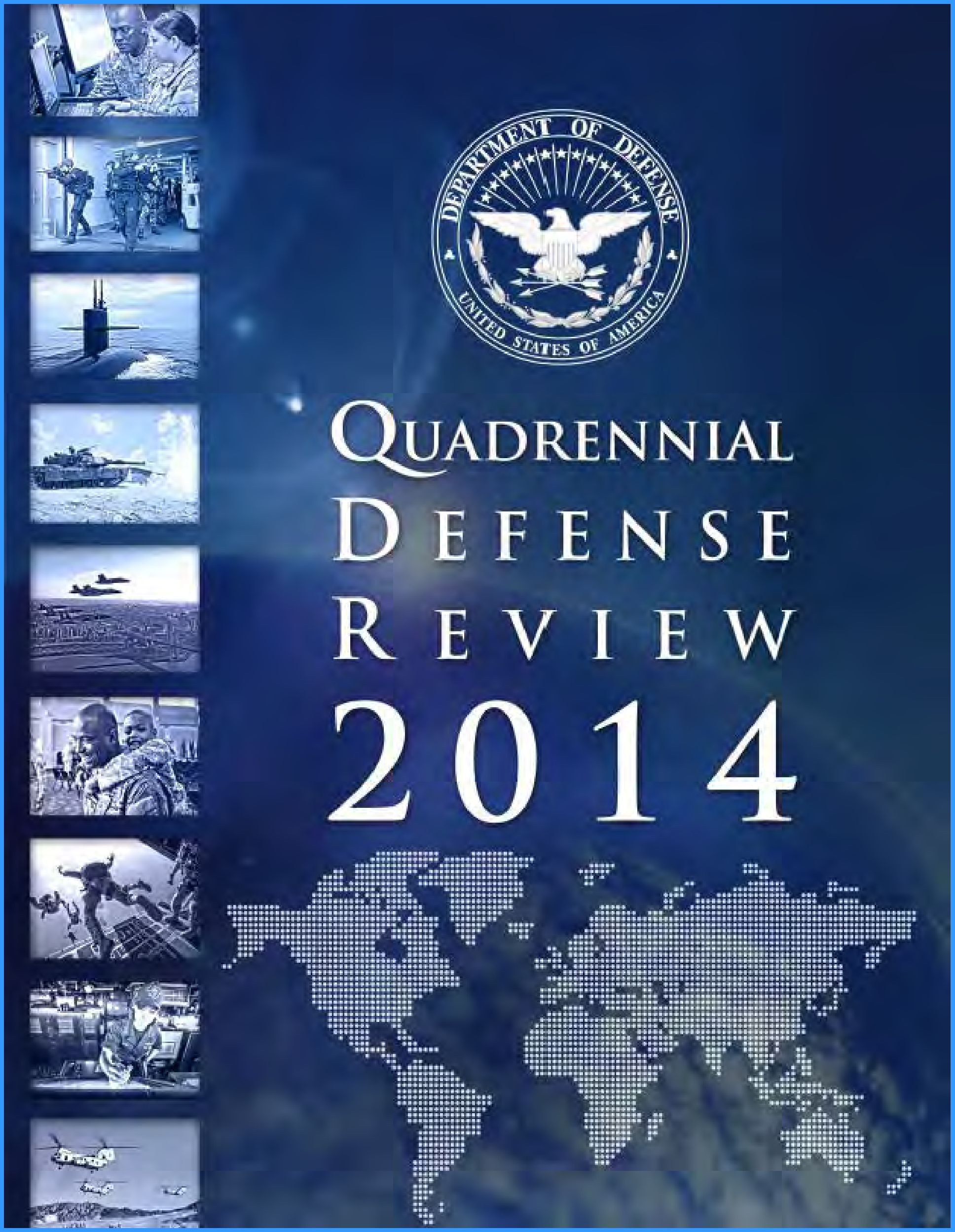
"Climate change threatens our fragile existence on this planet."

—Jim Yong Kim, World Bank[1]

"For public health, climate change is the defining issue for the 21st century."

—Margaret Chan, World Health Organization[2]




DEPARTMENT OF DEFENSE
UNITED STATES OF AMERICA
QUADRENNIAL
DEFENSE
REVIEW
2014

Institute of Medicine

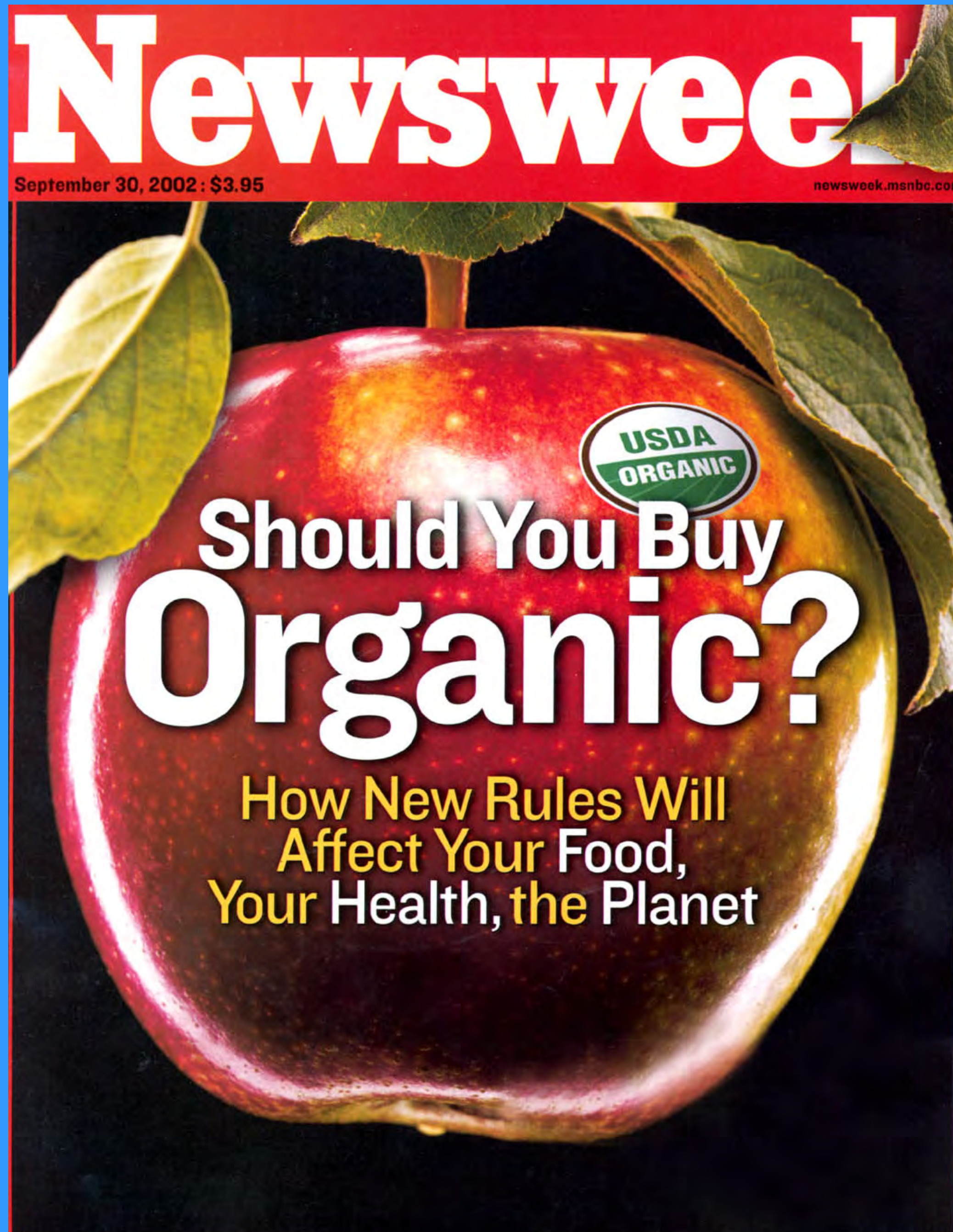
The purpose of public health is to fulfill society's interest in assuring the conditions in which people can be healthy

Food

Likely Results of a Sugar Sweetened Beverage (SSB) Tax

- "A national tax of 1 cent per ounce on sugar-sweetened beverages (SSBs) would decrease consumption by 23% and raise $14.9 billion in the first year alone."

Brownell KD, et al. The public health and economic benefits of taxing sugar-sweetened beverages. NEJM. 2009;361(16):1599-1605.

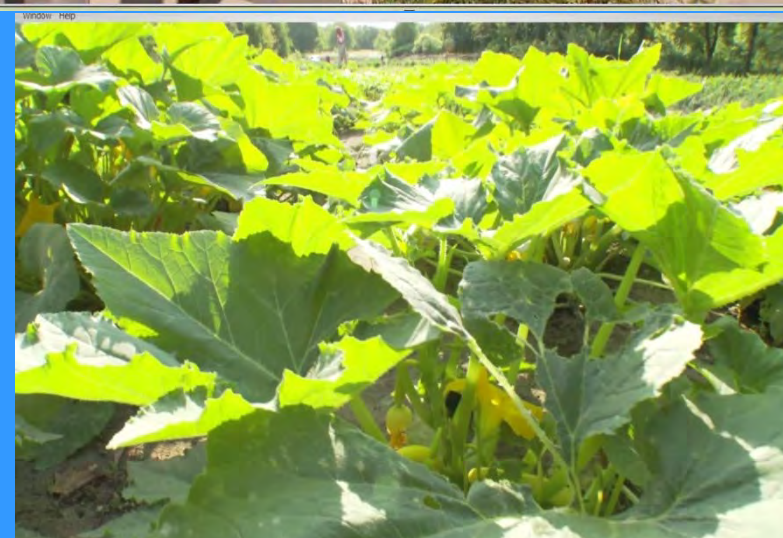

Newsweek
September 30, 2002 : $3.95
newsweek.msnbc.com
USDA
ORGANIC
Should You Buy
Organic?
How New Rules Will
Affect Your Food,
Your Health, the Planet

The Need for Health Impact Assessment

- Big decisions are made without examining potential health impacts (both positive and negative) over the life cycle.


BeltLine
BeltLine
Trail


Malik Yakini
Chairperson, Detroit Black Food Security Network



IMPROVING HEALTH IN THE UNITED STATES

The Role of Health Impact Assessment

Committee on Health Impact Assessment

Board on Environmental Studies and Toxicology

Division on Earth and Life Studies

National Research Council

NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

THE NATIONAL ACADEMIES PRESS
Washington, D.C.
www.nap.edu

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Integrating HIA into environmental impact assessment (EIA). The U.S. National Environmental Policy Act (NEPA) and some related state laws explicitly require the identification and analysis of health effects when EIA is conducted. EIA, however, has traditionally included at most only a cursory analysis of health effects. Some argue that health analysis should be integrated into EIA because NEPA and related state laws provide a mechanism for achieving the same substantive goals as HIA. Others contend that EIA has become too rigid to accommodate a comprehensive health analysis and that attention should be focused on the independent practice of HIA. The committee emphasizes that the appropriate assessment of direct, indirect, and cumulative health effects in EIA under NEPA is a matter of law and not discretion, and recent efforts have successfully integrated the HIA framework into EIA. Thus, where legal standards

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"…the appropriate assessment of Direct, Indirect, and Cumulative Health Effects in Environmental Impact Assessment Under the National Environmental Policy Act is a Matter of Law and Not Discretion."

American Academy of Pediatrics

POLICY STATEMENT

The Built Environment: Designing Communities to Promote Physical Activity in Children

Committee on Environmental Health

ABSTRACT

An estimated 32% of American children are overweight, and physical inactivity contributes to this high prevalence of overweight. This policy statement highlights how the built environment of a community affects children's opportunities for physical activity. Neighborhoods and communities can provide opportunities for recreational physical activity with parks and open spaces, and policies must support this capacity. Children can engage in physical activity as a part of their daily lives, such as on their travel to school. Factors such as school location have played a significant role in the decreased rates of walking to school, and changes in policy may help to increase the number of children who are able to walk to school. Environment modification that addresses risks associated with automobile traffic is likely to be conducive to more walking and biking among children. Actions that reduce parental perception and fear of crime may promote outdoor physical activity. Policies that promote more active lifestyles among children and adolescents will enable them to achieve the recommended 60 minutes of daily physical activity. By working with community partners, pediatricians can participate in establishing communities designed for activity and health. *Pediatrics* 2009;123:1591–1598

INTRODUCTION

A child's life is affected by the environment in which he or she lives. Relationships between health and the quality of air, water, and food are well recognized. The physical environments of the home and school also influence health through exposures to lead, mold, noise, or ambient light. In addition, the overall structure of the physical environment of a child's community (referred to as the "built environment") can also affect health in diverse ways.

As cities have expanded into rural areas, large tracts of land have been frequently transformed into low-density developments in a "leapfrog" manner. The resultant urban sprawl can increase automobile travel, which increases air pollution as well as passenger and pedestrian traffic fatalities. Some urban areas may have few supermarkets, produce stands, or community gardens, thereby limiting access to fresh fruits and vegetables. The physical environment of a community can support opportunities for play, an essential component of child development, and for physical activity, a health behavior that not only reduces risk of excess-weight gain but also has many other benefits for overall well-being.

Many factors influence a child's level of physical activity, including individual-level psychosocial factors such as self-efficacy; family factors such as parental support; and larger-scale factors such as social norms. Although these are all important contributors, this policy statement is limited to focusing on how the physical design of the community affects children's opportunities for physical activity. Opportunities for recreational physical activity arise with parks and green spaces. "Utilitarian" physical activity, such as walking or bicycling to school and to other activities, is an equally important part of a child's daily life. Environments that promote more active lifestyles among children and adolescents will be important to enable them to achieve recommended levels of physical activity.

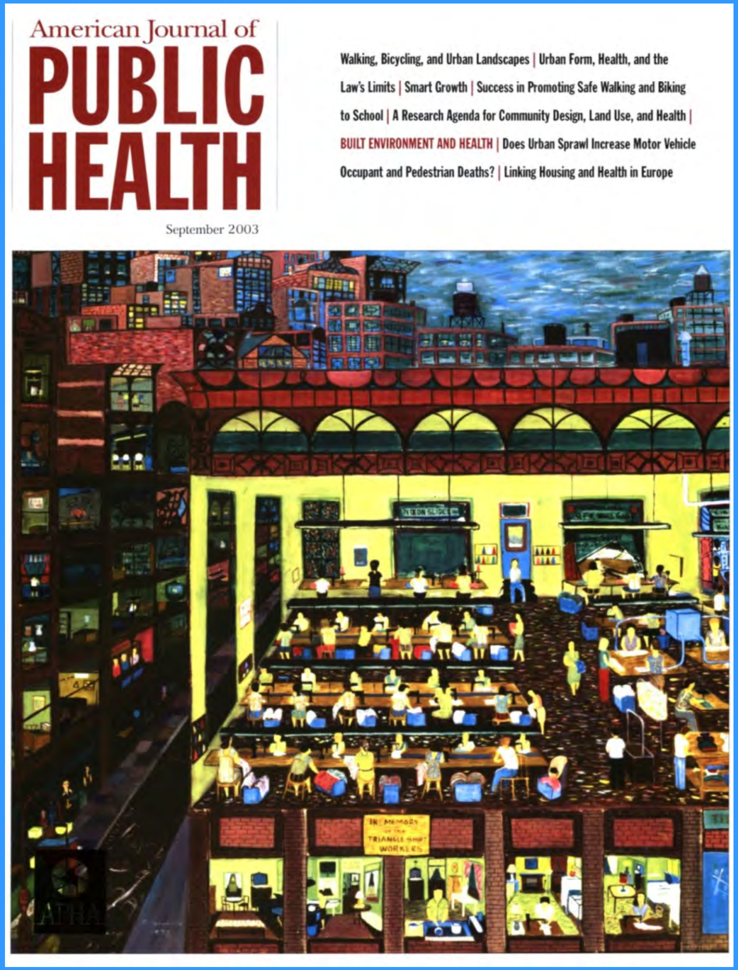
BACKGROUND

The term "built environment" refers to spaces such as buildings and streets that are deliberately constructed as well as outdoor spaces that are altered in some way by human activity. This term may be unfamiliar to most clinicians, but with the high prevalence of childhood overweight and obesity, the subject is increasingly relevant.

- The Built Environment: Designing Communities to Promote Physical Activity in Children
- Policy Statement American Academy of Pediatrics
- June 2009

Medline Keyword Search:

"Built Environment" and *"Health"*



Sept1993 – Sept 2003

58 Articles

Sept 2003 – May 2013

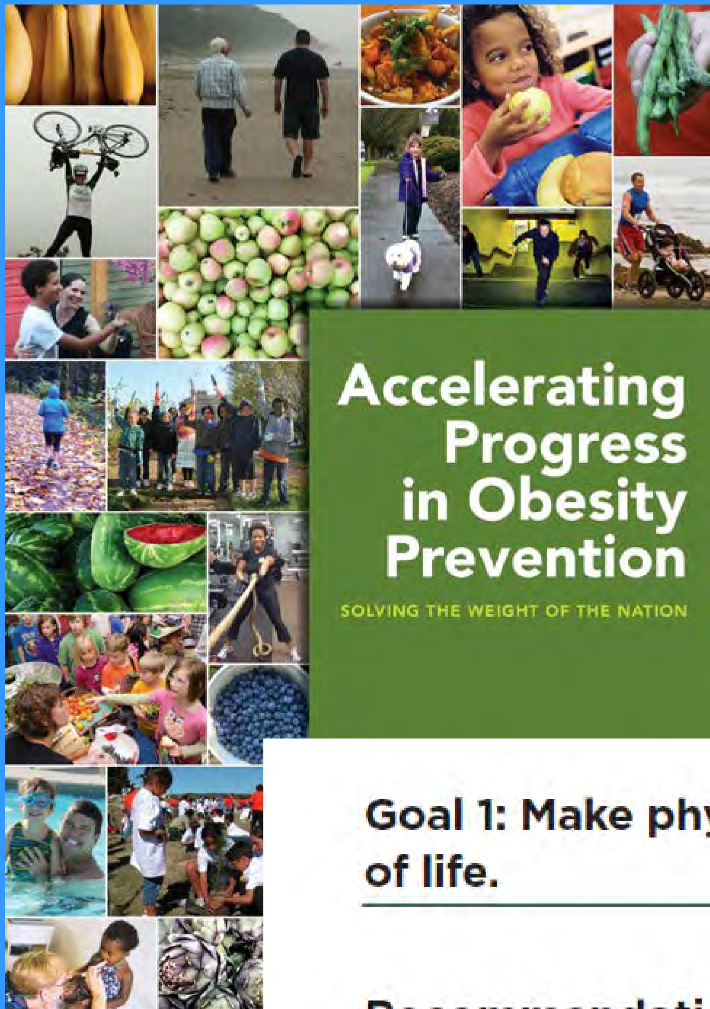
665 Articles

American Journal of Public Health

Built Environment and Health Issue

September, 2003

Institute of Medicine
Report
Accelerating Progress
in Obesity Prevention
May 8, 2012

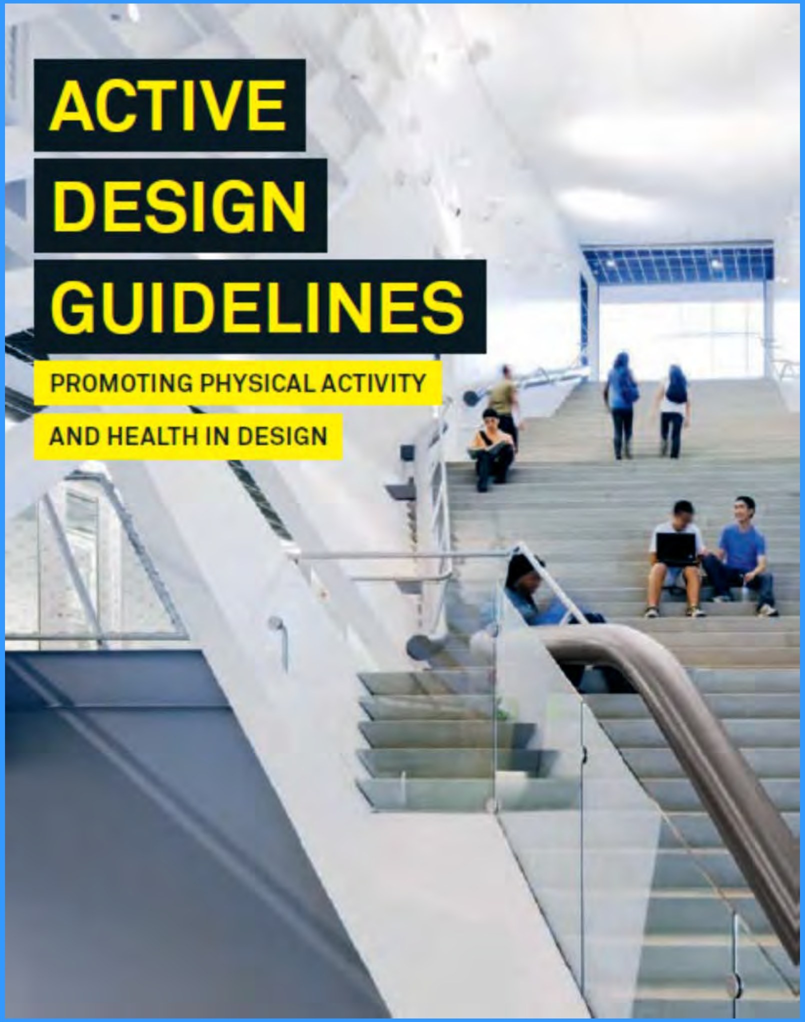


Goal 1: Make physical activity an integral and routine part of life.

Recommendation 1: Communities, transportation officials, community planners, health professionals, and governments should make promotion of physical activity a priority by substantially increasing access to places and opportunities for such activity.

NYC Active Design Guidelines

- Resilient Bldgs
- Energy Efficient Buildings
- Healthy Bldgs
- Smart zoning and locations



http://www.nyc.gov/html/ddc/html/design/active_design.shtml

Charlotte, NC, Light Rail Opened November, 2007

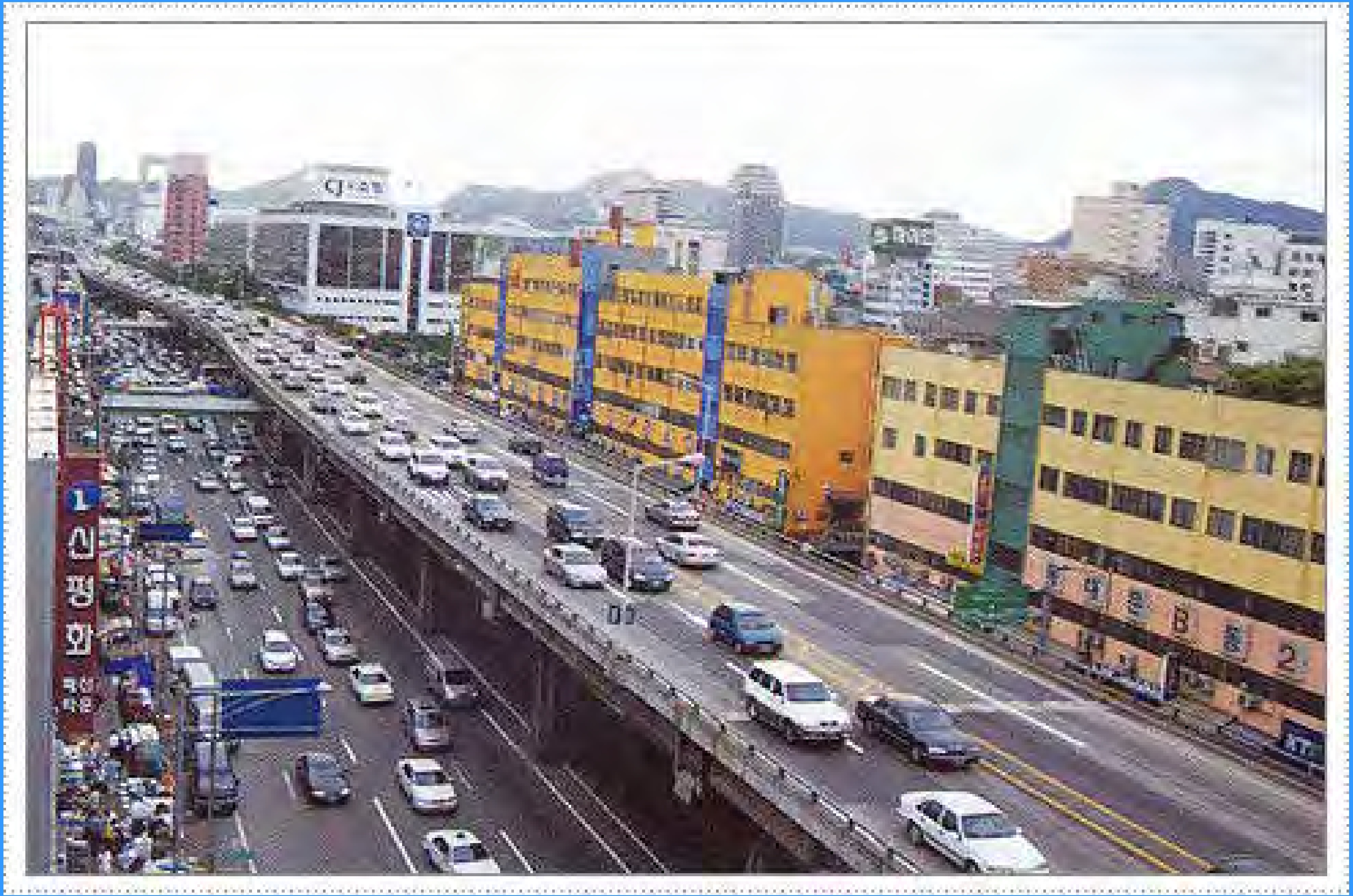
After 2 Years…
Light Rail Transit Users Had

- An average reduction of 1.18 BMI points
  - For a person who is 5’5” --equivalent to a weight loss of 6.45 lbs.
- An 81% reduced odds of becoming obese over time.

The High Line NYC

A 20 block walk in Manhattan without a cross street–

and it was delightful even with a 2 year old.



- The Chenoggye freeway ran through the center of Seoul ~1970-2005

- Cheonggyecheon -- 8.4 km long downtown Seoul, South Korea.
    - The $900 million project initially attracted much public criticism.

Integrating Health into Decision-Making

Importance of What Makes People Happy

Marketplace is Shifting--

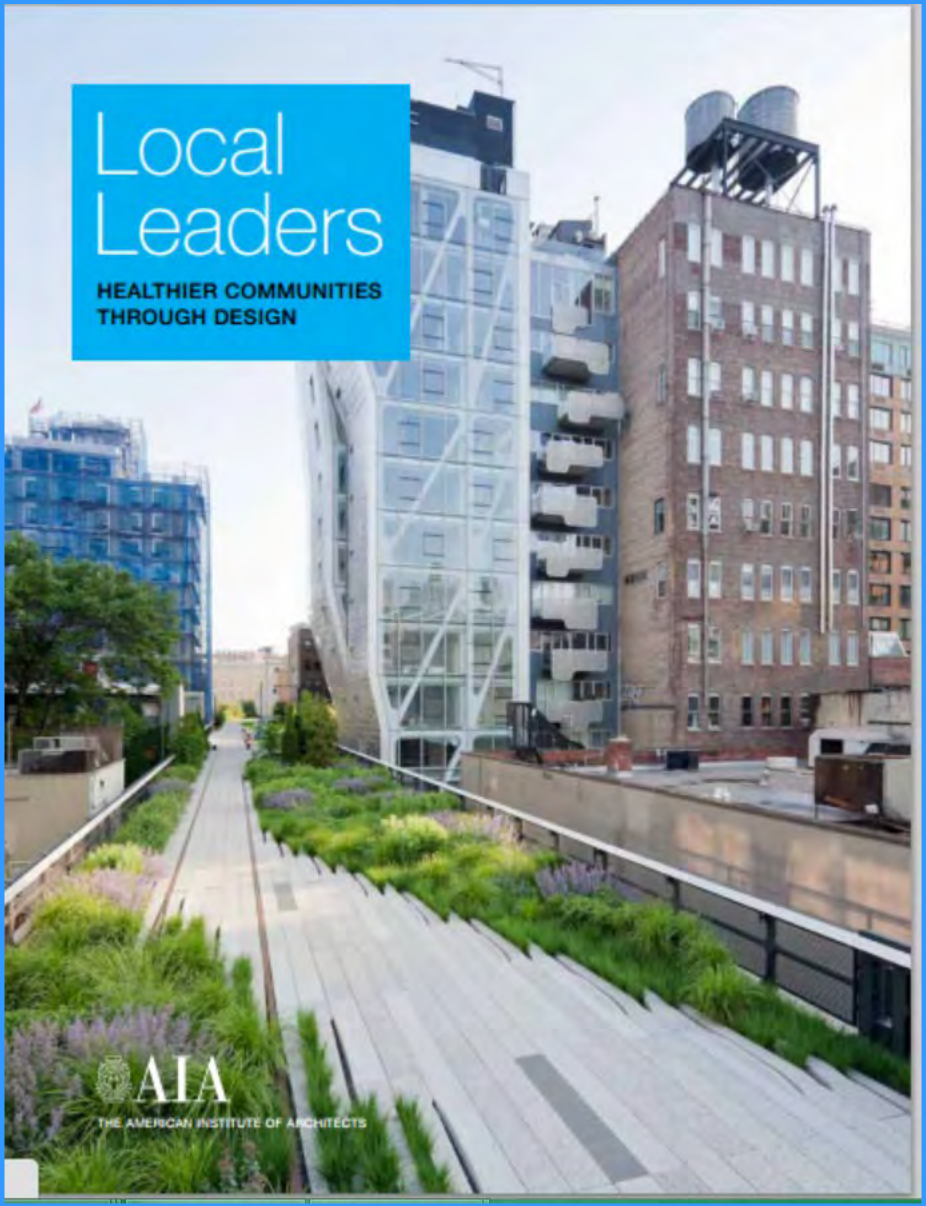
More than 56% of home buyers want a home that is a walkable neighborhood with as little need for driving as possible.

- Ciclavia Los Angeles April 2012

Indianapolis Cultural Trail

Importance of Art and Beauty and Nature

- 8 miles $69 million
- First $15 million from Glick family (start with philanthropy)
- $2 million for Art
- Links the city together
- Revitalized Business
- Helps to Recruit and Retain Top Talent
- And, yes, a GOP Mayor



- Importance of Courage– The NYC High Line

- AIA Report:

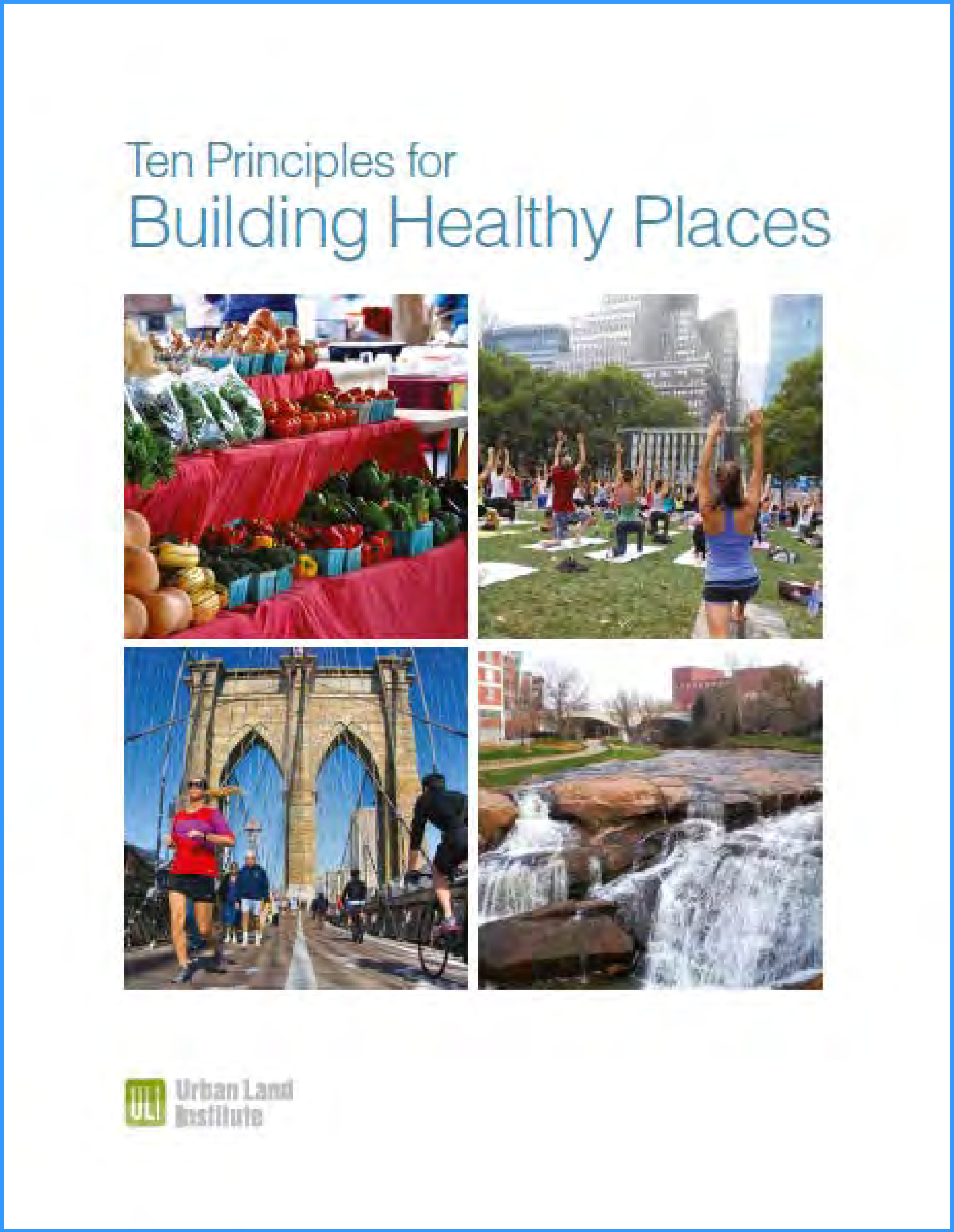
Local Leaders—

Healthier Communities Through Design

2013

Ten Principles for Building Healthy Places

The Urban Land Institute 2013

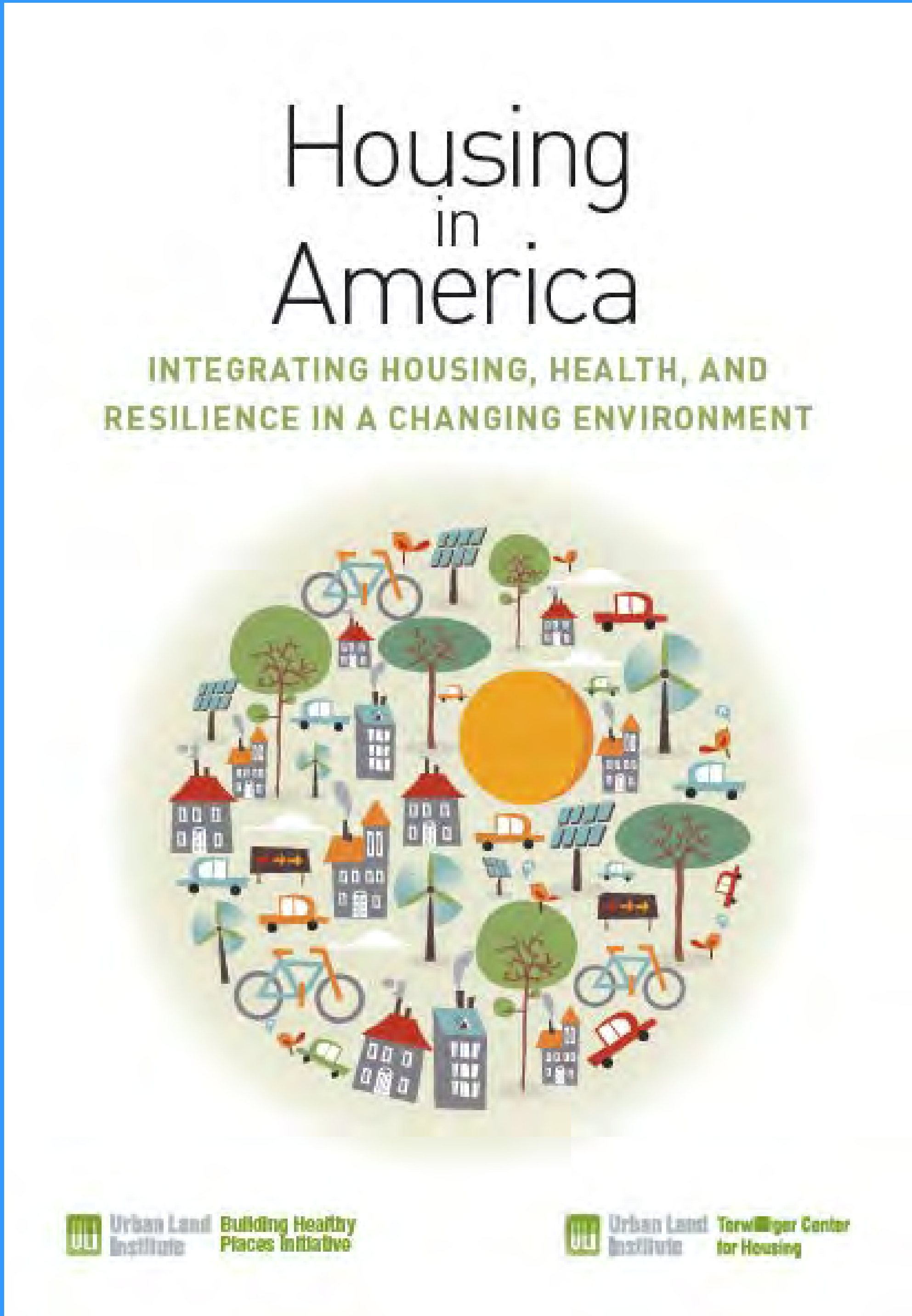


Ten Principles for Building Healthy Places

1. **Put People First**
2. **Recognize the Economic Value**
3. **Empower Champions for Health**
4. **Energize Shared Spaces**
5. **Make Healthy Choices Easy**
6. **Ensure Equitable Access**
7. **Mix It Up**
8. **Embrace Unique Character**
9. **Promote Access to Healthy Food**
10. **Make It Active**

5 Make Healthy Choices Easy

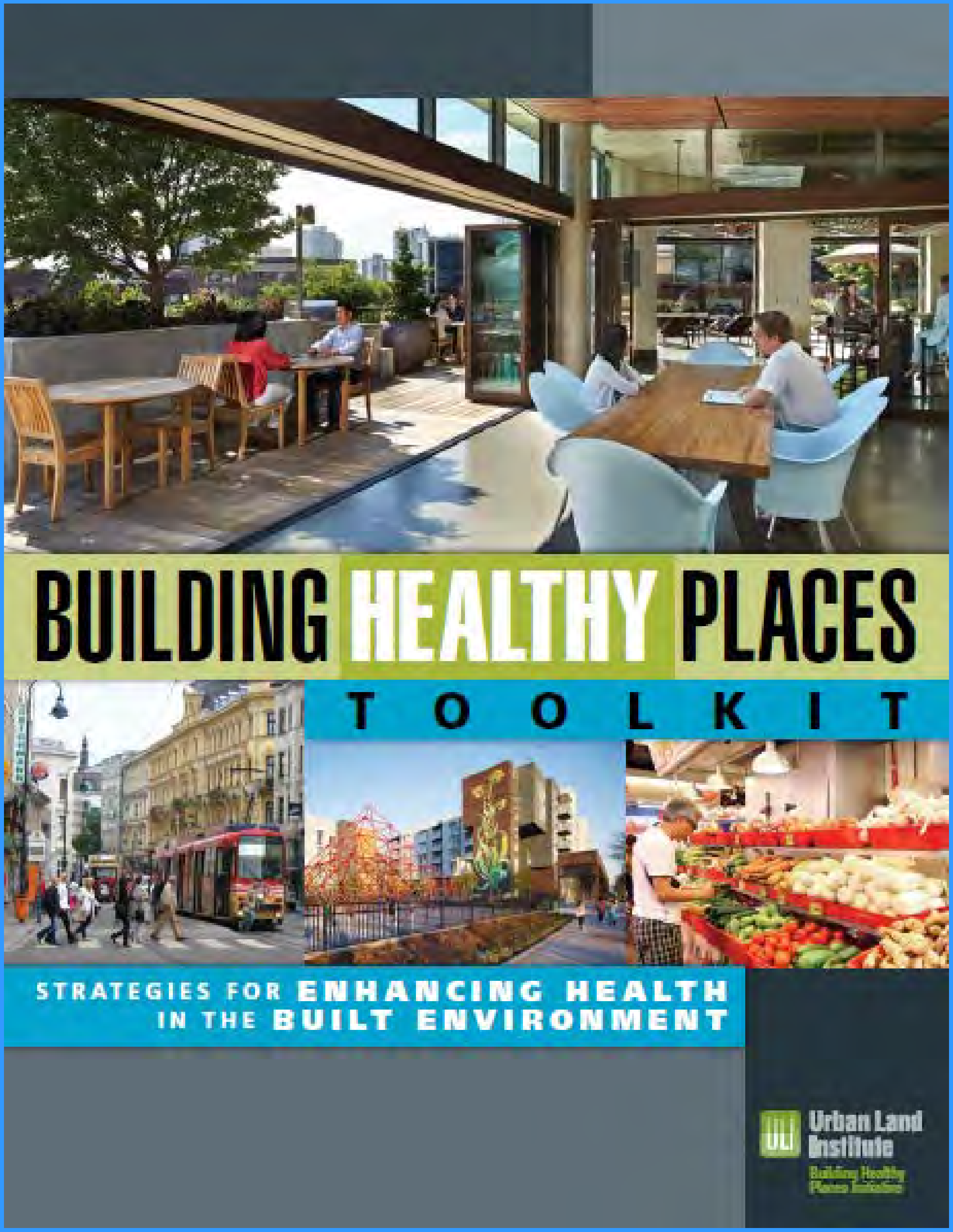
Communities should make the healthy choice the one that is SAFE—safe, accessible, fun, and easy.



Housing in America
-- ULI --

August, 2014

Integrating Housing, Health, and Resilience in a Changing Environment



Urban Land Institute's *Healthy Places Toolkit*

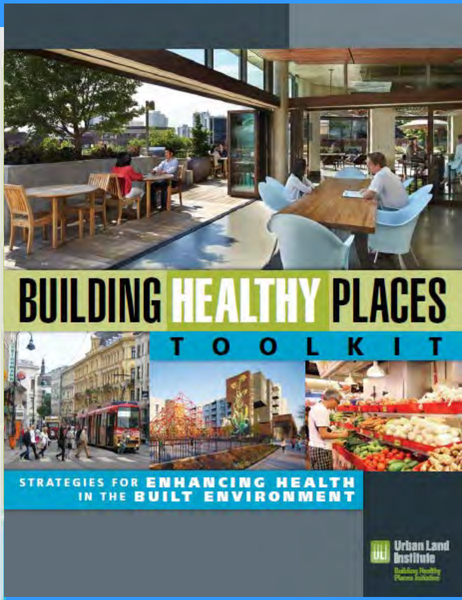
To be released at International Meeting in Paris February 5, 2015

http://www.uli.org/toolkit

http://www.uli.org/toolkit

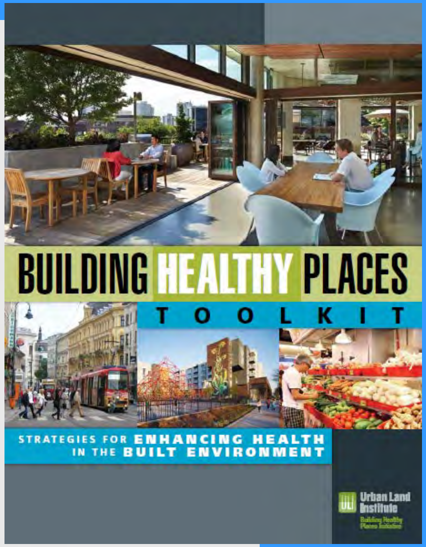
Evidence-Based Recommendations

1. Incorporate a mix of land uses
2. Design well-connected street networks at the human scale
3. Provide sidewalks and enticing, pedestrian-oriented streetscapes
4. Provide infrastructure to support biking
5. Design visible, enticing stairs to encourage everyday use
6. Install stair prompts and signage
7. Provide high-quality spaces for multigenerational play and recreation
8. Build play spaces for children



http://www.uli.org/toolkit

Evidence-Based Recommendations



- **9** Accommodate a grocery store
- **10** Host a farmers market
- **11** Promote healthy food retail
- **12** Support on-site gardening and farming
- **13** Enhance access to drinking water
- **14** Ban smoking
- **15** Use materials and products that support healthy indoor air quality
- **16** Facilitate proper ventilation and airflow
- **17** Maximize indoor lighting quality
- **18** Minimize noise pollution
- **19** Increase access to nature
- **20** Facilitate social engagement
- **21** Adopt pet-friendly policies

http://www.uli.org/toolkit

Richard J Jackson MD
dickjackson@ucla.edu

Sustainable Road Design And Multimodal Roads

Presented by: Sheina Hughes

May 21, 2015

Roadways – more than just mobility

- **Perspectives from a former City Engineer**
- **LEED for Buildings made a Public Agency change its approach**
- **Envision for Roadways**

Stantec

Beyond ‘Business as Usual’

US Federal Highway Administration defines sustainable roadways as those that:

- Consider life cycle costs
- Reduce consumption of natural resources
- Enhance the natural environment
- Provide access to all people and goods
- Provide transportation choices
- Promote safety and raise comfort for walking, cycling, and transit

Recognition that technical design excellence alone is not enough to guarantee an optimal end result

Stantec

What does a sustainable road look like?

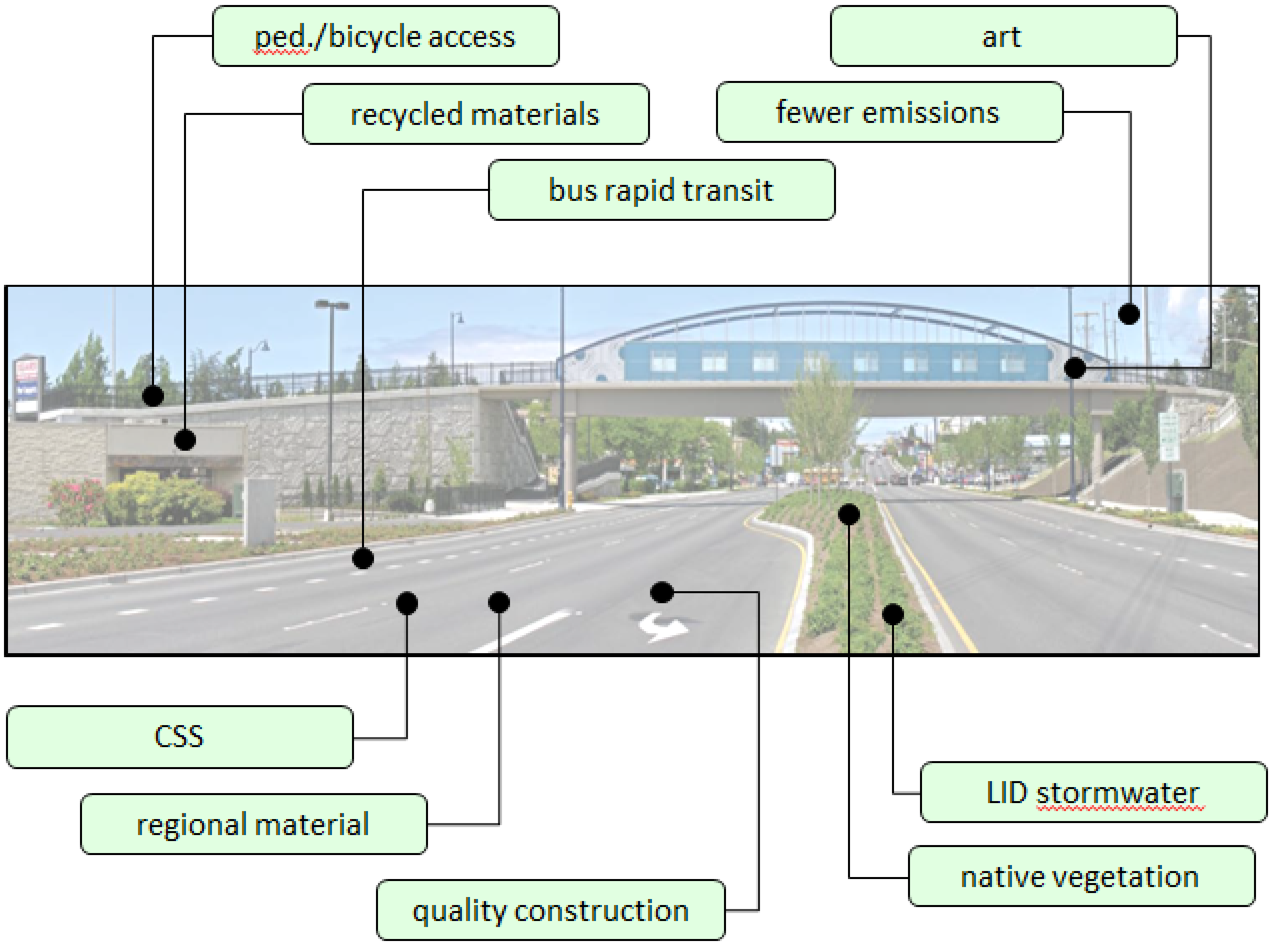


Image courtesy of the Greenroads Foundation

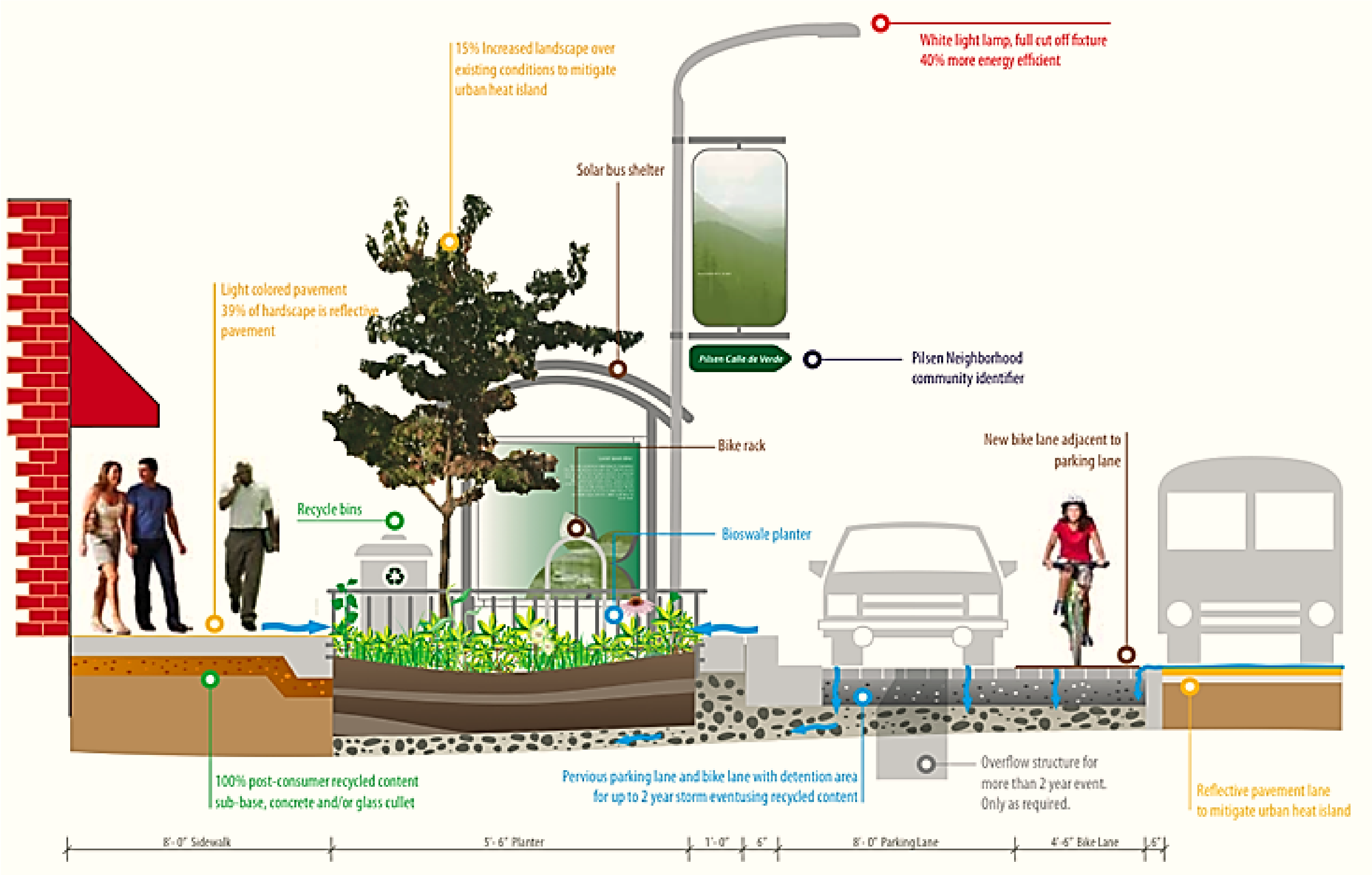
‘Complete Streets’

A set of design principles for transportation planning intended to:

- Provide travel options for all users in a safe and accessible manner
- Forma network that allows for efficient and high quality travel experiences
- Be adaptable to accommodate present and future needs
- Contribute to environmental sustainability and resiliency
- Consider life cycle costs

-taken from City of Edmonton *Complete Streets Guidelines*

What does a sustainable road look like?



Cermak Road – Chicago, IL

Stantec

Rating Sustainability

- **Ratings frameworks and systems can benefit the design process in the following ways by:**
    1. Providing best practice guidance
    2. As a platform for considering design alternatives
    3. As a communications and stakeholder engagement tool
    4. As a method for verifying performance

Stantec

Rating Sustainability

- **Many transportation-specific tools available to assist with technical design:**

GreenLITES
Evergreen

New York State DOT

I-LAST™

Illinois State DOT

INVEST
ECONOMIC • SOCIAL • ENVIRONMENTAL

US Federal Highway Administration

Greenroads

Greenroads Foundation

PEACH Roads
Preserving Environment And Community Heritage

Cobb County, GA

Rating Sustainability

What about situations where issues beyond transportation-related challenges need to be considered?

ENVISION™

Introducing Envision™

Stantec

Introducing Envision™

Envision™ provides a holistic framework for planning, evaluating and rating the community, environmental, and economic benefits of all types and sizes of infrastructure projects. It gives recognition to infrastructure projects that use transformational and collaborative approaches to assessing sustainable performance over the course of a project's life cycle.

- Institute for Sustainable Infrastructure

A Joint Collaboration

INSTITUTE FOR SUSTAINABLE INFRASTRUCTURE

ISI

ZOFNASS PROGRAM FOR SUSTAINABLE INFRASTRUCTURE

Graduate School of Design
Harvard University

ISI Founding Organizations

AMERICAN PUBLIC WORKS ASSOCIATION
APWA
Your Comprehensive Public Works Resource

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

ACEC
American Council of Engineering Companies
100 Years of Excellence

The Envision™ Framework

In a nutshell:

- **Think LEED®** (for buildings), only **enhanced** and more **broadly applicable**, more **flexible**, more **adaptable**, more focused on **community priorities** and a project's **lifecycle**
- From planning and design framework to validation and recognition
- Uses outcome-based objectives (with the goal of no net impact or restorative performance)
- **55 credits (plus 5 innovation) across 5 categories**

Stantec

The Envision™ Framework

Envision™ can add value to design through:

- Helping to determine the **right** project to pursue
- Consideration of the **full project lifecycle**
- **Incorporating stakeholder needs** and concerns
- **Facilitating integration** with existing assets & networks
- **Identifying synergies** and cost efficiencies

THE ENVISION™ RATING SYSTEM

Stantec

Envision addresses the ***public*** side of infrastructure

- Infrastructure is a public asset not a private commodity
- No single responsible entity
- Multiple stakeholders with different agendas, schedules, customers
- Taxpayer funding predominates
- Integration is essential for achieving optimal performance across the entire infrastructure network

Stantec

Relationship to other standards

- Envision is not intended to supplant existing, sector-specific infrastructure rating systems
- Envision draws on niche standards to create a consolidated standard for ALL infrastructure in North America

THE ENVISION RATING SYSTEM


A Practical Example
Low Level Road
North Vancouver, Canada

Low Level Road

- Stantec worked with Port Metro Vancouver and the City of North Vancouver as Prime Design Consultant on the realignment of 2.2 km of rail tracks and a major east-west artery known as the Low Level Road
- This roadway and rail represents a vital transportation link that enables the Port to move cargo in and out of its facilities, and required expansion to meet projected increases in demand
- Expansion and realignment of the Low Level Road was constrained by limited space, steep slopes, and the close proximity of local residential homes and parkland in a heavily urbanized area
- Development was also complicated by significant geotechnical risks (including landslides and earthquakes)

Key project aspects:

- ✓ Extensive stakeholder engagement
- ✓ Minimization of noise/lighting impacts
- ✓ Expansion of pedestrian and cyclist networks
- ✓ Slope stabilization
- ✓ Preservation of Bald Eagle habitat

Stantec

Project Challenges

Increased rail traffic to Port facilities outstripped existing rail infrastructure

Roadway bordered by private residences immediately to the north with significant concerns around lighting/noise

Endangered Bald eagles maintained nests on the project site

The City desired to expand cycling networks to enable connection with transit facilities

Project site presented an opportunity for linking existing trailways and green spaces known as the Spirit Trail

Site lies in an earthquake fault zone and was determined to have unstable slopes and suffered from rockfalls onto road surface

Stantec

What we did

- Eliminated three at-grade rail crossings
- Stabilized slopes with tiered retaining walls
- Raised roadway above projected 200 year flood levels
- Mitigated environmental damage through off-site remediation, preservation, and installation of artificial eagle nesting poles
- Expanded pedestrian/cyclist access and reconfigured lanes
- Installed noise walls to reduce impact on local residents
- Engaged extensively with local community, First Nations, and stakeholders
- Eliminated invasive species on site and planted native species
- Selected high efficiency LED streetlights
- Incorporated work by local artists and vegetated retaining walls to raise aesthetic value

Noise walls

Vegetated walls and public art

Overpass

Expanded rail track network

Moodyville Park

Stabilized retaining walls

Spirit Trail & pedestrian overpass

Diverging diamond intersection

All images courtesy of PMV

Stantec

Low Level Road & Envision

- Project currently undergoing Envision certification process, targeting highest level of achievement (Platinum)
- First transportation-based project to undergo certification
- This project will serve as a case study for sustainable roadway design at Stantec

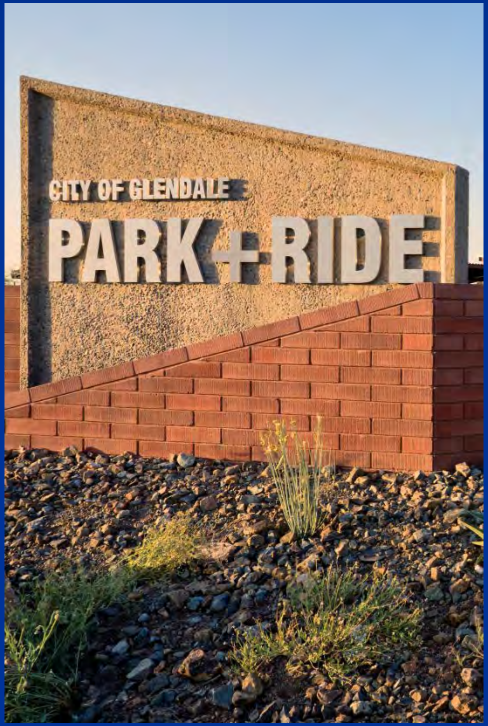
Stantec

Envision For Roadways

- Takes the focus from a department and brings all the stakeholders together
- Provides an approach to allow all stakeholder a voice
- Balances the playing field for all users and stakeholders

Stantec

Border Green Infrastructure Forum May 2015 Park and Ride Facility – Glendale AZ

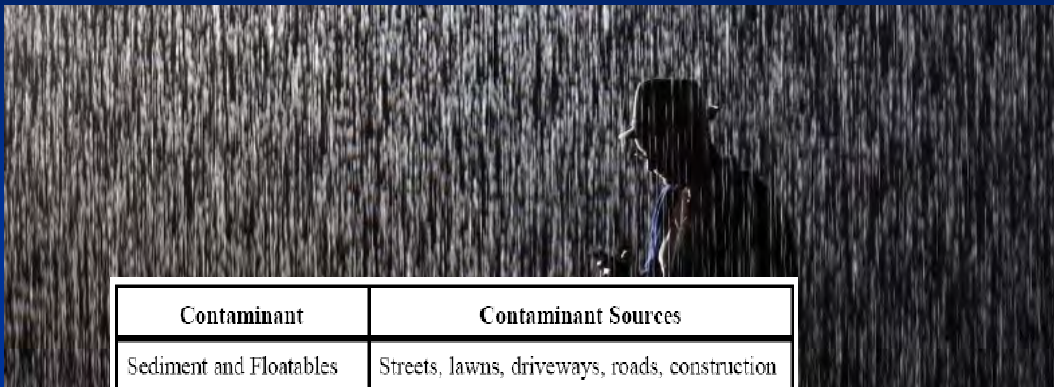


Overview

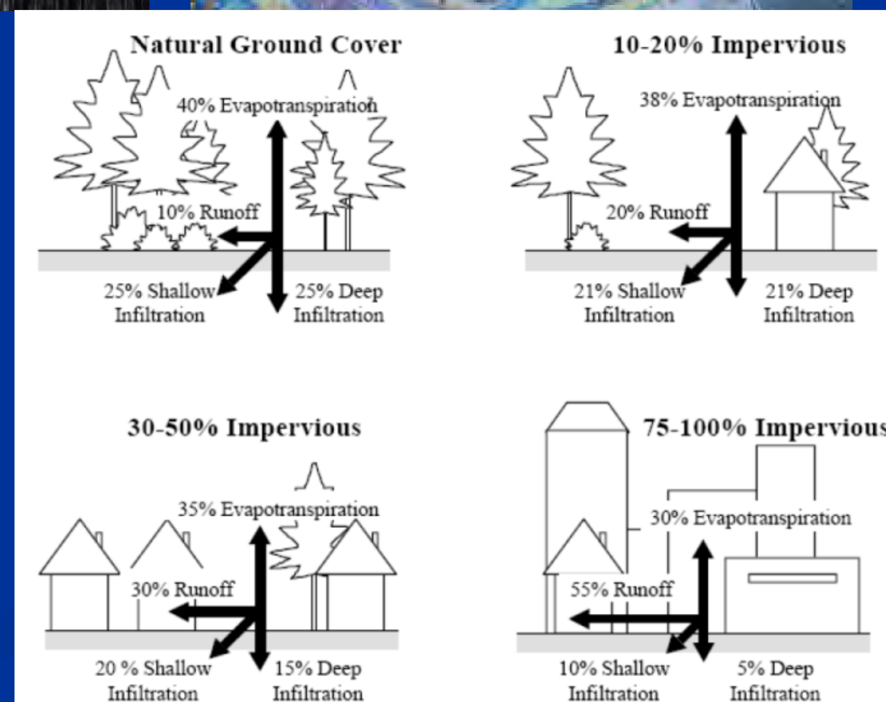
- ✓ Stormwater
- ✓ LID / "Green" infrastructure
- ✓ Pavements and pavement alternatives
- ✓ Pervious project history (Engineering perspective)
- ✓ Project performance

Stormwater "make-up" & runoff

REMEMBER – stormwater is not treated (MS4)



Contaminant	Contaminant Sources
Sediment and Floatables	Streets, lawns, driveways, roads, construction activities, atmospheric deposition, drainage channel erosion
Pesticides and Herbicides	Residential lawns and gardens, roadsides, utility right-of-ways, commercial and industrial landscaped areas, soil wash-off
Organic Materials	Residential lawns and gardens, commercial landscaping, animal wastes
Metals	Automobiles, bridges, atmospheric deposition, industrial areas, soil erosion, corroding metal surfaces, combustion processes
Oil and Grease/ Hydrocarbons	Roads, driveways, parking lots, vehicle maintenance areas, gas stations, illicit dumping to storm drains
Bacteria and Viruses	Lawns, roads, leaky sanitary sewer lines, sanitary sewer cross-connections, animal waste, septic systems
Nitrogen and Phosphorus	Lawn fertilizers, atmospheric deposition, automobile exhaust, soil erosion, animal waste, detergents



How much water are we talking about?

- 7200ciA where C controls the amount !!!
  - 1 Acre impervious (surface) yields 74,200 gallons (C=0.95)
  - Park and Ride = 240,000 gallons for a 100 year event.
  - Retention requirements of property owners (cities too)
    - Most expensive part of development – land / development
    - Basins use up valuable land – why not eliminate?
    - What to do with all that water?

Low Impact Design (LID)

- LID - approach to work with nature to manage stormwater as close to its source as possible
  - Try to recreate natural features (parking lot?) to ***treat stormwater BEFORE it leaves the site***
  - Minimizing imperviousness or "pass thru" stormwater. Actually USES stormwater as a ***resource*** rather than a waste product

LID "Toolkits" from an Engineers Perspective

- LID is a requirement of NPDES permit (AZ)
  - City of Glendale / City of Mesa LID toolkit
- In use, must assume capacity of system will be exceed for all swales, basins, curb cuts, bio retention!
- In arid SW, still requires additional water sources such as irrigation
- Maintenance of LID item (ROW / Private?)
- Engineer – function is most important!
  - Flow control, detention, retention, filtration, infiltration, treatment – DUST WILL accumulate !!!!

Surface types

Flexible pavements – asphalt (HMA)
Rigid Pavements – concrete (PCCP)
Surface treatments – additives / emulsions

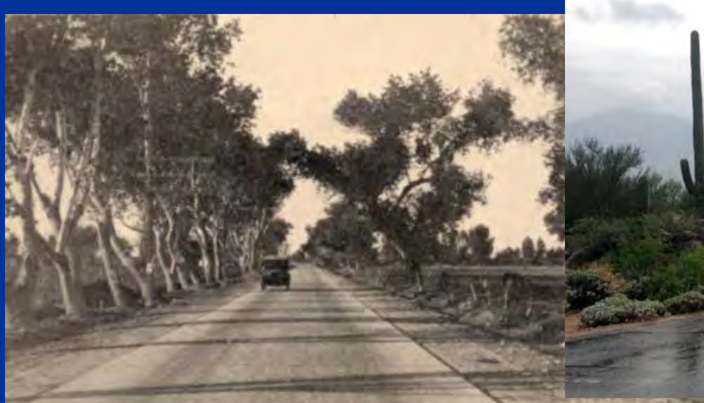
ALL

Lead to higher peak flows (Q's) – sheet flows

Reduce or substantially inhibit infiltration

Lead to potentially unfiltered and contaminated stormwater runoff

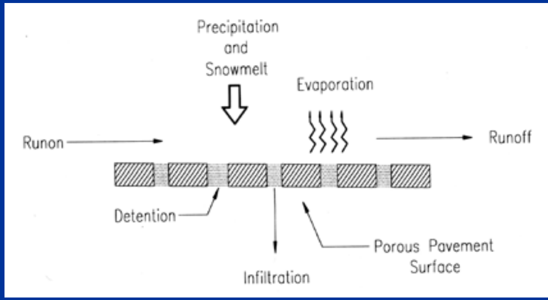
Increase pollutant loads on streams / washes / "Waters of the US & Mexico"

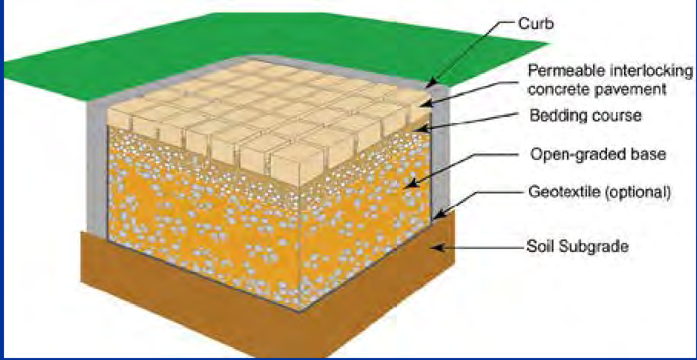


What to do? - Open jointed pavers & geogrids

"Permeable" pavements – allow water to pass around

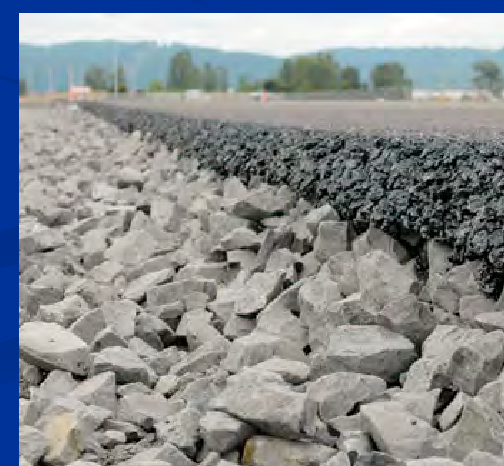
- Initial infiltration rates reduced less
- Urban heat island effect reduced / mitigated
- LEED's credit (Leadership in Energy and Environmental Design)
- Mechanically installed – no cure time!





What else do to?

Pervious (porous) concrete / ~~asphalt~~ – allow water to pass thru…



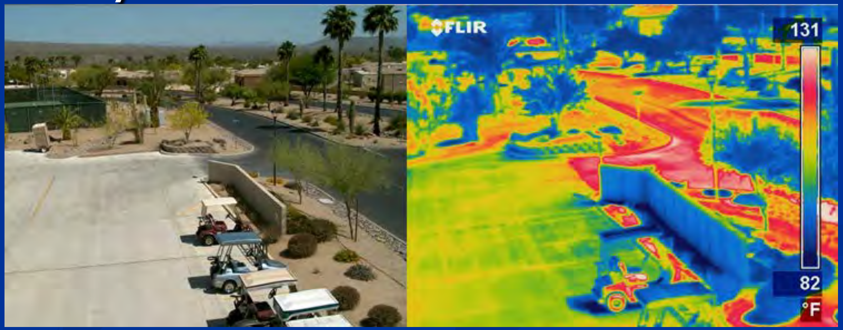
Park and ride Design concept

ORIGINAL concept

- Hot mix asphalt (HMA) on aggregate base course (ABC) for site
- Standard shade canopies for parking stalls

RE-EVALUATED concept (Council input / direction)

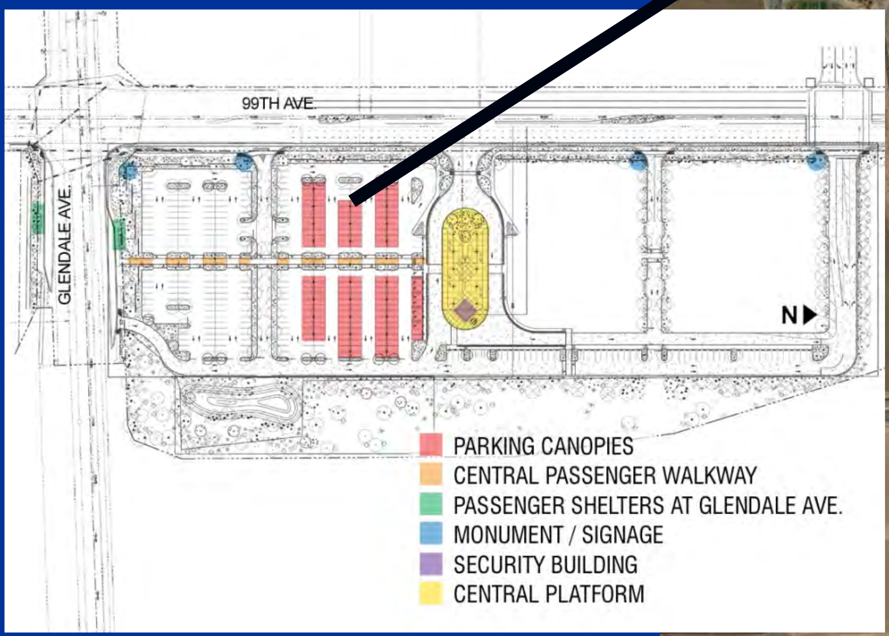
- **Gravel Pave / Grass-pave / Geogrids / Pavers– ruled out for striping / use / consistency**
- **Upgraded shade canopies**
- **Pervious Concrete**
  - Presented by Jacobs Engineering
  - Dr. Kamil E. Kaloush, PhD – ASU
    - Attributes
      - Not structurally sufficient – ONLY parking
      - Mitigates heat island effect
      - Size down or eliminate basins (0.95 to 0.3 -)
      - Hydrocarbon remediation (97.6% to 99%)
        - Large surface area + food for bacteria etc.
        - Air degrades as well



Glendale Avenue Park and Ride

12 Acres - NE corner of 99th Avenue and Glendale

388 spaces (Phase 1) + 254 (Phase 2) = 642 at build-out



City Engineering concerns

- Cost$ (think benefits too!)
  - HMA - $693,570 (20 yr. = $844,962)`
  - Pervious - $916,460 (20yr. = $844,070)
  - Difference - $222,890 (20 yr. = $892)
    - Crack seal, slurry, striping, overlay, mill / overlay / oxidation
- Primarily used in non-arid climates
  - Arizona dust storms + “no rain” = pore clogging
  - Installation during HOT summer months
  - Increased Maintenance costs, long term durability
  - Subsurface drainage / Developing specifications / Testing
    - Site characteristics, no arid specs. / compression & materials testing, surface spalling

More thinking
Acceptance / acceptance testing – (all LID)
"Non-conventional" sampling techniques

- NRMCA (8 hour course) – City and consultants attended !
- Mix Temperature <95F (<90F), voids by volumetric unit weight - truck batch weights
- 28 day compressive strength / thickness, unit weight / voids
- Thickness investigated if >0.25in. MAG Specifications govern for removal-initially cored 14d samples for unit weights & thickness

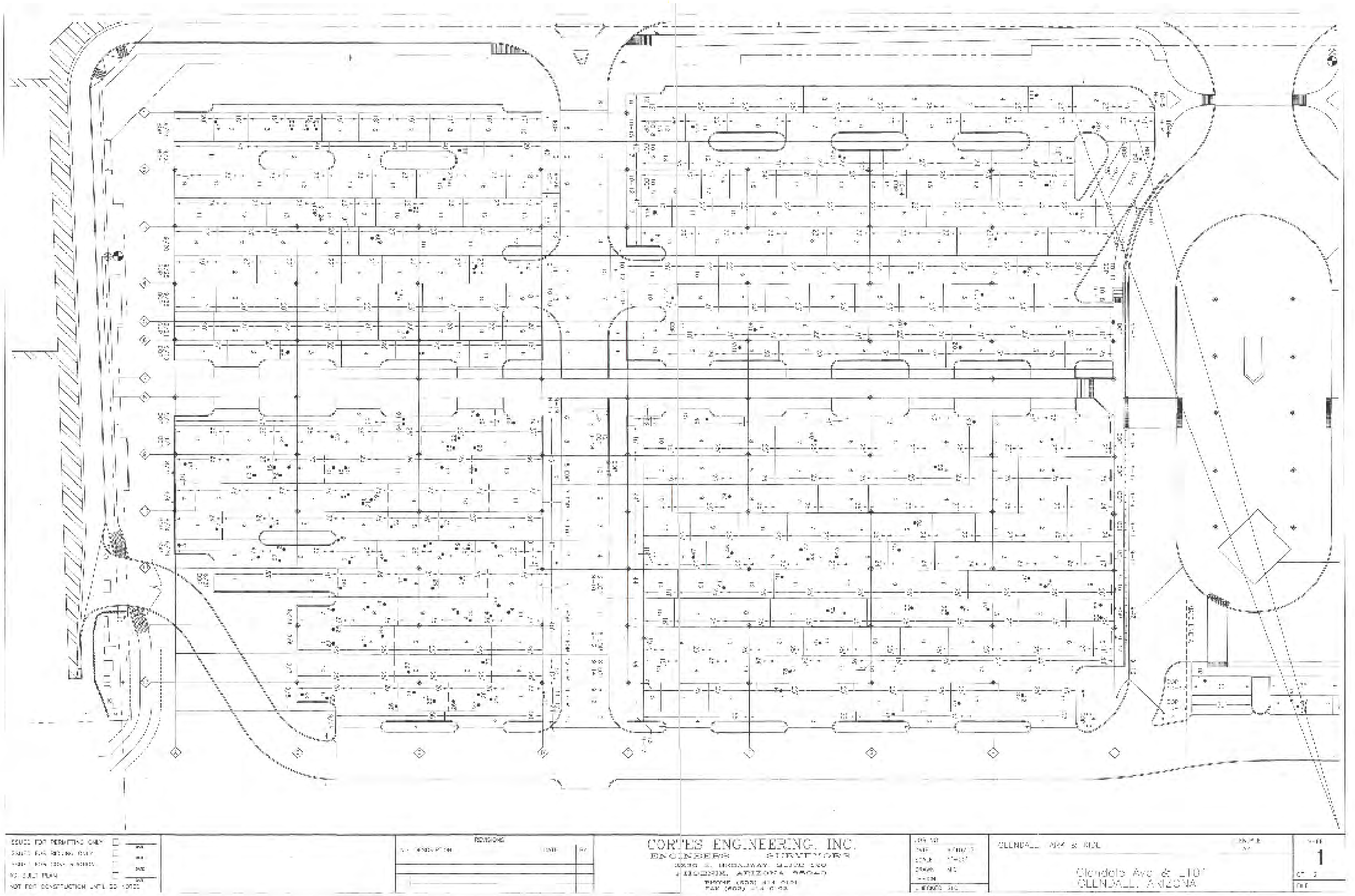
Initial placement – August 2007

(110 degrees +/-)

Continued placement thru October

Project acceptance – March 2008

Quality Assurance



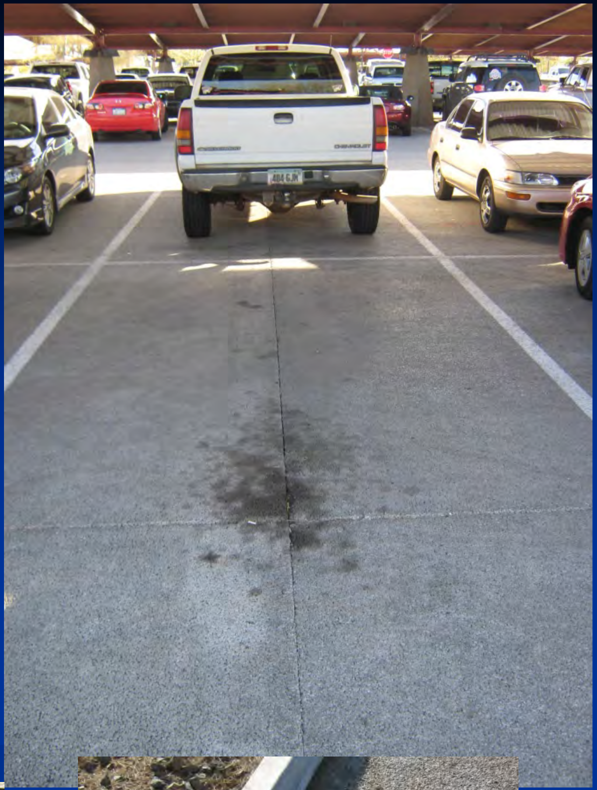
Final data summation

- Average strengths = 1325 psi to 2900 psi = 2174 psi average
- Unit weight = 103.7pcf to 124.5pcf = 115.1 pcf average
- Temperature – 1 load >95F (rejected by contractor)
- Voids= 21.3% to 34.6% Average = 27.3%
- Thickness 6.0” with 5.75” average – need to monitor depth of pavement
- Deficient thickness in about 10-15% of cores (<5.5”) – differing opinions on thickness measurement – NEED TO MONITOR PLACEMENT @ QC – not acceptance (too late)

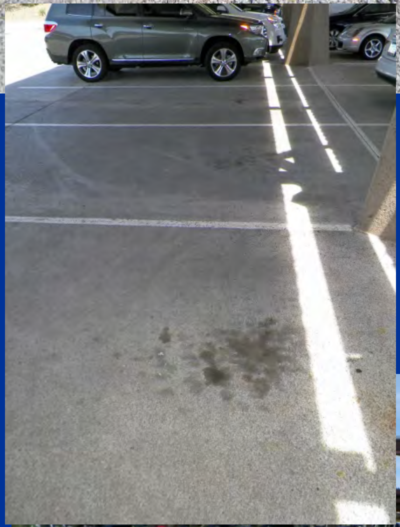
DID / DOES / WILL IT WORK?

April 2010 (25 months old – 2 yr. +)

January 2013 (58 months old - < 5 yrs.)



April 2015 (86 months old – 7 yrs. +)

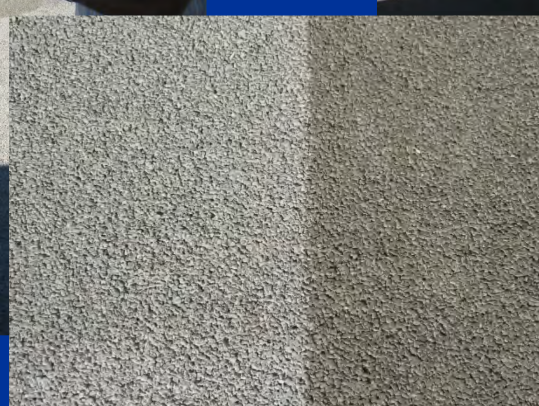



Challenges expected?

- Surface spalling?
- Crack propagation?
- Differential settlement
- Joint expansion
- Void structure durability

Maintenance

- Flush 4 times / yr. using water truck (remote)
- Inspect joints for cracks / debris
- Personal involvement
- Past maintenance
  - March 2012 (48mos)



Total Seconds for Test	Total Inches Per Hour Test 8 lbs
91	77.5
53.6	131.5
	69.8%
38.8	181.7
36.9	191.0
	5.1%
59.4	118.7
51.2	137.7
	16.0%

Comparative uses / removals

BMP Type	Typical Pollutant Removal (percent)				
	Suspended Solids	Nitrogen	Phosphorus	Pathogens	Metals
Dry Detention Basins	30 - 65	15 - 45	15 - 45	< 30	15 - 45
Retention Basins	50 - 80	30 - 65	30 - 65	< 30	50 - 80
Constructed Wetlands	50 - 80	< 30	15 - 45	< 30	50 - 80
Infiltration Basins	50 - 80	50 - 80	50 - 80	65 - 100	50 - 80
Infiltration Trenches/ Dry Wells	50 - 80	50 - 80	15 - 45	65 - 100	50 - 80
Porous Pavement	65 - 100	65 - 100	30 - 65	65 - 100	65 - 100
Grassed Swales	30 - 65	15 - 45	15 - 45	< 30	15 - 45
Vegetated Filter Strips	50 - 80	50 - 80	50 - 80	< 30	30 - 65
Surface Sand Filters	50 - 80	< 30	50 - 80	< 30	50 - 80
Other Media Filters	65 - 100	15 - 45	< 30	< 30	50 - 80

Other projects in AZ?

- ASU Arts Building parking lot 2007
- NAU – Engineering building 2006
  - Failed – freeze / thaw (not in Southern AZ)
- Glendale Park and Ride 2008
- Superlite Block Facility
- Phoenix Cement Terminal

Pervious references

- Dr. Kamil Kaloush, PhD., P.E. – ASU Smart Technology Center
- Ken Ricker of RAMM Engineering – Specs. & Testing
- Mark Wavering / Pam Iacovo – Jacobs
- Mike Riggs (Owner) Progressive Concrete Works Inc. – Placement Contractor ***Pervious Concrete You tube video***
- ASU National Center of Excellence "Pervious Concrete: Questions Answered" January 17, 2007 - Whitepaper
- National Redi-Mix Concrete Association (NRMCA)- Pervious Certification Course

Final closing comments

- Park and Ride has exceeded our expectations at the 7 year mark
  - Maintenance will be ongoing BUT surface is remarkably "new"
  - Use is at about 70-80%
  - Consideration for new Park / Ride in North Glendale – adjacent to the new river
  - LID Private is being integrated but for retention (require?)
  - LID ROW is being "integrated" at a calculated rate
    - Curb cuts, vegetated swales, bio retention – POST Inspections for NPDES

Questions ?????

EXPERIENCIA DE UN DISEÑO DE VIALIDADES EN CÓCORIT, SONORA

SUELOS PERMEABLES, RESPONSABILIDAD SOCIAL, ECOLÓGICA Y AMBIENTAL.

UNA REFLEXIÓN URBANA SOCIAL

FUNDACIÓN TICHI MUÑOZ

E-comunidad

SUELOS URBANOS PERMEABLES

RESPONSABILIDAD SOCIAL, ECOLÓGICA Y AMBIENTAL.

CONTENIDO

SUELOS URBANOS PERMEABLES

1. MANEJO INTEGRAL DEL AGUA EN MÉXICO
    1. CONFORMACIÓN DEL MANTO HIDRICO
    2. PROBLEMÁTICA QUE SE ENFRENTA
    3. RECARGA DEL ACUÍFERO
    4. LEGISLACIÓN PARA LA RECARGA ARTIFICIAL DE ACUIFEROS
2. POZOS DE ABSORCIÓN
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    2. FUNCIONAMIENTO
    3. VENTAJAS E INCONVENIENCIAS
3. DESCRIPCIÓN EL PROYECTO COCOREÑO
    1. CONTEXTO HISTORICO ETNOLÓGICO
    2. ADMINISTRACIÓN DEL AGUA EN LA REGIÓN. DISTRITO DE RIEGO DEL VALLE DEL YAQUI
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            2. COSECHA DE AGUA EN LUGARES PÚBLICOS
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5. RETROSPECTIVA DE SUELOS PERMEABLES EN MÉXICO

1

SUELOS URBANOS PERMEABLES

MANEJO INTEGRAL DEL AGUA EN MÉXICO

EXPERIENCIA DE UN DISEÑO DE VIALIDADES EN CÓCORIT, SONORA

MANEJO INTEGRAL DEL AGUA EN MÉXICO

CONFORMACIÓN DEL MANTO HÍDRICO

1

CONAGUA ha definido 731 cuencas hidrológicas en México con propósitos de administración de las aguas Nacionales

MANEJO INTEGRAL DEL AGUA EN MÉXICO

PROBLEMÁTICA QUE SE ENFRENTA

1

México es un país que recibe en promedio un alto volumen de agua de lluvia 1,489 miles de millones de m³ (760 mm) al año.

Sin embargo, de este volumen **tan sólo el 4.7% se infiltra en el subsuelo** y recarga los acuíferos.

DISPONIBILIDAD DE AGUA DE LLUVIA Y RECARGA, DE ACUERDO A REGIÓN HIDROLÓGICA			
REGIÓN HIDROLÓGICA	POBLACIÓN (Mill. de habitantes)	PRECIPITACIÓN ANUAL (mm)	RECARGA MEDIA TOTAL (hm³/año)
1-Península de Baja California	3.78	169	1,300
2- Noroeste	2.62	445	3,426
3- Pacífico Norte	3.96	747	3,267
4- Balsas	10.62	963	4,623
5-Pacífico Sur	4.13	1,187	2,024
6- Río Bravo	10.98	438	5,306
7- Cuencas Centrales del Norte	4.19	430	2,392
8-Lerma-Santiago-Pacífico	20.97	816	8,102
9- Golfo Norte	4.97	914	1,338
10- Golfo Centro	9.65	1,558	4,260
11- Frontera Sur	6.62	1,846	18,015
12-Península de Yucatán	4.06	1,218	25,316
13 - Aguas del Valle de México	21.42	606	2,339

Se extrae del acuífero en todos los casos más agua de la que naturalmente se recarga (y cada vez menos). Por lo que **El manto freático disminuye cada vez más su nivel.**

Se extraen en promedio en México **59.6m3 por segundo**, pero solo es **posible recargar 31.6m3**, con el escaso porcentaje de agua de lluvia que se aprovecha y el que se trata en las plantas respectivas

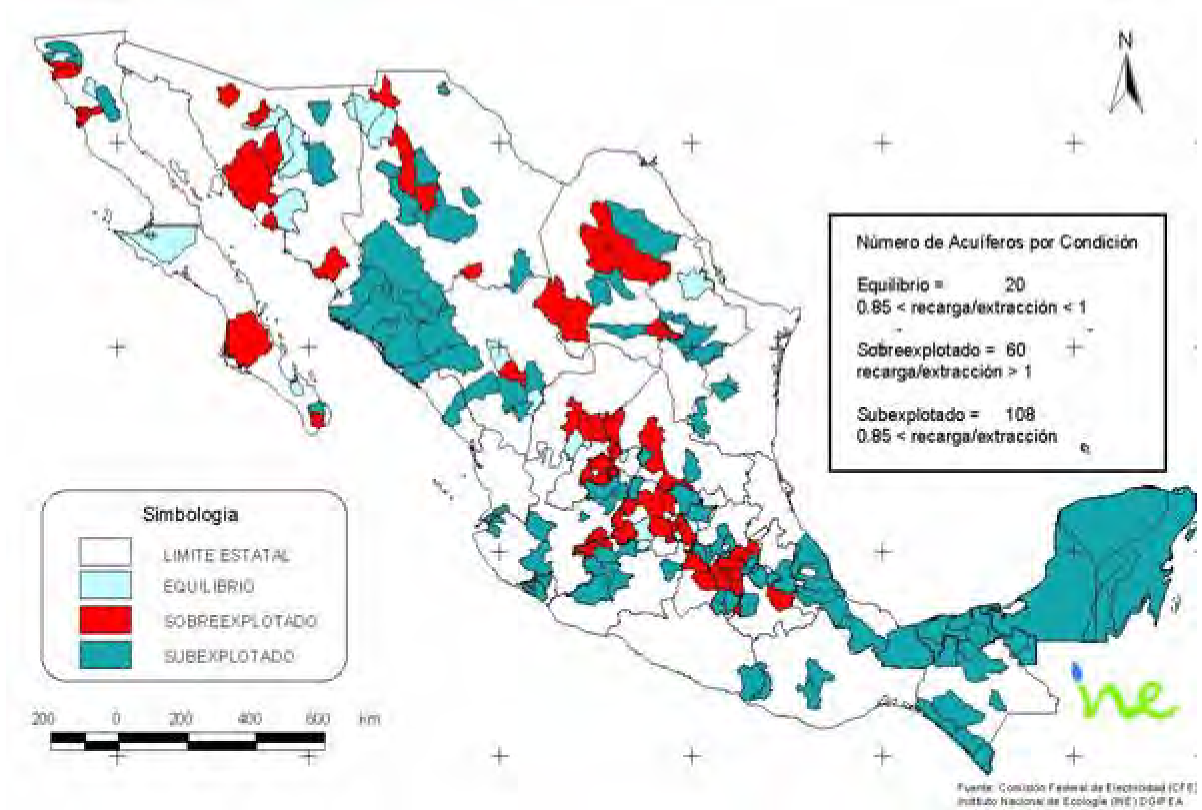
Para la gestión de las aguas subterráneas, se han definido 653 acuíferos

- Suministran el **50% de las demandas de agua industrial**
- Cerca del **70% del volumen de agua urbana**, donde se concentran 70 millones de habitantes

MANEJO INTEGRAL DEL AGUA EN MÉXICO

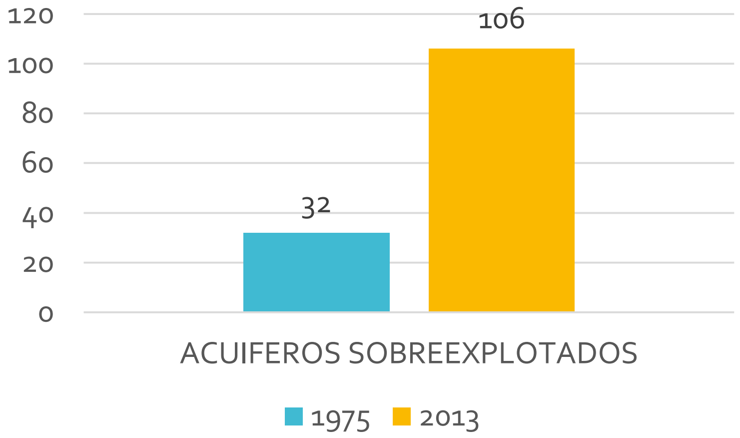
PROBLEMÁTICA QUE SE ENFRENTA

1



La sobre explotación de los acuíferos en México es cada año más alarmante:

De los 653 106 son sobreexplotados
De ellos se extrae el 58% del agua subterránea



MANEJO INTEGRAL DEL AGUA EN MÉXICO

RECARGA DEL ACUÍFERO EN MÉXICO

1

GESTIÓN DE LA RECARGA ARTIFICIAL DE ACUÍFEROS EN MÉXICO (MAR)

Gestión hídrica económica de gran efectividad en las grandes obras hidráulicas

NATURAL

- Entrada de agua ala zona saturada procedente de la superficie de terreno, asociada al flujo descendente de las aguas hacia la zona saturada

INCIDENTAL

- Produce aportaciones al acuífero de manera no intencional: fugas, conducciones o fosas sépticas, retornos de riego, etc.
- En muchos casos representa un impacto negativo para los acuíferos (Bouwer, 1999)

ARTIFICIAL

- Conjunto de técnicas que permiten una mejor explotación de los acuíferos por aumento de sus recursos y creación de reservas, mediante una intervención directa o indirecta en el ciclo natural del agua (Freeze and Cherry, 1979)

La recarga artificial de acuíferos "Consiste en **disponer agua superficial** en balsas, surcos, zanjas o cualquier otro dispositivo, **desde donde se infiltra y alcanza el acuífero"** (Bouwer, 2002)

RECARGA ARTIFICIAL DE ACUÍFEROS

PROCEDIMIENTOS

(IGRAC, 2014)

MANEJO INTEGRAL DEL AGUA EN MÉXICO

RECARGA DEL

ACUÍFERO EN MÉXICO

1

OBJETIVO: Aumentar los recursos hídricos subterráneos disponibles y mejorar la calidad de las aguas.

Solo **11** proyectos registrados
4 operando
7 en gestión

- **INFILTRACIÓN DE AGUA**
  - METODOS DE DISTRIBUCIÓN
    - Lagunas y estanques de infiltración
    - Inundación controlada
    - Zanjas, surcos, canales
    - Recarga incidental por riego
  - INFILTRACIÓN INDUCIDA EN LAS MÁRGENES DE LOS RÍOS
    - Filtración en la margen del río
    - Filtración inter-dunar
  - POZOS, TUNELES Y PERFORACIONES
    - Inyección en pozo profundo
    - Pozo poco profundo/eje/fosa de infiltración
- **TECNICAS PARA INTERCEPTAR EL AGUA**
  - MODIFICACIONES EN CANALES
    - Represas subsuperficiales
    - Estanques de percolación
    - Represas de arena
    - Represas perforadas
  - CAPTACIÓN DE AGUA DE AGUA DE LLUVIA (COSECHA)
    - Tanques, canaletas, cisternas
    - **Pozos de absorción, pozos de infiltración**

MANEJO INTEGRAL DEL AGUA EN MÉXICO

LEGISLACIÓN PARA LA RECARGA DEL ACUÍFERO EN MÉXICO

1

LEGISLACIÓN PARA RECARGA ARTIFICIAL DE ACUÍFEROS

LEY DE AGUAS NACIONALES

- Declara de utilidad pública el restablecimiento de las aguas nacionales, incluida la recarga del acuífero
- Protección, mejoramiento, conservación y restauración de cuencas, acuíferos, cauces, vasos y demás; así como la infiltración natural o artificial de aguas para reabastecer mantos acuíferos
- Saneamiento de cuencas, subcuencas, microcuencas, acuíferos y cuerpos receptores de aguas residuales
- Regulación de cuencas y acuíferos
- Clasificación y elaboración de balances hídricos de cuencas y acuiferos

NOM-014-CONAGUA-2007

Requisitos para la recarga artificial de acuíferos con agua residual tratada

- Información y estudios básicos
- Permiso de CONAGUA
- Calidad del agua tratada

NOM-015-CONAGUA-2007

Infiltración artificial de agua a los acuíferos. Características y especificaciones de las obras y del agua

2

SUELOS URBANOS PERMEABLES

POZOS DE ABSORCIÓN

EXPERIENCIA DE UN DISEÑO DE VIALIDADES EN CÓCORIT, SONORA

POZOS DE ABSORCIÓN

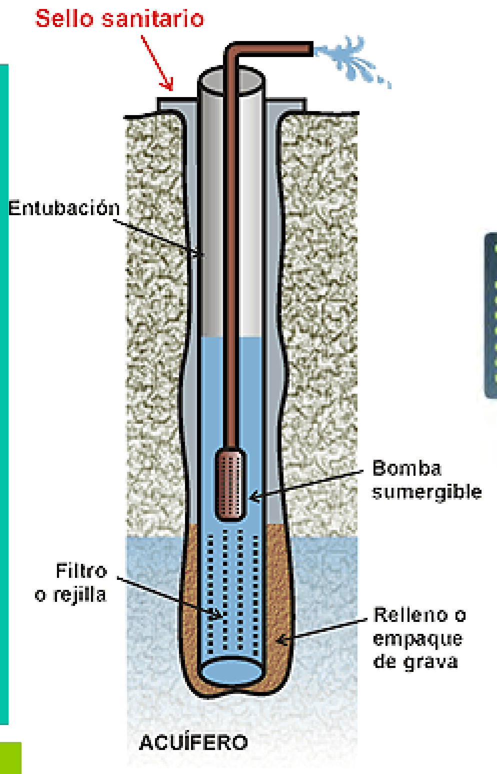
DESCRIPCIÓN

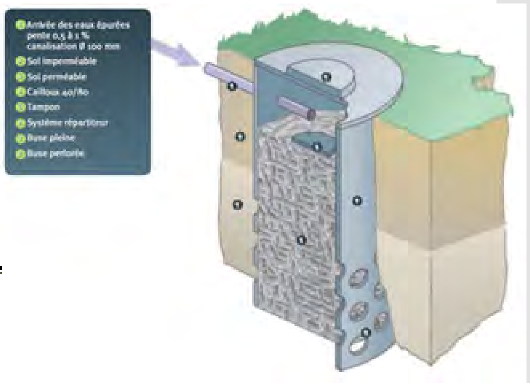
El pozo de absorción es un hoyo excavado en el suelo, que facilita la infiltración del agua hasta el manto freático.

Su construcción puede ser rústica (rellenado con piedras), de mediana complejidad (ubicación de un tubo perforado) o completamente industrializada

OBJETIVO:

HACER LLEGAR DESDE LA SUPERFICIE DONDE SE DESPERDICIA, EL AGUA DE LLUVIA HASTA EL MANTO FREÁTICO, PARA HACER CUMPLIR DE MODO ARTIFICIAL EL CICLO DEL AGUA





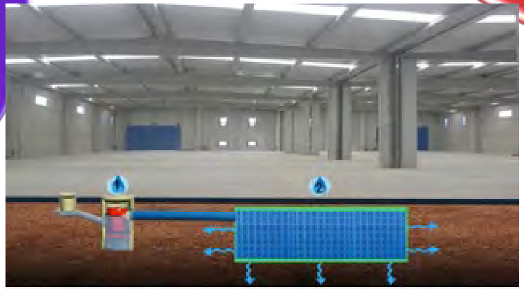
POZOS DE ABSORCIÓN

FUNCIONAMIENTO

2

INFILTRACIÓN PROFUNDA

INFILTRACIÓN SUPERFICIAL



LA INFILTRACIÓN DEPENDE DE:

TIPO DE SUELO

COEFICIENTE DE ESCURRIMIENTO

COEFICIENTE DE INFILTRACIÓN

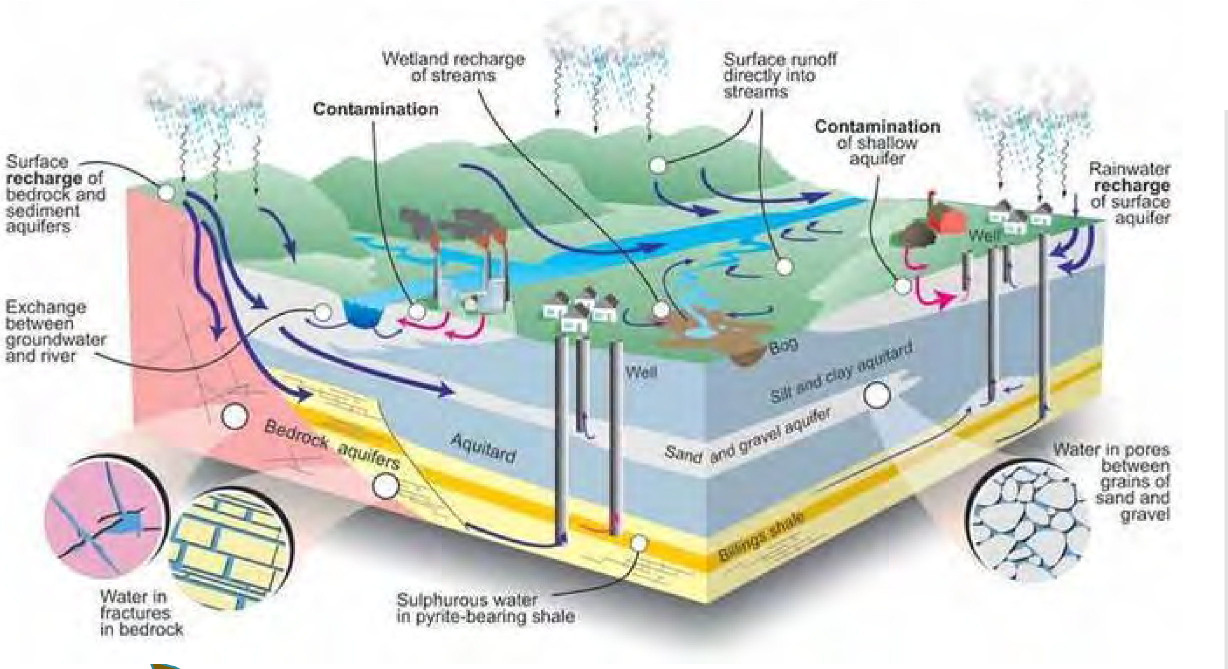
PRECIPITACIÓN PLUVIAL DEL LUGAR

CALIDAD DEL AGUA

POZOS DE ABSORCIÓN

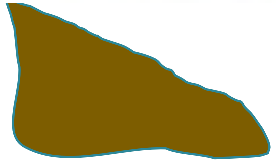
PROVENIENTES DE:

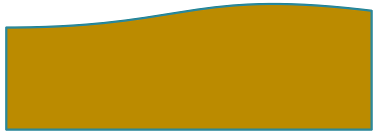
- Zonas deforestadas
- Aguas grises
- Aguas tratadas
- Lluvias no conectadas a la red
- Lluvia de techos
- Lluvia calles
- Charcos urbanos
- Superficies que generan problemas de salud



FUNCIONAMIENTO

2





MUY INCLINADAS
Favorecen la escurrantía superficial, poco tiempo para infiltración

POCO INCLINADAS
Retienen por más tiempo el agua, favoreciendo la infiltración

SUPERFICIES PLANAS
Desarrollan suelos herméticos, superficie dura

CAPACIDAD DE INFILTRACIÓN:
Cantidad máxima de agua que puede absorber un suelo, haciéndola llegar hasta el manto freático.

POZOS DE ABSORCIÓN

FUNCIONAMIENTO

2

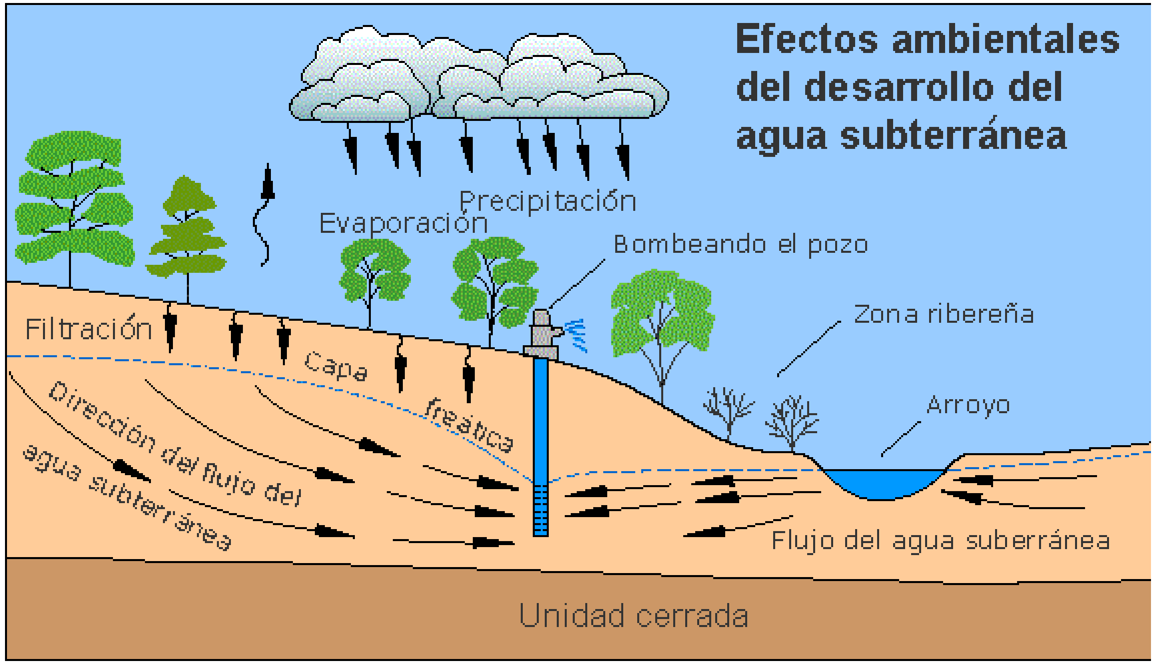
El agua primero satisface la deficiencia de humedad del suelo y después cualquier exceso pasa a formar parte del agua subterránea

PERMEABILIDAD ACUIFERA. Capacidad de un medio poroso para transmitir agua. (se produce por una diferencia de presiones o carga entre dos puntos).

POROSIDAD
Proporción de volumen de un acuífero compuesta por poros o aberturas. Es el índice que indica cuanta agua puede ser almacenada (no cedida) por el material saturado

RENDIMIENTO ESPECÍFICO
Cantidad de agua que un volumen retiene cuando se somete a drenaje por gravedad

PERMEABILIDAD
VALOR UTIL PARA LA INFILTRACIÓN DE AGUA AL MANTO FREÁTICO



MATERIAL	POROSIDAD %	RENDIMIENTO ESPECÍFICO %	PERMEABILIDAD M3/DIA/m2
ARCILLA	45	3	0.0004
ARENA	35	25	41
GRAVA	25	22	4100
GRAVA Y ARENA	20	16	410
ARENISCAS	15	8	4.10
CALIZAS DENSAS	5	2	0.041
CUARZO Y GRANITO	1	0.5	0.0004

POZOS DE ABSORCIÓN

VENTAJAS E INCONVENIENCIAS

2

VENTAJAS

- Evita inundaciones superficiales en terrenos no permeables
- Evita charcos y zonas lodosas o intransitables
- Es más sencillo y económico que una red de alcantarillado pluvial
- Evita incluir el flujo pluvial a la red sanitaria en ciudades
- Ocupa poco espacio
- Fácil de construir
- Reabastece el manto freático
- Revitaliza los ecosistemas
- No perjudica los pavimentos urbanos

INCONVENIENCIAS

- Impurezas o residuos en el agua vertida (solución: filtros)
- Insuficiencia por flujo y colmarse
- Desbordamiento (solución: pozo decantación)
- Mantenimiento necesario a bocas de ingreso
- Ubicación a por lo menos 30m de pozo de extracción
- No debe ser alcanzado por raíces

3

SUELOS URBANOS PERMEABLES

DESCRIPCIÓN PROYECTO COCOREÑO DE ABSORCIÓN

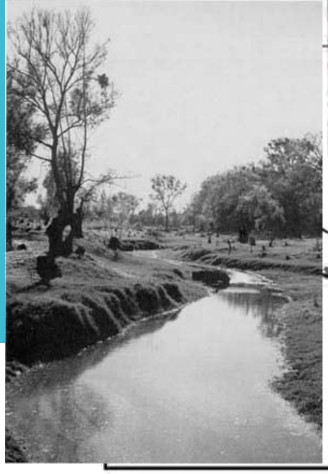
EXPERIENCIA DE UN DISEÑO DE VIALIDADES EN CÓCORIT, SONORA

PROYECTO COCOREÑO DE ABSORCIÓN

CONTEXTO HISTÓRICO ETNOLÓGICO

3

Desde épocas muy remotas, esta extensa región es habitada por miembros de la TRIBU YAQUI.
Con la llegada de Diego de Guzmán en 1553, se inicia la labor evangelizadora de los nativos, llegándose a fundar en 1623 los ocho Pueblos Yaquis originales, sobre las márgenes del río Yaqui: Vícam, Tórim, Pótam, Huíviris, Ráhum, Belem, Bácum y **Cócorit.**



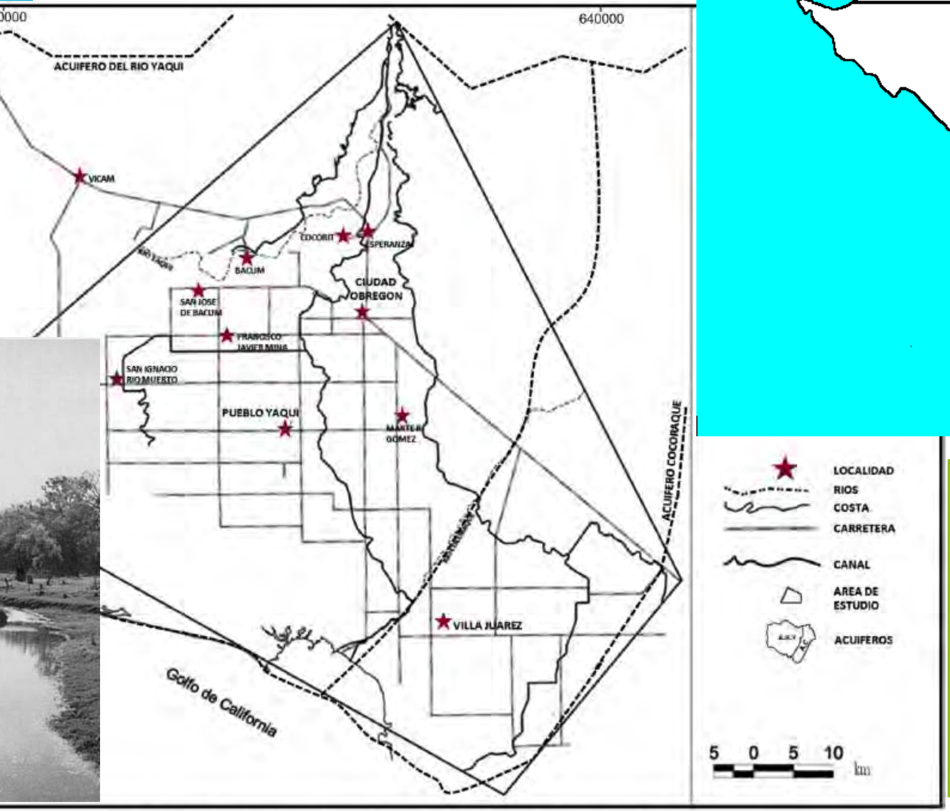
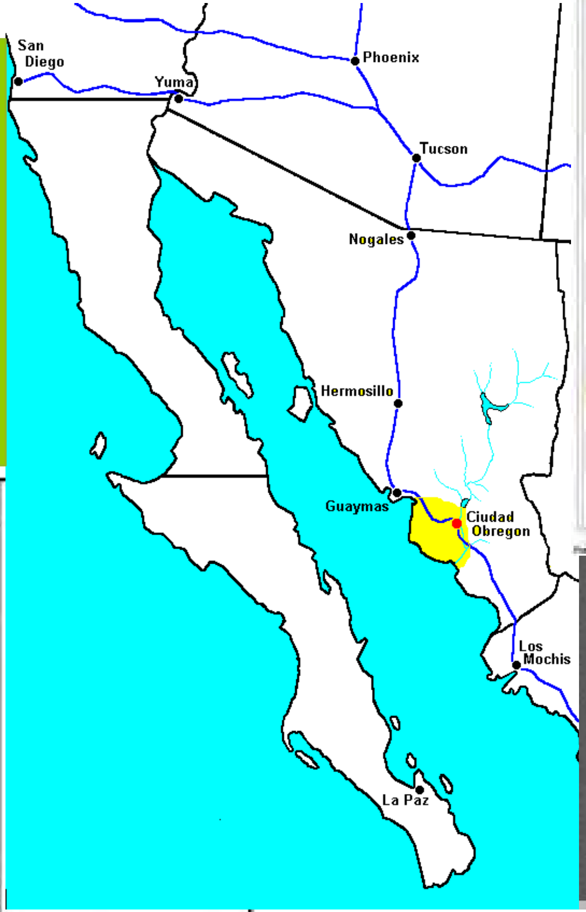


Figura 2. Localización del área de estudio del acuífero de valle del río Yaqui.



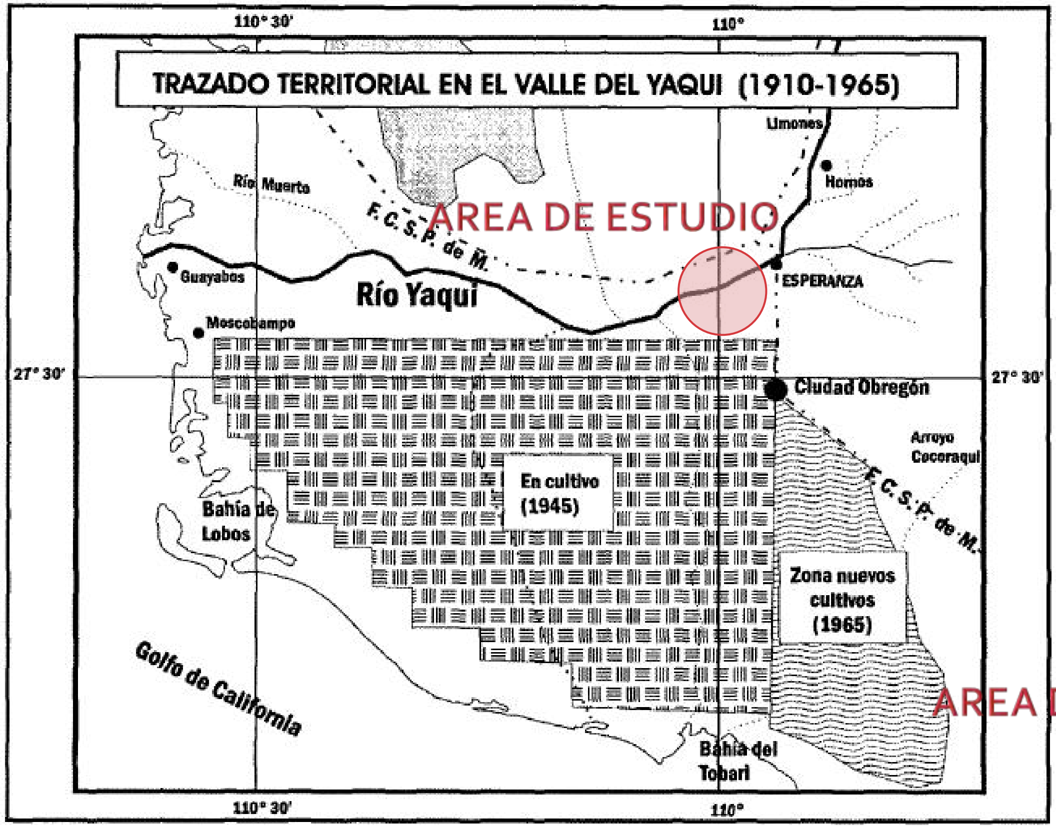
La tribu Yaqui mantuvo su autonomía rigiéndose por sus propias leyes y códigos, permitiéndoles conservar sus tradiciones y costumbres. Con el paso del tiempo, el territorio de los Yaquis se fue reduciendo debido a la presión ejercida por la llegada de colonizadores, conservándose su estado natural hasta mediados del siglo pasado.

PROYECTO COCOREÑO DE ABSORCIÓN

CONTEXTO HISTÓRICO ETNOLÓGICO

3

MAPA 2



Fuente: AHA, varios expedientes. Elaboró Óscar Jurado.

Desde 1893, con la llegada de un mayor número de emigrantes al poblado de Cócorit hasta 1911, con la fundación de la Villa de Esperanza, donde tuvo asiento el 23º Regimiento de Caballería del Ejercito Mexicano, el predominio de los Yaquis inicia su declinación y al mismo tiempo se inicia la explotación de las aguas del río Yaqui y la apertura de tierras de cultivo bajo riego

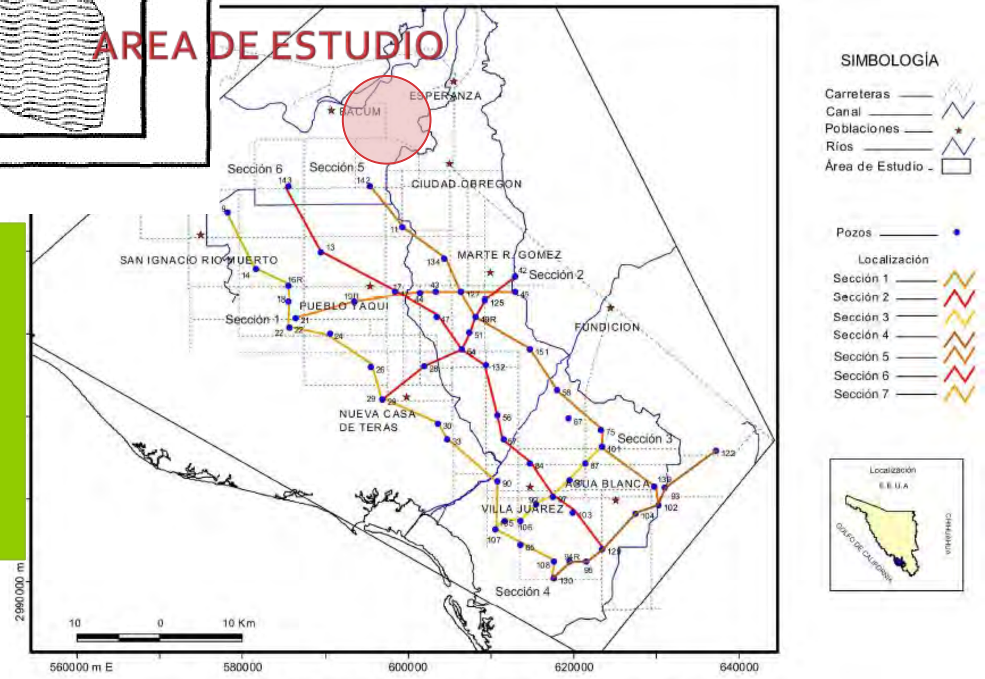


Figura 5. Localización de secciones estratigráficas en el área del valle del río Yaqui.

RAIZ HISTÓRICA: PLANEACION URBANA CON BASE EN CUENCAS HIDROLÓGICAS

PROYECTO COCOREÑO DE ABSORCIÓN

ADMINISTRACIÓN DEL AGUA EN LA REGIÓN. DISTRITO DE RIEGO DEL RÍO YAQUI

3

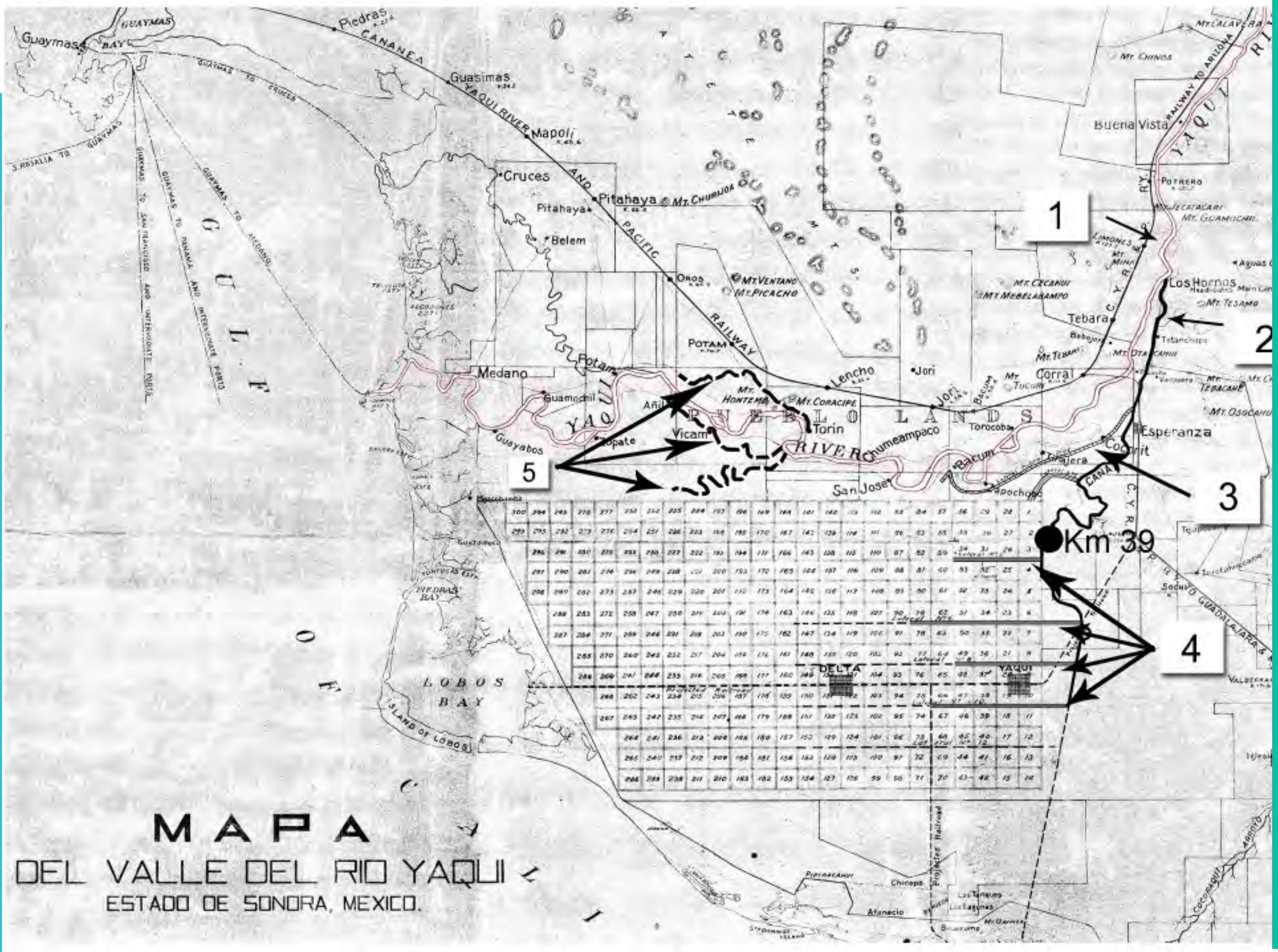
- En 1890 el gobierno federal autoriza al señor Carlos Conant Maldonado, la concesión de abrir al cultivo 300 mil hectáreas en las márgenes de los ríos Fuerte en Sinaloa, y Yaqui y Mayo en Sonora
- Desde 1905 a 1928 la concesión fue autorizada a la "Compañía Constructora Richardson, S.A.", la cual logró poner bajo riego 40,000 hectáreas, haciendo uso de las aguas en época de avenidas.
- En los años 1937 a 1941 se fortifica la infraestructura ya que se construye la presa Lázaro Cárdenas al norte del Edo.
- En **1944 se amplían los canales existentes**; y se construyen la red de irrigación del sur y del oeste del valle del Yaqui
- En los años 1947 a 1952 Se construye la presa Alvaro Obregón (Oviáchic), terminándose el Canal Alto y su red de canales de distribución en 1953
- 1953 hasta 1988, llegándose a beneficiar en total 220,000 hectáreas en el Distrito de Riego del Río Yaqui.

PROYECTO COCOREÑO DE ABSORCIÓN

ADMINISTRACIÓN DEL AGUA EN LA REGIÓN. DISTRITO DE RIEGO DEL RÍO YAQUI

3

Mapa 1. Canales en el valle del río Yaqui



Hidrografía:
La corriente principal del Distrito es el **río Yaqui**, con una longitud hasta su desembocadura en el mar de 850 km;
Su escurrimiento medio anual en 70 años de observaciones es de 2,944 millones de metros cúbicos;
Su cuenca hidrológica abarca una superficie de 71,452 km cuadrados, de los cuales 4,000 se ubican sobre los estados de Arizona y Nuevo México en Estados Unidos de Norteamérica. De la superficie restante, una cuarta parte se encuentra en el estado de Chihuahua y tres cuartas partes en el estado de Sonora.
Su precipitación media anual es de 500 mm, estos escurrimientos se captan en tres grandes presas o vasos de almacenamiento con capacidad total de 6,873 millones de metros cúbicos.

Clima:
El valle del Yaqui posee un clima semi-árido con humedad deficiente la mayor parte del año, con temperaturas medias tomadas de la estación climatológica del C.I.A.N.O. de 22° C, con mínimas de 0° C y **máximas de 52° C.**

Precipitación:
La media anual es de 261 mm, con lluvias en verano donde se registra diez veces mayor cantidad de lluvias en el mes más húmedo comparado con el más seco. Como dato curioso, las avenidas históricas del río Yaqui se han registrado en la estación de invierno.

Suelo:
El área distrital tiene el 60% con suelos pesados, el 30% con suelos medios, y el 10% restante con suelos ligeros. **Su topografía en su mayor parte es plana**, con una altitud de 4 a 58 msnm y una **pendiente de 1.5 metros por kilómetro**, dirigida ésta del noroeste hacia el (mar) suroeste.

PROYECTO COCOREÑO DE ABSORCIÓN

ADMINISTRACIÓN DEL AGUA EN LA REGIÓN. DISTRITO DE RIEGO DEL RÍO YAQUI

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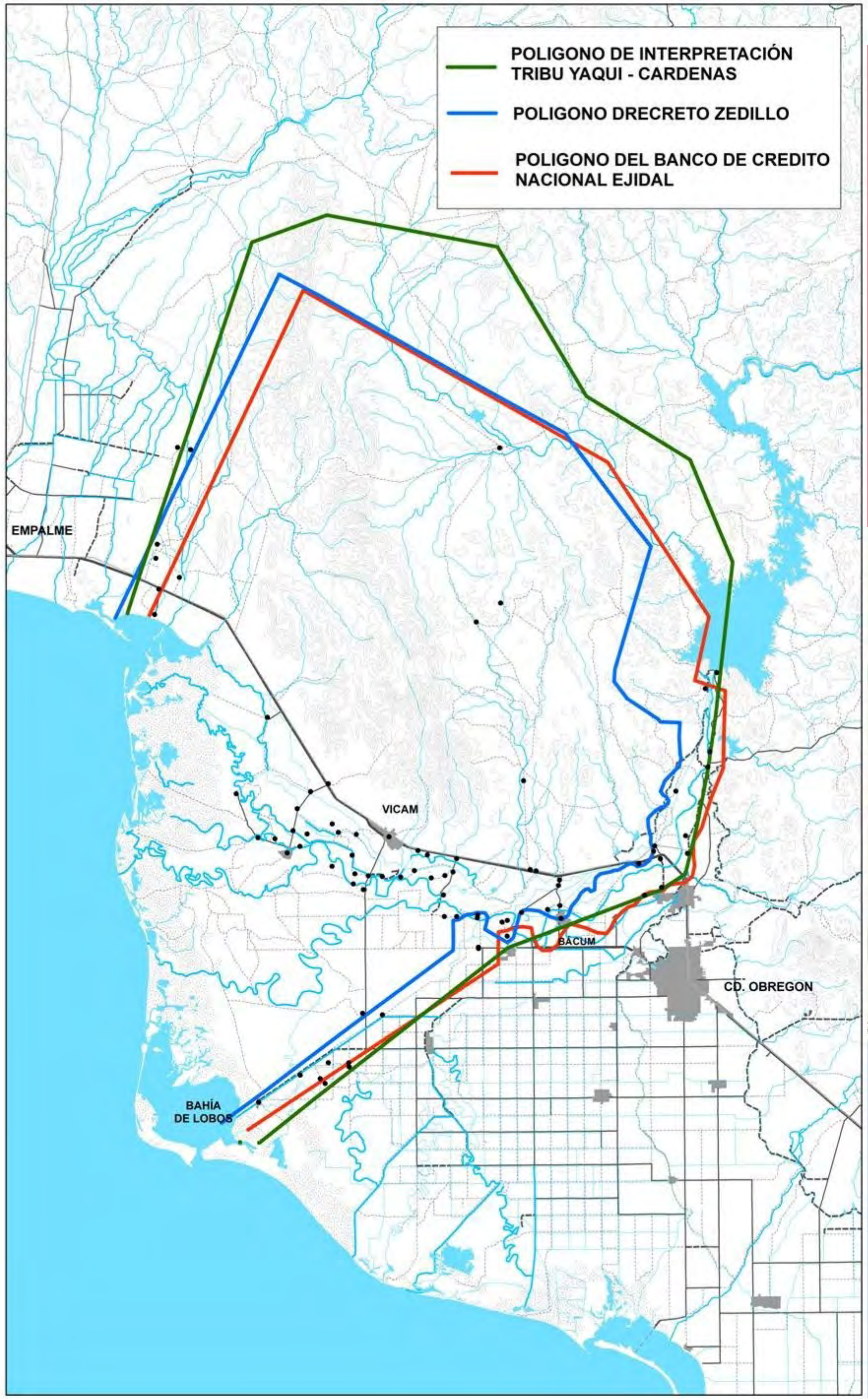

Por otra parte, a lo largo y ancho del área de riego del Distrito, se perforó una gran cantidad de pozos profundos por cuenta de particulares; y se construyeron drenes y diversas obras de infraestructura hidroagrícola .

Pero la propiedad y derechos de explotación siguen siendo por derechos Constitucional de la Etnia Yaqui.

PROYECTO COCOREÑO DE ABSORCIÓN

ADMINISTRACIÓN DEL AGUA EN LA REGIÓN. DISTRITO DE RIEGO DEL RÍO YAQUI

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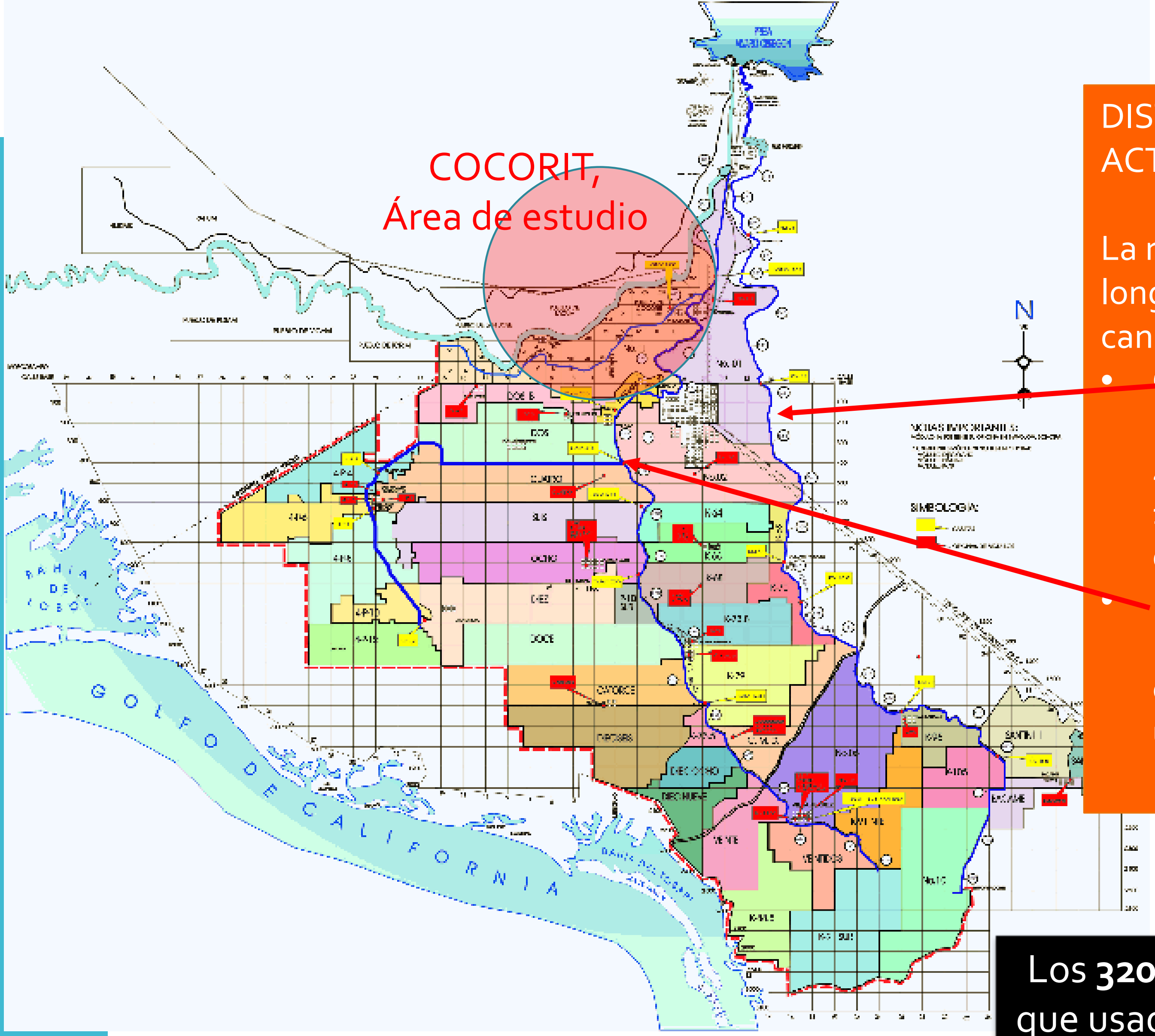


DISTRITO DE RIEGO DEL RIO YAQUI ACTUALMENTE:

La red de distribución cuenta con una longitud total de 2,774 km de canales, siendo los siguientes:

- **Canal Principal Alto** con una longitud de 120 km, incluyendo 42 km revestidos y capacidad de 110 m³/seg.., irriga una superficie de 100,000 hectáreas.
- **El Canal Principal Bajo**, tiene una longitud de 100 km., con capacidad de 120 m³ /seg., irriga una superficie de 120,000 hectáreas.

Los **320 pozos profundos existentes** que usados directamente o mezclados con agua de gravedad, tienen una capacidad de aportación anual de 450 millones de m³

PROYECTO COCOREÑO DE ABSORCIÓN

POZOS DE ABSORCIÓN EN COCORIT

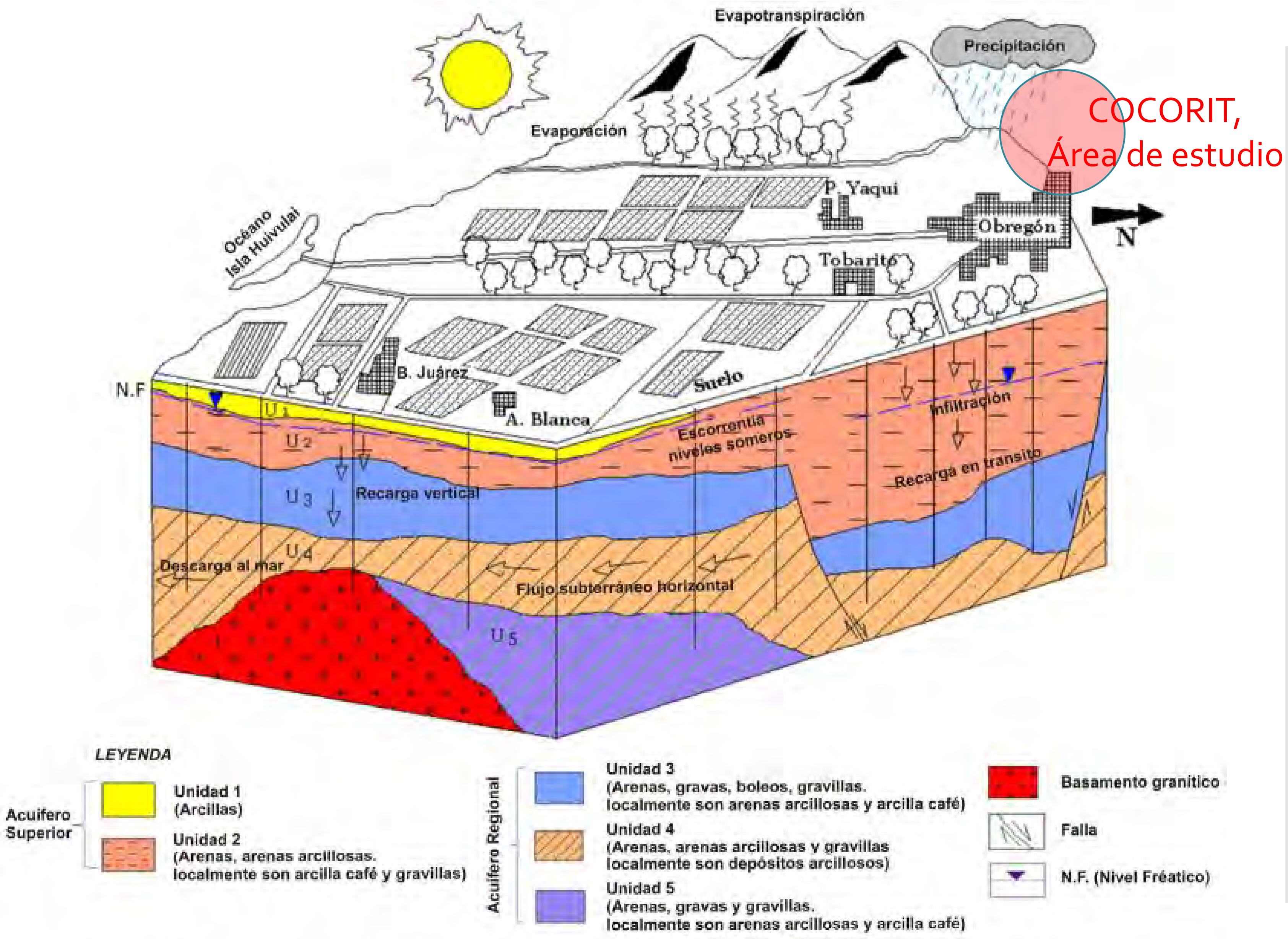


Figura 13. Bloque tridimensional que muestra las unidades hidroestratigráficas presentes en el acuífero del valle del río Yaqui.

PROYECTO COCOREÑO DE ABSORCIÓN

POZOS DE ABSORCIÓN EN COCORIT

3

OBJETIVO:
Brindar una solución a los problemas de encharcamientos masivos en las calles del poblado

PROYECTO COCOREÑO DE ABSORCIÓN

POZOS DE ABSORCIÓN EN COCORIT

3

OBJETIVO:
Brindar conocimiento a la población sobre superficies no lodosas, distintas al pavimento

PROYECTO COCOREÑO DE ABSORCIÓN

POZOS DE ABSORCIÓN EN COCORIT

3

OBJETIVO:
Aportar una solución a la pérdida de arborización característica del pueblo, por la baja dramática en el nivel freático

PROYECTO COCOREÑO DE ABSORCIÓN

POZOS DE ABSORCIÓN EN COCORIT

3

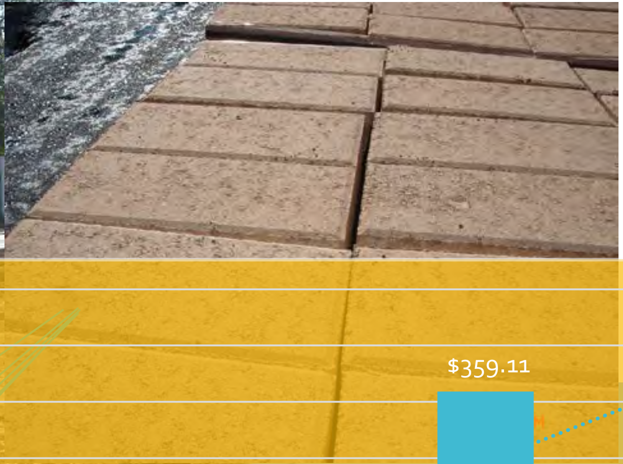
PROYECTO COCOREÑO DE ABSORCIÓN

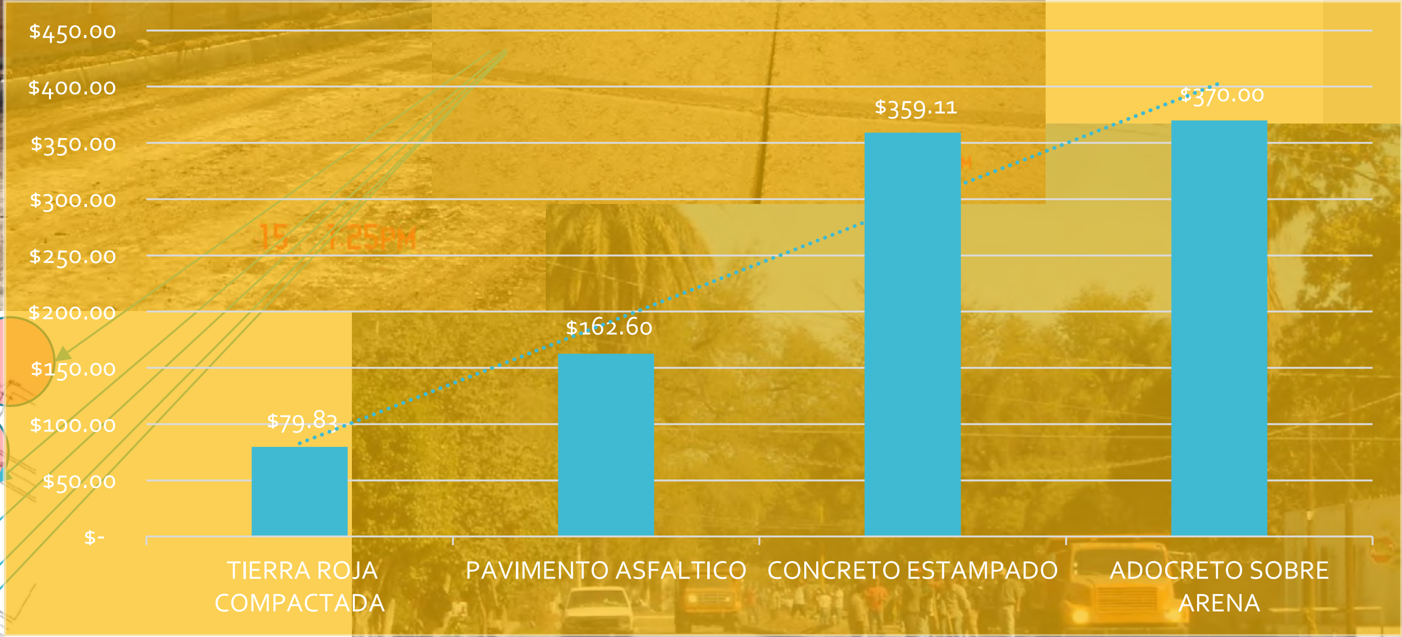
POZOS DE ABSORCIÓN EN COCORIT

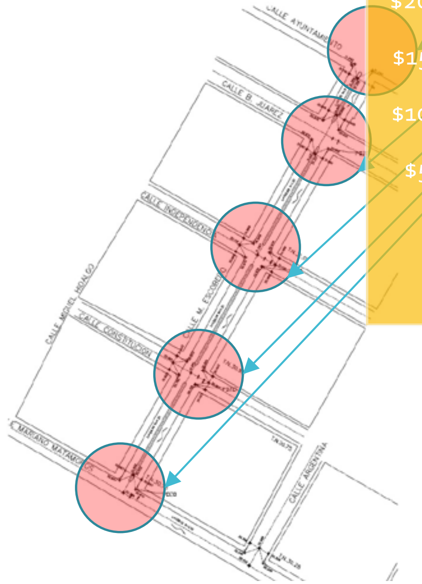
3

2 tipos de superficies que evitaran encharcamientos:

- Adoquín
- Asfalto







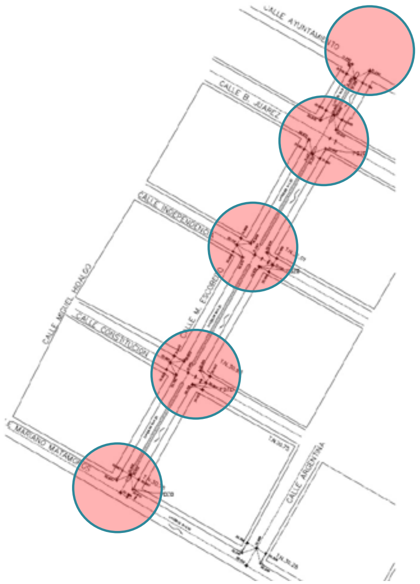
PROYECTO COCOREÑO DE ABSORCIÓN

POZOS DE ABSORCIÓN EN COCORIT

3

INVERSION COMPARADA

33% AUMENTO



PROGRAMA DE INVERSIÓN DESGLOSADO — **PAVIMENTACION CALLE MARIANO ESCOBEDO**

COCORIT SONORA — OPCION: **ADOQUIN**

22 NOVIEMBRE DEL 2007

	CONCEPTO	IMPORTE UNITARIO	CANTIDAD	IMPORTE TOTAL	SEMANA 1 26 NOV-01 DIC	SEMANA 2 03-08 DIC	SEMANA 3 10-15DIC
1	ESTRUCTURA DE PAVIMENTO			526,345.08	263,172.54		
2	PAVIMENTO ASFÁLTICO			744,523.83	372,261.92		
3	BACHEO (si se requiere)			84,003.48			
4	POZOS DE ABSORCIÓN Y REGISTROS			220,800.00			
5	CORTE DE CARPETA EXISTENTE			59,585.02			
6	ADOQUÍN EN CABECERA PLAZA			216,663.22			
7	ADOQUÍN EN CABECERA 1° MANZANA			238,698.64			
8	ADOQUÍN EN CABECERA QUINTA			392,385.97			
9	ADOQUÍN EN CRUCEROS (3)	70,943.00	3	212,829.01			
10	ADOQUIN ACCESO QUINTA (INC. TERRACERIAS)			310,111.92			
11	INST. PLUVIAL (BOCAS TORMENTA)						
12	PLAZA ESCULTÓRICA						
				$ 3,005,946.16	$ 635,434.46	$ -	$ -

PROGRAMA DE INVERSIÓN DESGLOSADO — **PAVIMENTACION CALLE MARIANO ESCOBEDO**

COCORIT SONORA — OPCION: **CARPETA ASFÁLTICA**

22 NOVIEMBRE DEL 2007

	CONCEPTO	IMPORTE UNITARIO	CANTIDAD	IMPORTE TOTAL	SEMANA 1 26 NOV-01 DIC	SEMANA 2 03-08 DIC	SEMANA 3 10-15DIC
1	ESTRUCTURA DE PAVIMENTO			526,345.08	263,172.54		
2	PAVIMENTO ASFÁLTICO			744,523.83	372,261.92		
3	BACHEO (si se requiere)			84,003.48			
4	POZOS DE ABSORCIÓN Y REGISTROS			220,800.00			
5	CORTE DE CARPETA EXISTENTE			59,585.02			
6	ASFALTO EN CABECERA PLAZA			43,205.57			
7	ASFALTO EN CABECERA 1° MANZANA			47,599.73			
8	ASFALTO EN CABECERA QUINTA			78,247.06			
9	ADOQUÍN EN CRUCEROS (3)	70,943.00	3	212,829.01			
10	ASFALTO ACCESO QUINTA (INC. TERRACERIAS)			87,320.99			
11	INST. PLUVIAL (BOCAS TORMENTA)						
12	PLAZA ESCULTÓRICA						
				$ 2,104,459.76	$ 635,434.46	$ -	$ -

PROYECTO COCOREÑO DE ABSORCIÓN

POZOS DE ABSORCIÓN EN COCORIT

3

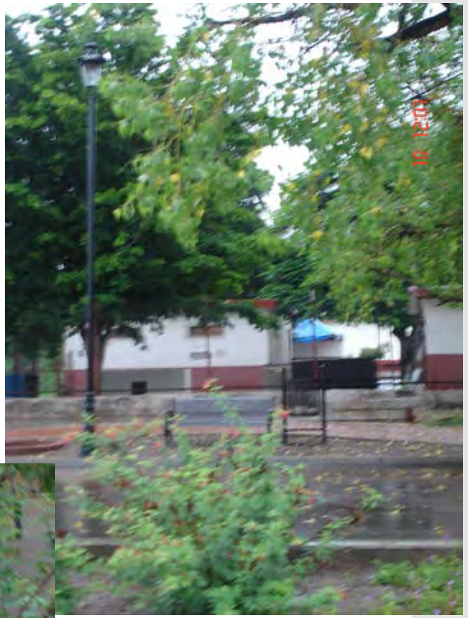
Este proyecto no solo pavimentó el desarrollo de los 400m que van desde la plaza de armas Ignacio Zaragoza hasta el tope del citado bulevar en la calle Matamoros, sino que realizó una significativa aportación a:

- Una cultura de ahorro del agua.

Con la introducción de un sistema de riego por goteo, que eficientiza el uso del agua y dirige de modo específico el agua a la raíz de la planta, evitando así el crecimiento de maleza y propiciando el crecimiento sano de las especies.

PROYECTO COCOREÑO DE ABSORCIÓN

POZOS DE ABSORCIÓN EN COCORIT



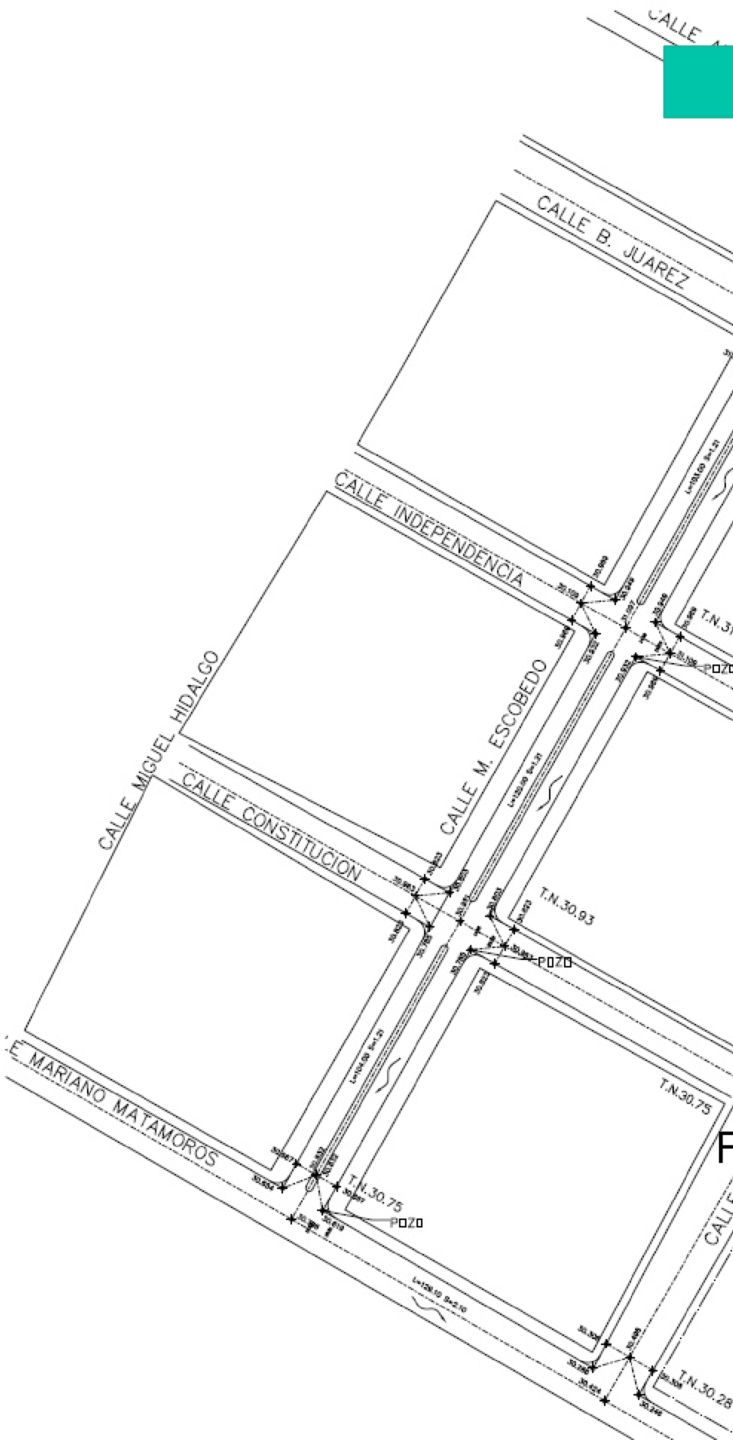
3

CALLE DE PROYECTO

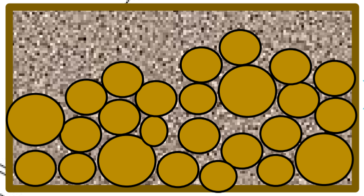
PROYECTO COCOREÑO DE ABSORCIÓN

POZOS DE ABSORCIÓN EN COCORIT

3



SE HIZO POSIBLE, GRACIAS A QUE ES ZONA RURAL Y LAS AREAS PÚBLICAS SON AUN DE DIMENSIONES HUMANAS



FILTROS EN CALLE

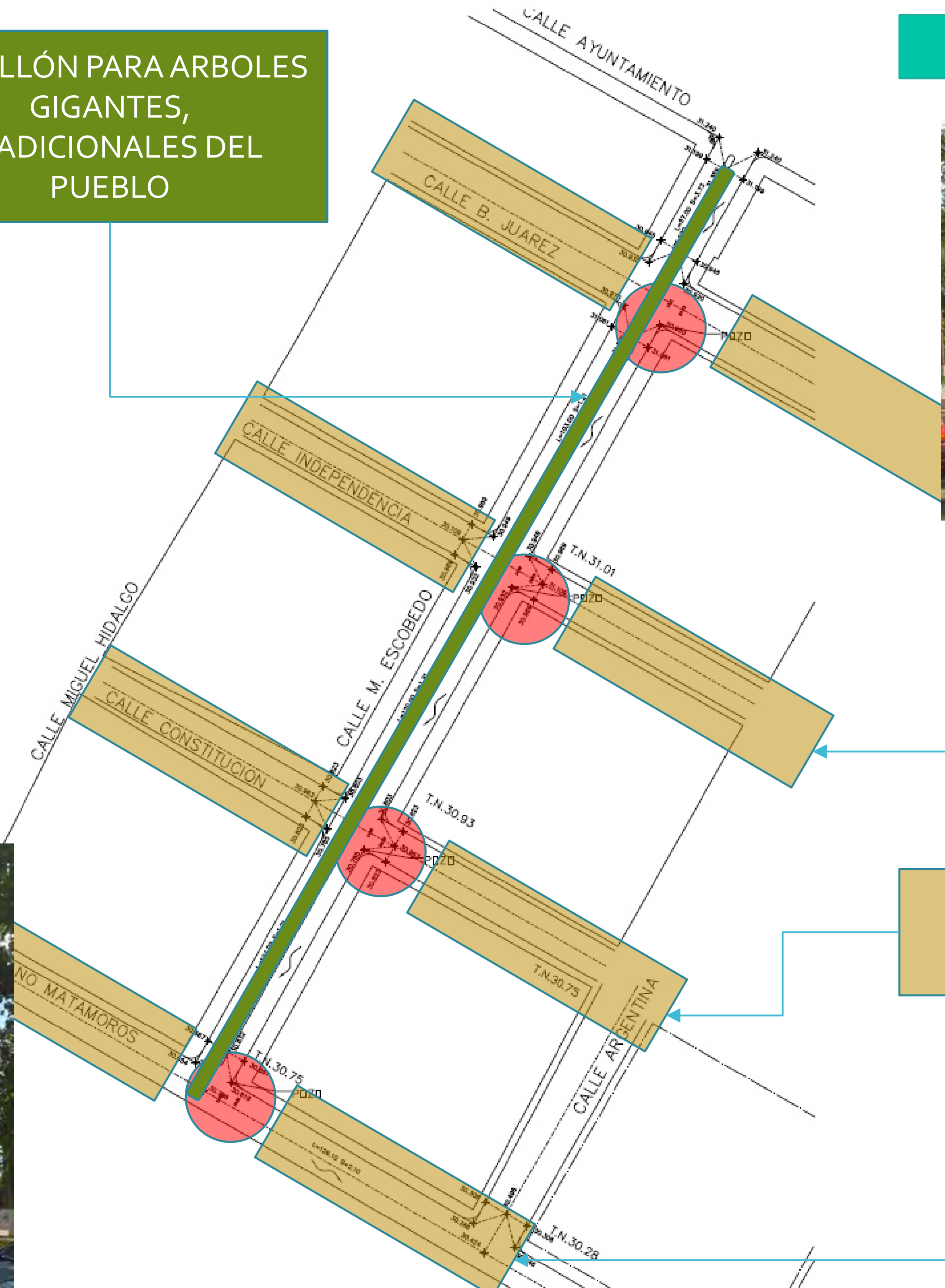
COSECHA AGUA

PROYECTO COCOREÑO DE ABSORCIÓN

POZOS DE ABSORCIÓN EN COCORIT

3

CAMELLÓN PARA ARBOLES GIGANTES, TRADICIONALES DEL PUEBLO



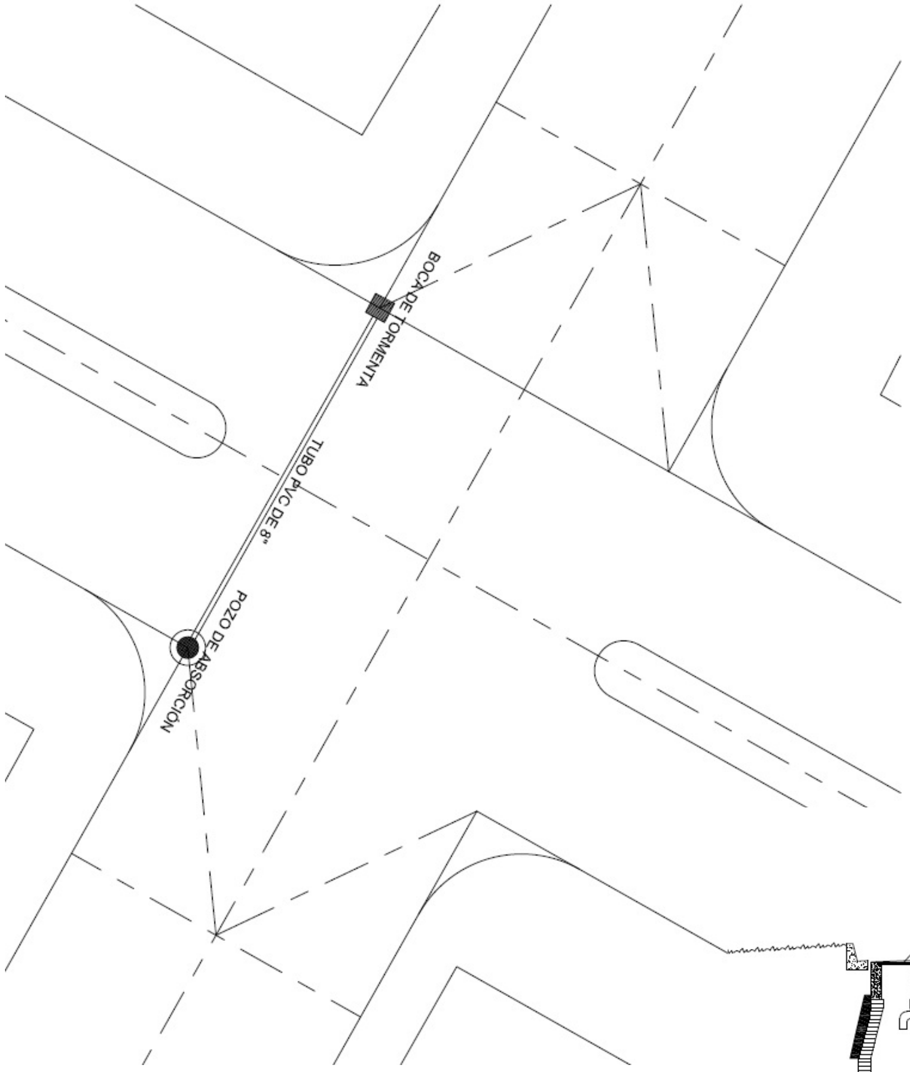
LOCALIZACIÓN DE POZOS

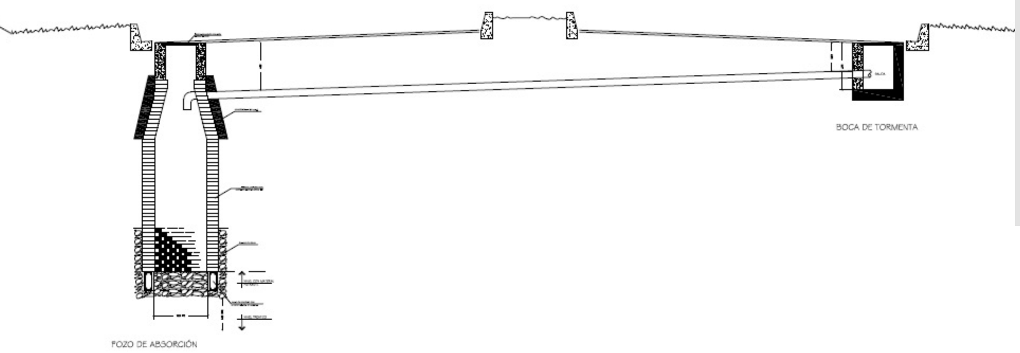
VIALIDADES A LAS QUE SE EVITA ESCURRIMIENTO PLUVIAL

PROYECTO COCOREÑO DE ABSORCIÓN

POZOS DE ABSORCIÓN EN COCORIT

3





PROYECTO COCOREÑO DE ABSORCIÓN

POZOS DE ABSORCIÓN EN COCORIT

3

El sistema de infiltración: pozos profundos con tubo perforado en las áreas tributarias de cada desembocadura vial

Hasta garantizar llegar al nivel del manto freático

PROYECTO COCOREÑO DE ABSORCIÓN

POZOS DE ABSORCIÓN EN COCORIT

3

A 8 años de construidos

PROYECTO COCOREÑO DE ABSORCIÓN

POZOS DE ABSORCIÓN EN COCORIT

3

Mantenimiento: limpieza a registros de piedras naturales

4

SUELOS URBANOS PERMEABLES

EVALUACIÓN DE IMPACTO PROYECTO

EXPERIENCIA DE UN DISEÑO DE VIALIDADES EN CÓCORIT, SONORA

SITUACIONES ESPERADAS E INESPERADAS

EVALUACIÓN DE IMPACTO PROYECTO

POZOS DE ABSORCIÓN EN COCORIT

4

AREAS DE IMPACTO

- TECNICO-CONSTRUCTIVO
- SOCIAL
- POLÍTICO-ADMINISTRATIVO
- ECONÓMICO

AREA DE IMPACTO TECNICO-CONSTRUCTIVO

EVALUACIÓN DE IMPACTO PROYECTO

POZOS DE ABSORCIÓN EN COCORIT

REQUIERE MANTENIMIENTO

AREA DE IMPACTO TECNICO-CONSTRUCTIVO

EVALUACIÓN DE IMPACTO PROYECTO

POZOS DE ABSORCIÓN EN COCORIT

4

EMBELLECE, RETIENE HUMEDAD BAJANDO TEMPERATURAS

AREA DE IMPACTO SOCIAL

EVALUACIÓN DE IMPACTO PROYECTO

POZOS DE ABSORCIÓN EN COCORIT

4

EVALUACIÓN DE IMPACTO PROYECTO

POZOS DE ABSORCIÓN EN COCORIT

4

AREA DE IMPACTO SOCIAL

EVALUACIÓN DE IMPACTO PROYECTO

POZOS DE ABSORCIÓN EN COCORIT

4

GENERA EXPECTATIVAS DEL RESTO DE LA POBLACIÓN, MANIFESTACIONES AGRESIVAS DE INCONFORMIDAD

AREA DE IMPACTO SOCIAL

EVALUACIÓN DE IMPACTO PROYECTO

POZOS DE ABSORCIÓN EN COCORIT

4

EJEMPLO DE ALIANZA INTERSECTORIAL

AREA DE IMPACTO POLÍTICO ADMINISTRATIVO

EVALUACIÓN DE IMPACTO PROYECTO

POZOS DE ABSORCIÓN EN COCORIT

4

NO TODOS LOS TERRENOS DEL VALLE (MISMA MUNICIPALIDAD) TIENEN LAS CUALIDADES PARA ABASTECER EL MANTO FREÁTICO

AREA DE IMPACTO POLÍTICO ADMINISTRATIVO

EVALUACIÓN DE IMPACTO PROYECTO

POZOS DE ABSORCIÓN EN COCORIT

4

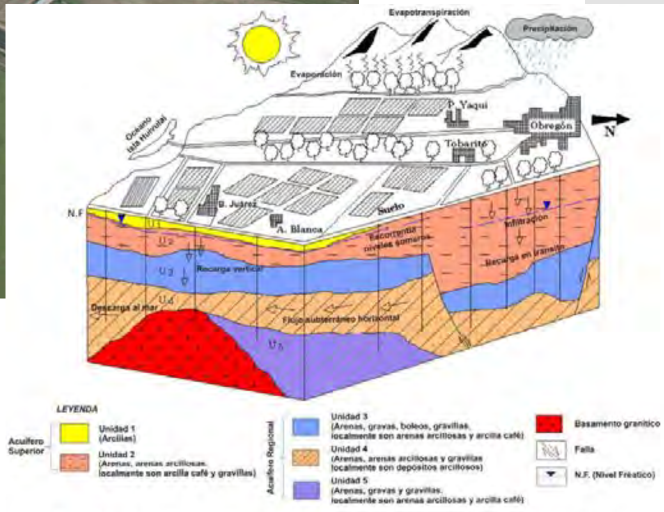


Figura 13. Bloque tridimensional que muestra las unidades hidroestratigráficas presentes en el acuífero del valle del río Yaqui.

COSTO DE LA PERMEABILIDAD Vs. CANTIDAD DE VIALIDADES REVESTIDAS, NO ES LLAMATIVA EN EL SENTIDO POLÍTICO ADMINISTRATIVO

AREA DE IMPACTO POLÍTICO ADMINISTRATIVO

EVALUACIÓN DE IMPACTO PROYECTO

POZOS DE ABSORCIÓN EN COCORIT

4

CAMBIO EN LAS POLÍTICAS DE VIVIENDA NACIONAL, QUE LLAMA ACCIONES A LOS HOGARES DE LAS FAMILIAS, DONDE NO CABEN NI DENTRO, NI FUERA

AREA DE IMPACTO POLÍTICO ADMINISTRATIVO

EVALUACIÓN DE IMPACTO PROYECTO

POZOS DE ABSORCIÓN EN COCORIT

4

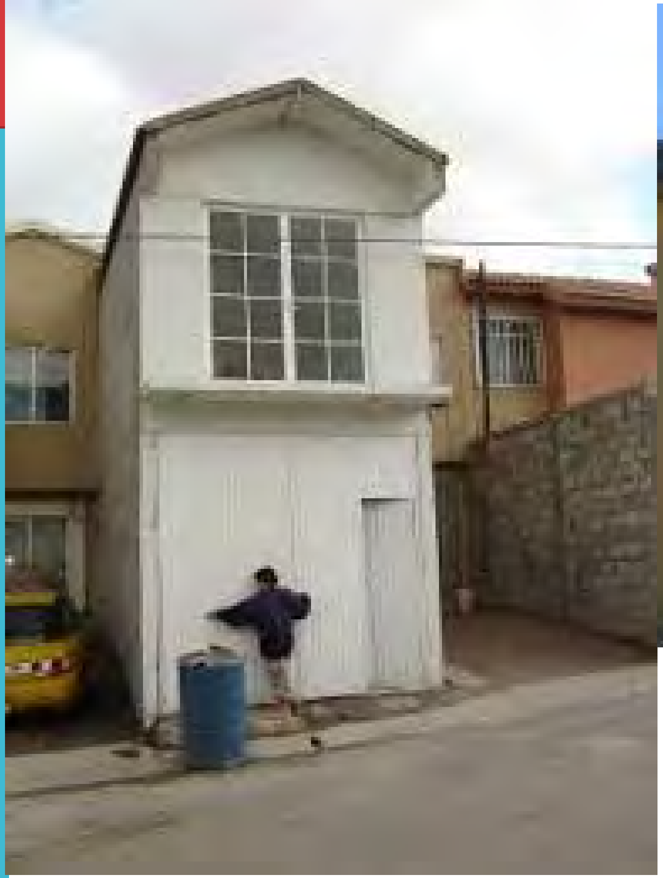
AREAS DE ENCUENTRO NO EXISTEN, NO HAY CIRCULACIONES PEATONALES, ¿DÓNDE CAPTAMOS?, SI NISIQUIERA CABEMOS

AREA DE IMPACTO POLÍTICO ADMINISTRATIVO

EVALUACIÓN DE IMPACTO PROYECTO

POZOS DE ABSORCIÓN EN COCORIT

4



DISEÑO CON BASE EN ESCURRIMIENTOS

EVALUACIÓN DE IMPACTO PROYECTO

POZOS DE ABSORCIÓN EN COCORIT

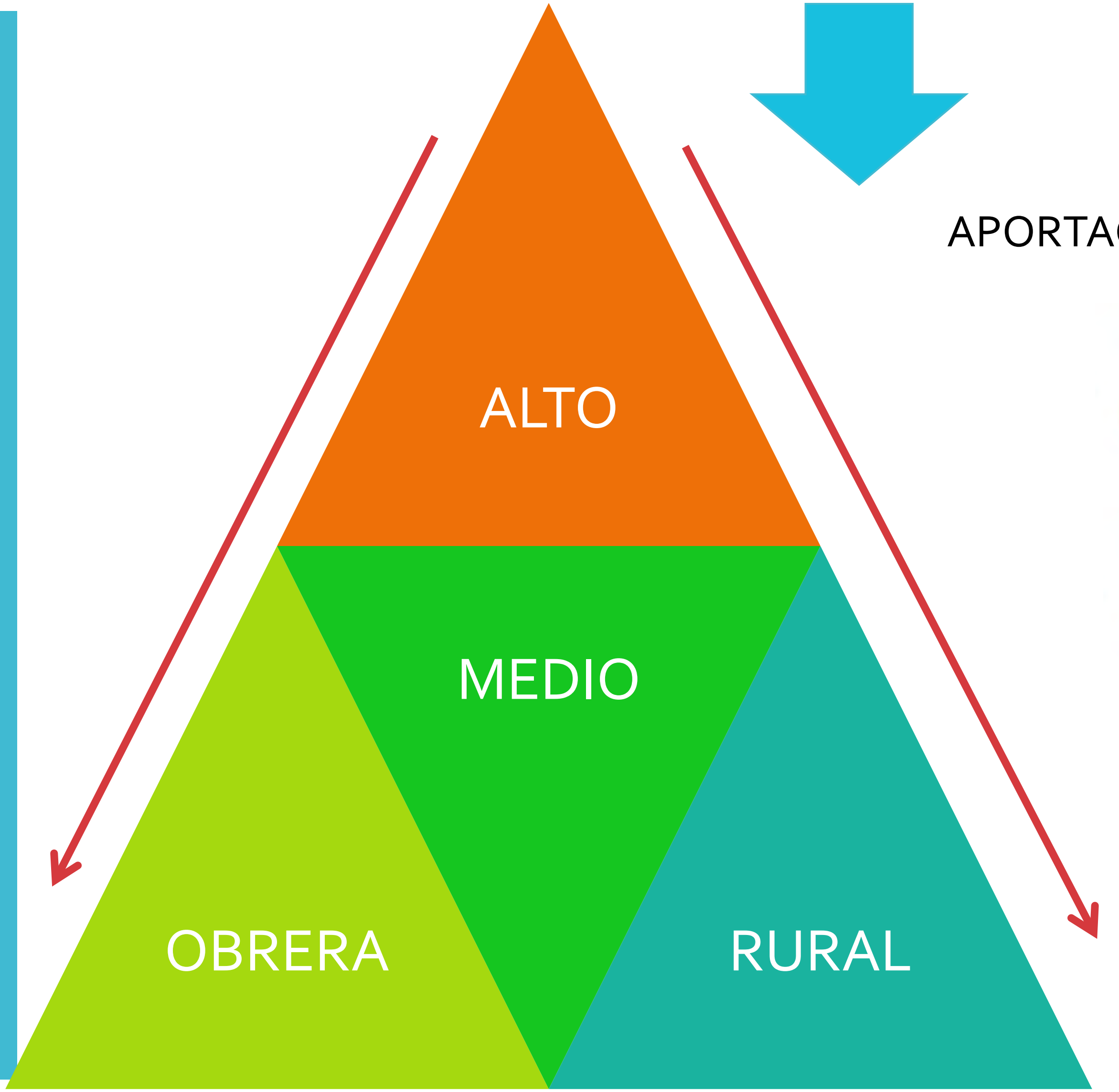
4

EVALUACIÓN DE IMPACTO PROYECTO

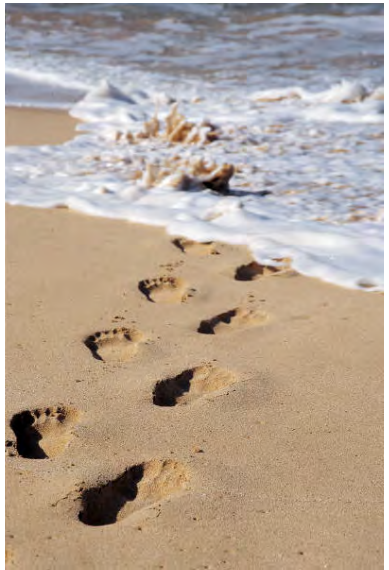
POZOS DE ABSORCIÓN EN COCORIT

4

CAMBIO SOCIAL



APORTACIONES



5

SUELOS URBANOS PERMEABLES

RETROSPECTIVA DE SUELOS PERMEABLES EN MÉXICO

EXPERIENCIA DE UN DISEÑO DE VIALIDADES EN CÓCORIT, SONORA

RETROSPECTIVA DE SUELOS PERMEABLES EN MÉXICO

HISTORIA

5

IMPACTAN EN LA SENSACIÓN DE CONFORT POR RETENCIÓN DE LA HUMEDAD

RETROSPECTIVA DE SUELOS PERMEABLES EN MÉXICO

DETALLE

5

SE EMPLEA MANO DE OBRA CALIFICADA, ARTESANAL. SE INVOLUCRA LA COMUNIDAD

RETROSPECTIVA DE SUELOS PERMEABLES EN MÉXICO

PROCESO

5

SE COPIAN MODELOS EN CIUDADES TURÍSTICAS

RETROSPECTIVA DE SUELOS PERMEABLES EN MÉXICO

ACTUALIDAD

5

RETROSPECTIVA DE SUELOS PERMEABLES EN MÉXICO

RODADAS

MINIMIZAN MOLESTIAS POR RUIDO Y VIBRACIÓN

RETROSPECTIVA DE SUELOS PERMEABLES EN MÉXICO

RODADAS

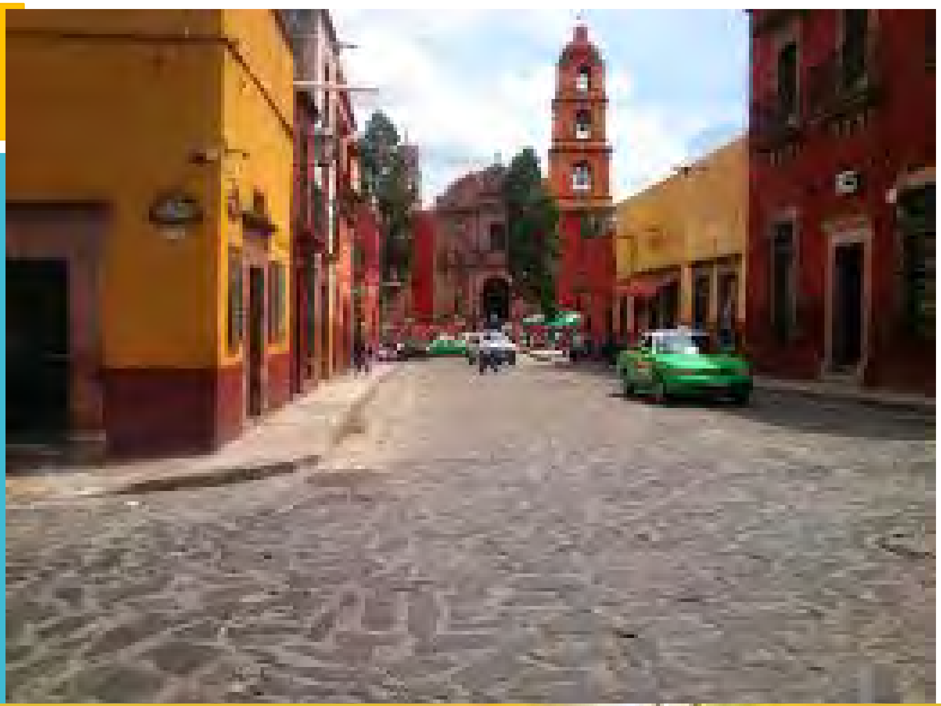
5

MATERIALES DIVERSOS, DE LA REGIÓN

RETROSPECTIVA DE SUELOS PERMEABLES EN MÉXICO

MATERIALES

5



ESCUCHAR LA SANGRE QUE TRANSMITE LA EXPERIENCIA DE NUESTROS ANTEPASADOS

RETROSPECTIVA DE SUELOS PERMEABLES EN MÉXICO

5

VISION: APRENDER DEL PASADO

RETROSPECTIVA DE SUELOS PERMEABLES EN MÉXICO

5

RETROSPECTIVA DE SUELOS PERMEABLES EN MÉXICO

5

INCORPORANDO LA EDUCACIÓN TECNOLOGIZADA ACTUAL

RETROSPECTIVA DE SUELOS PERMEABLES EN MÉXICO

5

FORMAN PARTE DEL DISEÑO PAISAJISTICO URBANO, NATURAL O PROVOCADO

RETROSPECTIVA DE SUELOS PERMEABLES EN MÉXICO

VEGETACIÓN

5

LA HUMEDAD PERMITE EL CRECIMIENTO DE VEGETACIÓN, ADORNA Y BRINDA CONFORT

RETROSPECTIVA DE SUELOS PERMEABLES EN MÉXICO

VEGETACIÓN

5

INFRAESTRUCTURA
GRIS

APEGO CULTURAL, COMODIDAD SOCIAL

INFRAESTRUCTURA
VERDE

INVERSIÓN INFRAESTRUCTURA URBANA, HACE COMUNIDAD *(JAMES RILEY)*

EXPERIENCIA DE UN DISEÑO DE VIALIDADES EN CÓCORIT, SONORA

SUELOS PERMEABLES, RESPONSABILIDAD SOCIAL, ECOLÓGICA Y AMBIENTAL.

UNA REFLEXIÓN URBANA SOCIAL

FUNDACIÓN TICHI MUÑOZ

E-comunidad

Border Green Infrastructure Forum
University of Arizona, Tucson, AZ
May 20-21, 2015

ECONOMIC STUDIES OF GREEN INFRASTRUCTURE IN TUCSON

Irene Ogata
Urban Landscape Manager
Office of Integrated Planning
City of Tucson

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

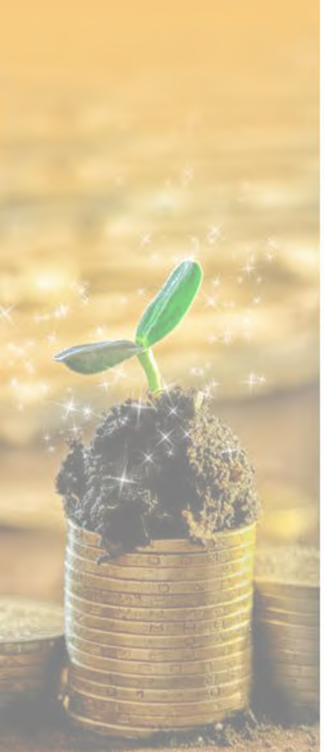
Jean McClain
UA WRRC

Evan Canfield
PC RFCD

Irene Ogata
COT OIP

Analyzing Economic Benefits

of Green Infrastructure



Managing stormwater infrastructure : At What

Gray Infrastructure:

Escalating needs

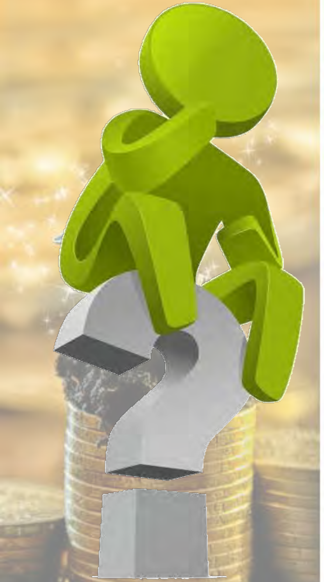
- Deferred Maintenance
- Growing communities
- Climate Change

resulting in rising

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 Infrastucture Benefit

Social

- Reduced flooding
- Greenways
- Human health

Environmental

- Water quality
- Air quality
- Urban heat stress reduction

Economic

- Increase property value
- Green jobs

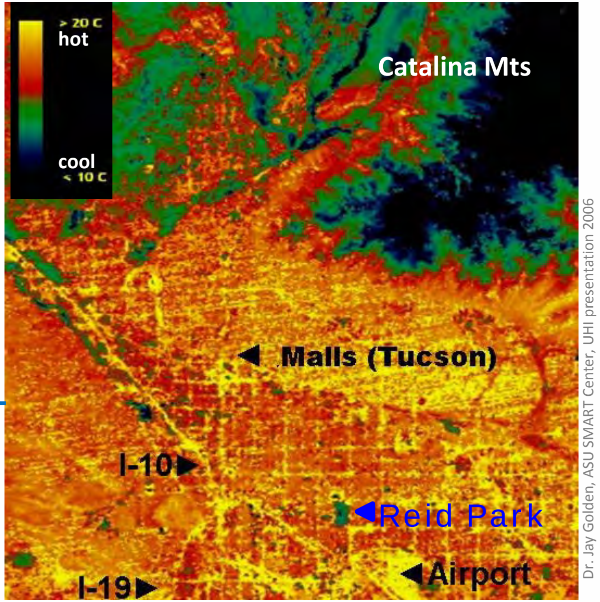
Economic Benefits of GI : in City of Tucson

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 Basin | 2005 | Kinetic Surface Temperature

Tucson Projects

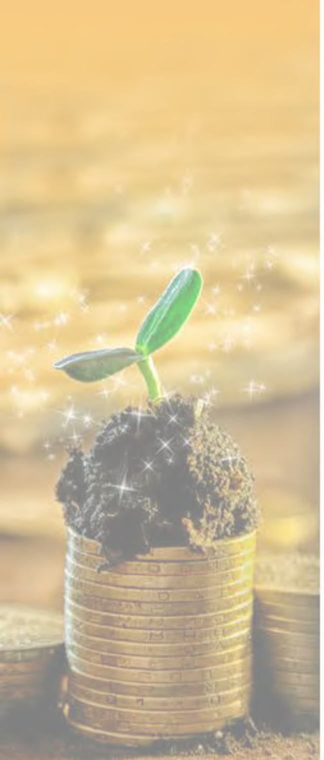
Elements: Low Impact/Green Infrastructure Manual

Road: Silverbell Road

Road: Scott Avenue

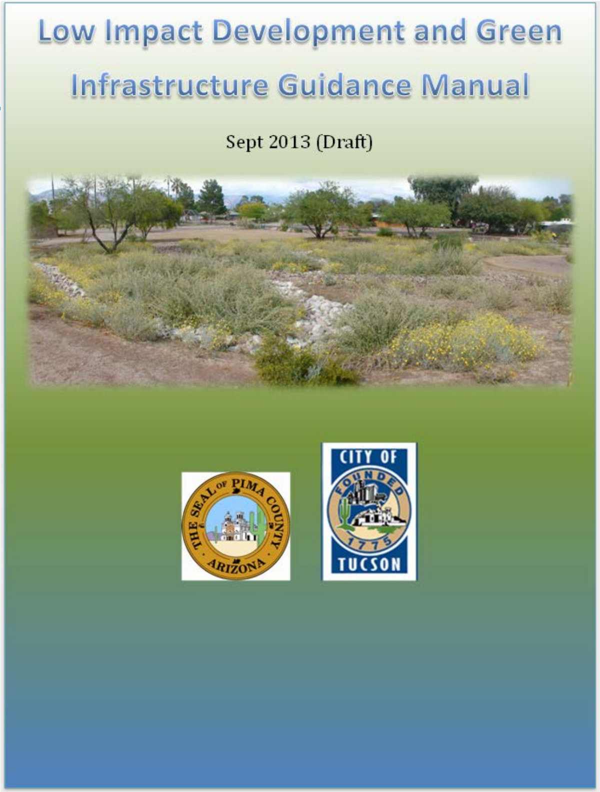
Garden: Blue Moon

Economic Benefits of GI : in City of Tucson



❶ LID/GI Guidance Manual

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



Function: Evaluate for Triple Bottom Line

Method: AutoCASE™

Economic Benefits of GI : in City of Tucson

❶ LID/GI Guidance Manual

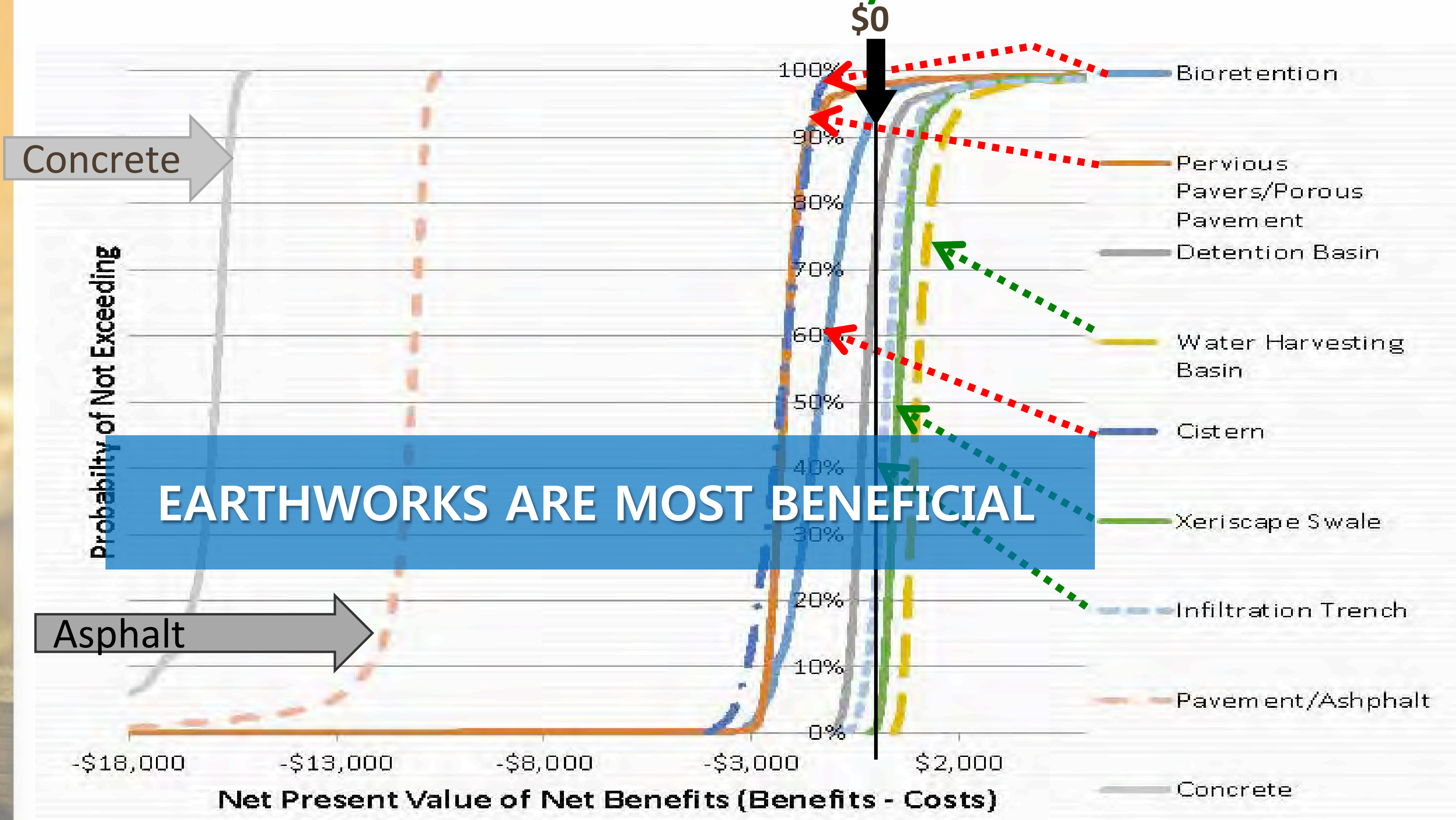
	Water Harvesting Basin								
		CapEx Cost	O&M	Flood Risk	Property Value	Heat Mortality	CO2 Emissions	F-NPV	S-NPV
Percentile	**10%**	*$ 13,012*	*-$ 9*	*$ 137*	*$ 16*	*$ 380*	*$ 1,308*	*$ 13,007*	*$ 15,091*
	50%	*$ 13,198*	*-$ 7*	*$ 350*	*$ 53*	*$ 503*	*$ 1,345*	*$ 13,192*	*$ 15,479*
	90%	*$ 13,368*	*-$ 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

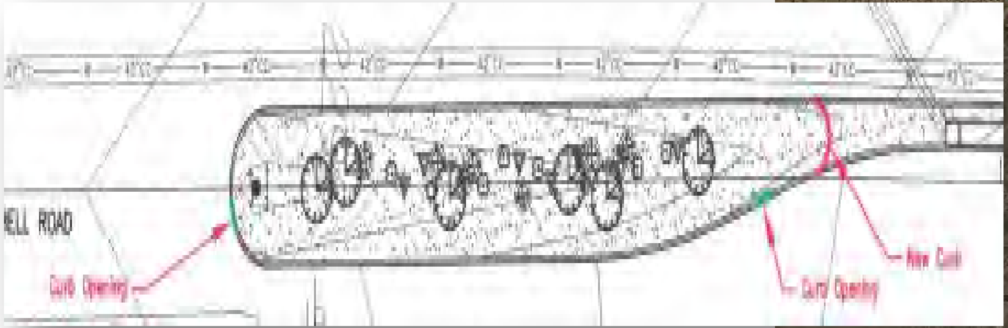


Graph: Impact Infrustructure, LLC AutoCASE final report 7-2014

Economic Benefits of GI : in City of Tucson

❷ 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

❷ Silverbell SROI

Traffic calming:

- Avoidance of loss of life

Cost of Water:

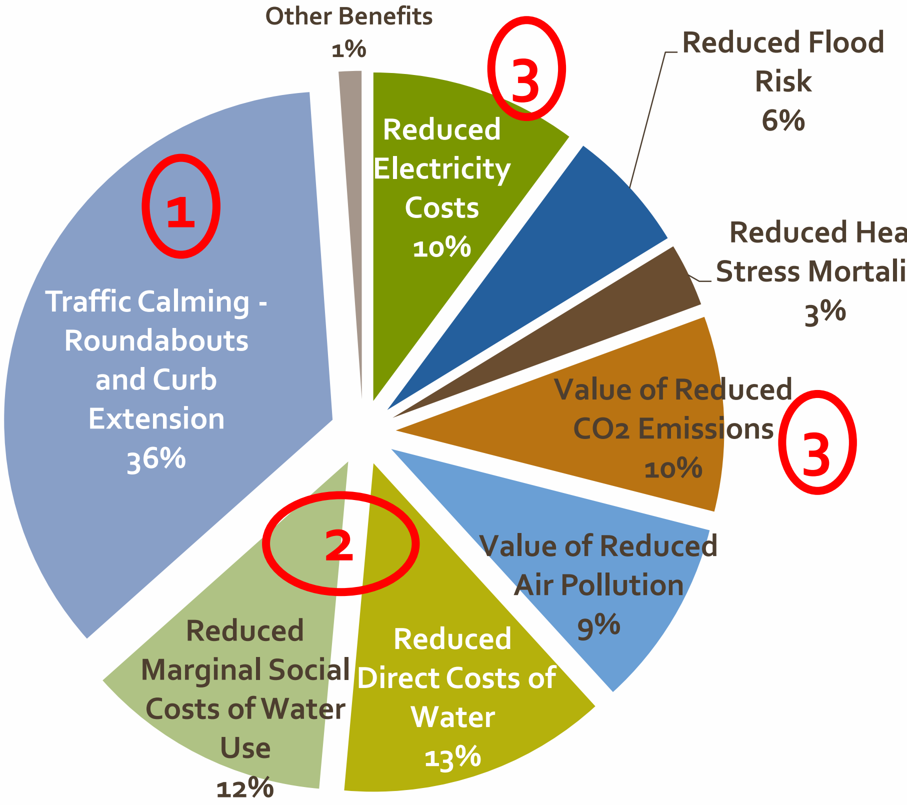
- Social +
- Direct

Energy savings:

- Reduced Electricity

Air Quality + Climate Change:

- Reduced CO_2



Economic Benefits of GI : in City of Tucson

❷ Silverbell Stakeholders' Benefit

Community:

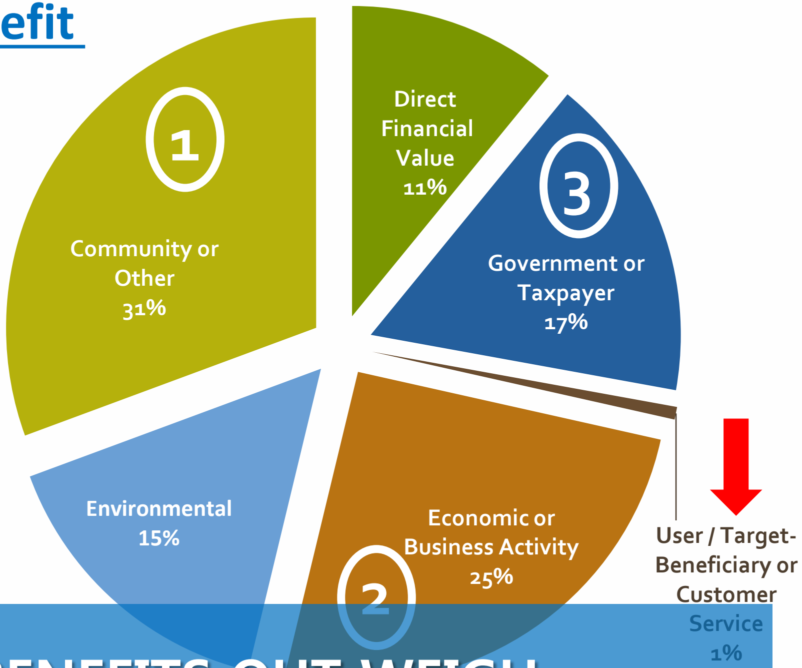
- Reduced traffic mortality
- Social cost of water; security

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

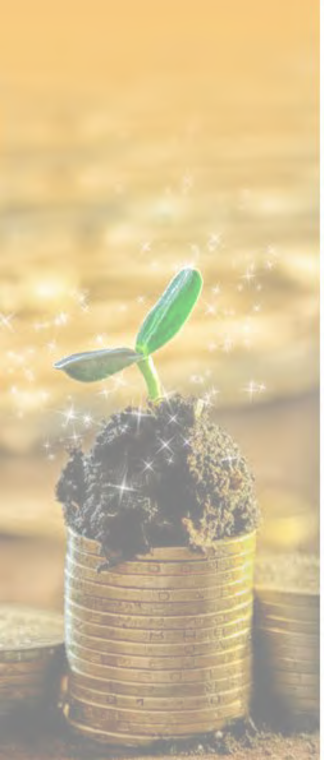
❸ Scott Avenue Re-Design

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

Scott Avenue
Construction curb cut : 2009

Function: Demonstrate range of net benefits = Triple Bottom Line

Method: Business Case Evaluator



Economic Benefits of GI : in City of Tucson

❸ Scott Avenue Re-Design

Social

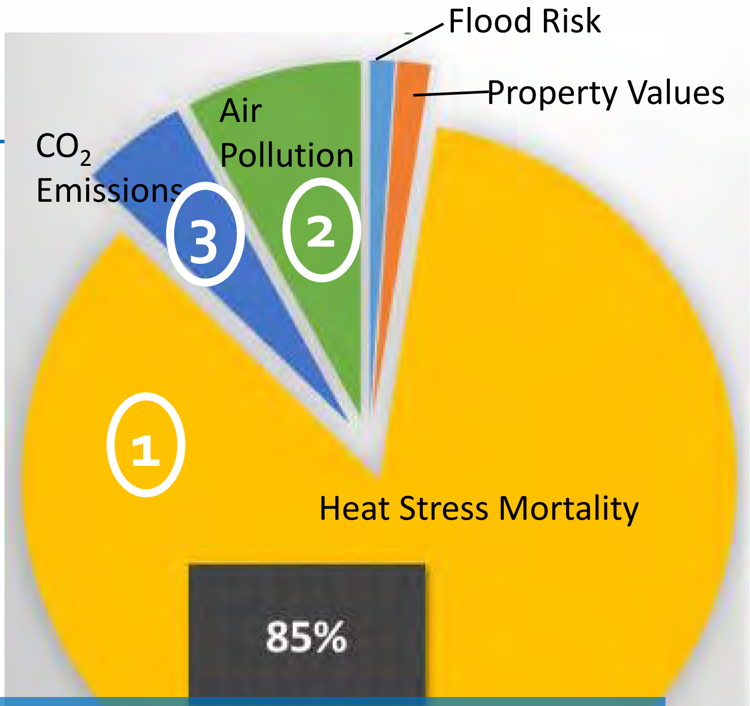
- Heat Stress Mortality ✓

Environmental

- Air Pollution ✓
- CO_2 Emissions ✓
- Flood risk

Economic

- Property ✓



TREES ADDED TO GREEN INFRASTRUCTURE HAS COMMUNITY BENEFIT

Economic Benefits of GI : in City of Tucson

❹ Blue Moon Community Gardens

- Cistern
- Water harvesting basins

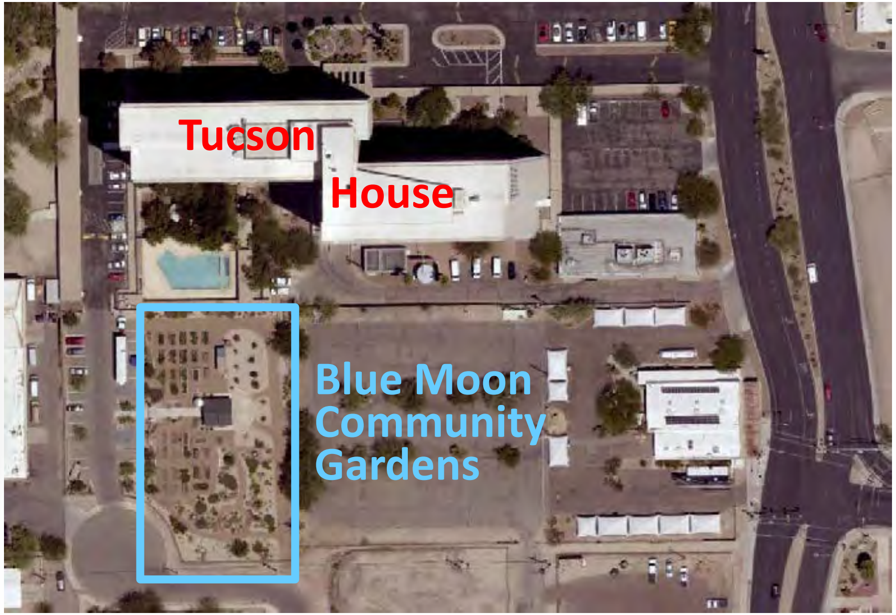
Function: Demonstrate range of net benefits

Method: Business Case Evaluator

Economic Benefits of GI : in City of Tucson

❹ Blue Moon Community Gardens

- Residents of Tucson House
- Actively involved in design



Economic Benefits of GI : in City of Tucson

❹ Blue Moon Community Gardens

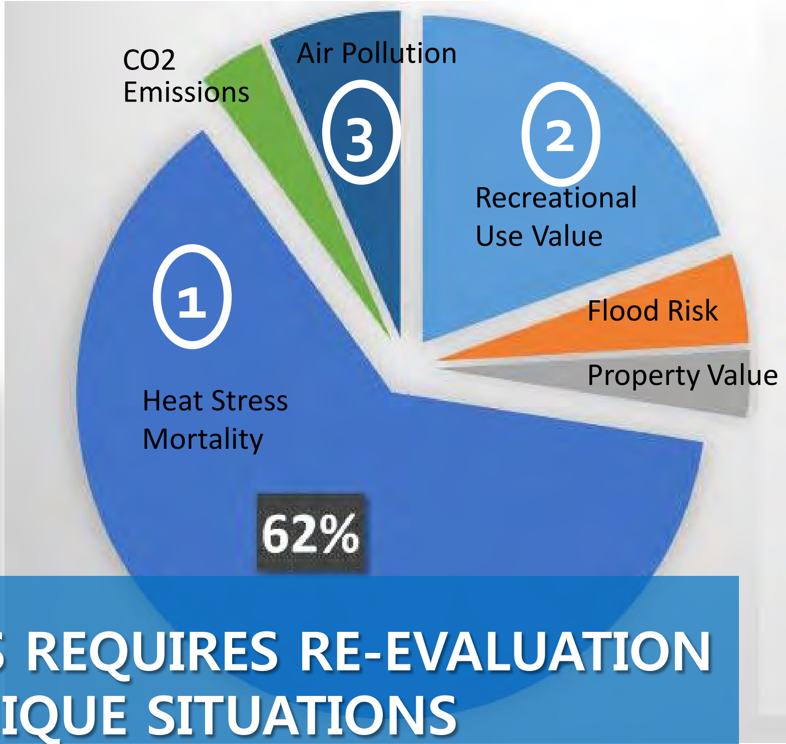
Social

- Heat Stress Mortality
- Recreation

Environment

- Air Pollution

Economic

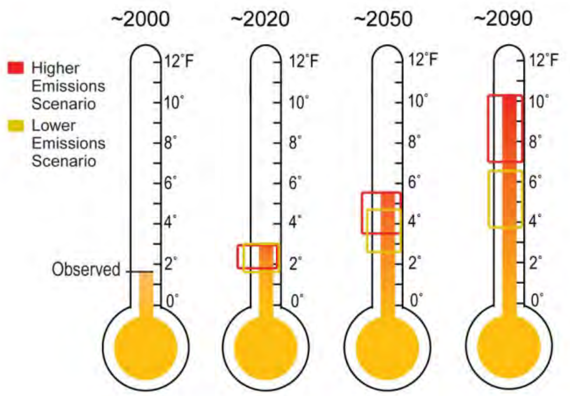


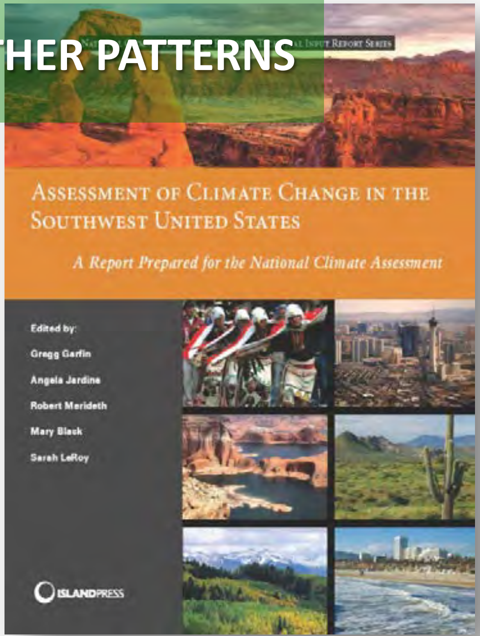
GI ECONOMIC ANALYSIS REQUIRES RE-EVALUATION BASED ON UNIQUE SITUATIONS

Economic Benefits of Green Infrastructure

A Few Considerations

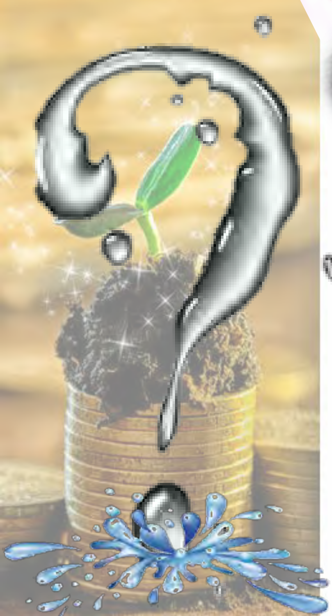
CLIMATE CHANGE HAS ALTERED WEATHER PATTERNS





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 .

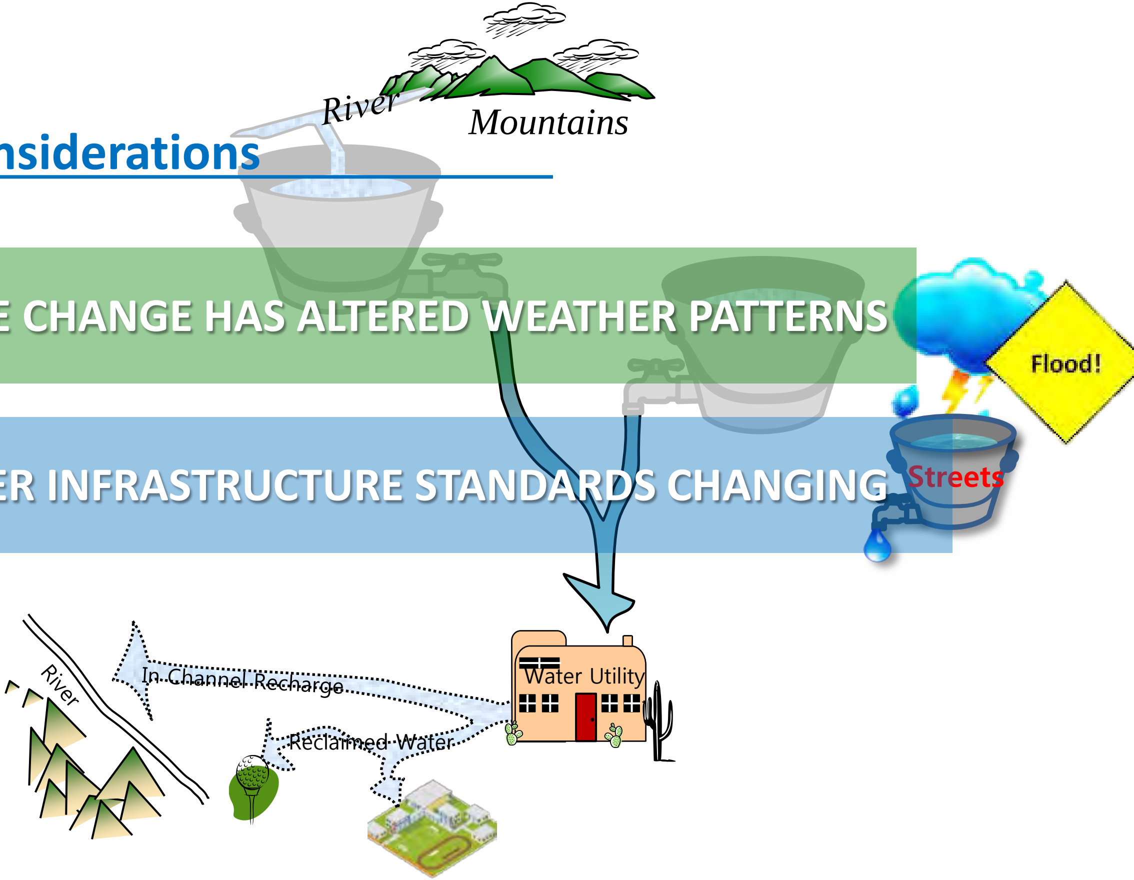
Economic Benefits of Green Infrastructure



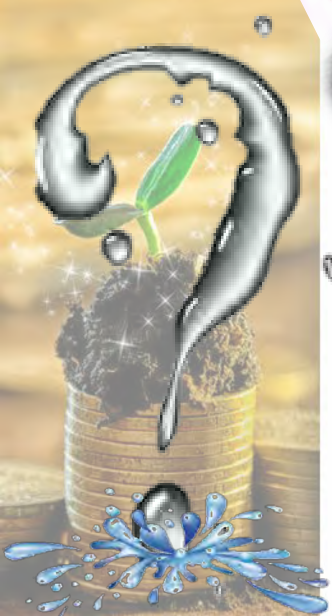
A Few Considerations

CLIMATE CHANGE HAS ALTERED WEATHER PATTERNS

STORMWATER INFRASTRUCTURE STANDARDS CHANGING



Economic Benefits of Green Infrastructure



A Few Considerations

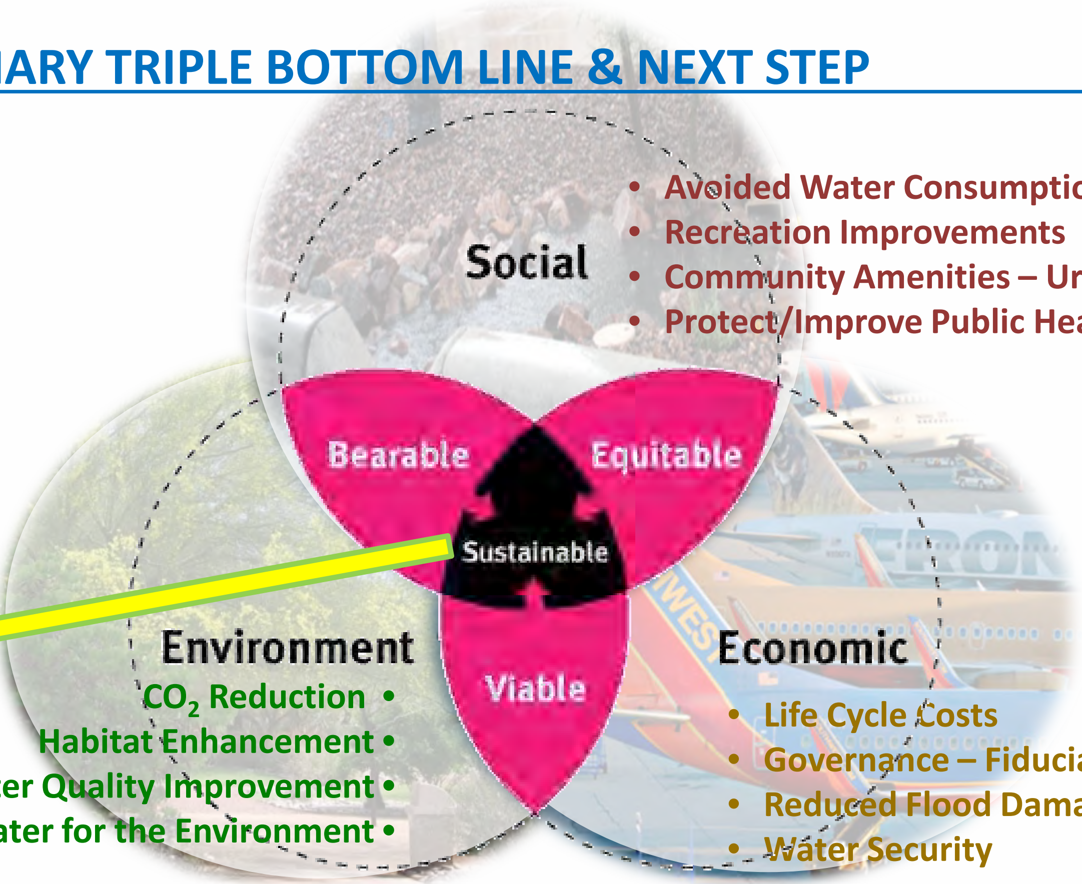
CLIMATE CHANGE HAS ALTERED WEATHER PATTERNS

STORMWATER INFRASTRUCTURE STANDARDS CHANGING

ECONOMIC ANALYSIS PART OF INFORMED DECISION-MAKING PROCESS

Economic Benefits of Green Infrastructure

SUMMARY TRIPLE BOTTOM LINE & NEXT STEP



- Avoided Water Consumption
- Recreation Improvements
- Community Amenities – Urban Canopy
- Protect/Improve Public Health

- CO_2 Reduction
- Habitat Enhancement
- Water Quality Improvement
- Water for the Environment

- Life Cycle Costs
- Governance – Fiduciary Responsibility
- Reduced Flood Damage
- Water Security

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