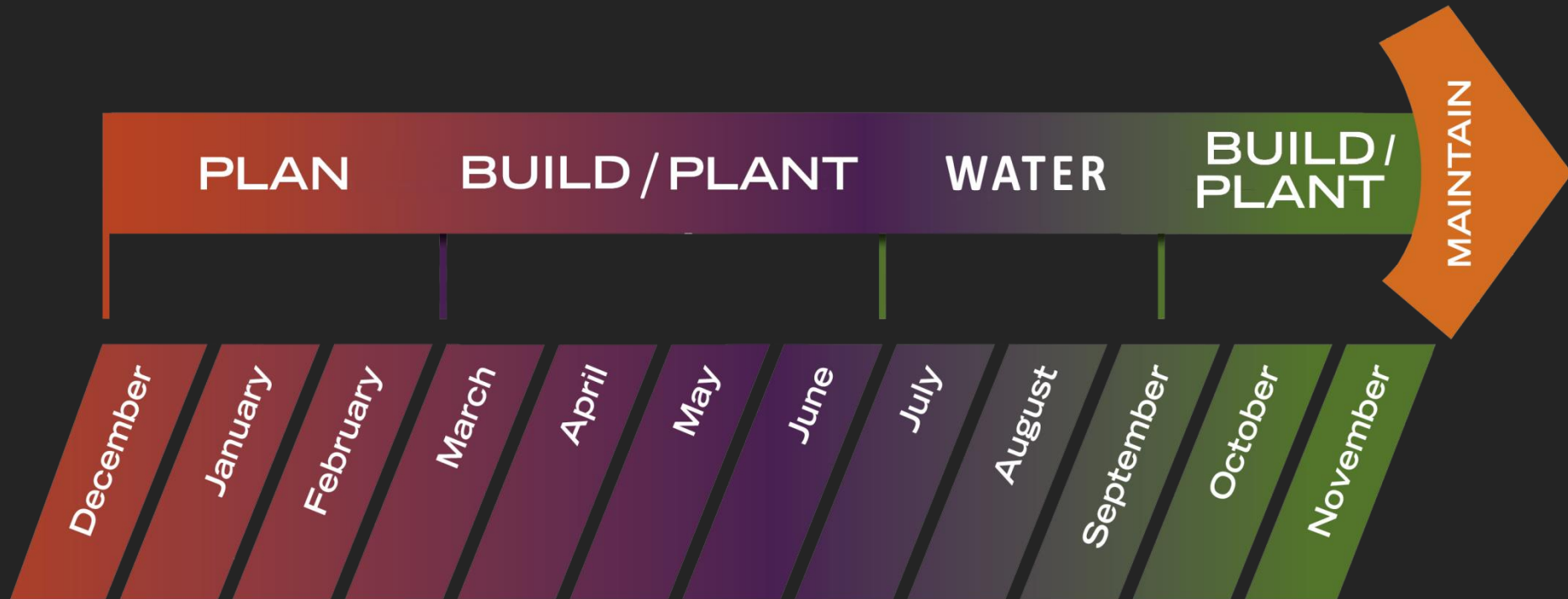


Rain Gardens: Plant selection and maintenance



Susan Kenzle, RLA, LI, ISA
Darcy Nuffer, RLA, LI, LEED AP

Timeline:



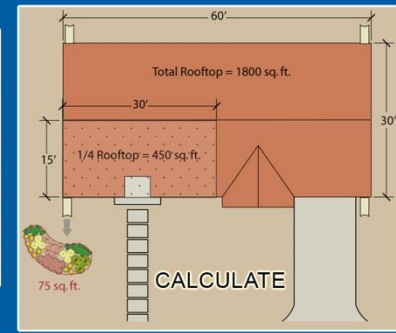
Adapted from *Rain garden Handbook for Western Washington*,
Washington State Department of Ecology, June 2013.

Steps



1

PLANNING & DESIGN



2

CONSTRUCTION



3

PLANT SELECTION & INSTALLATION



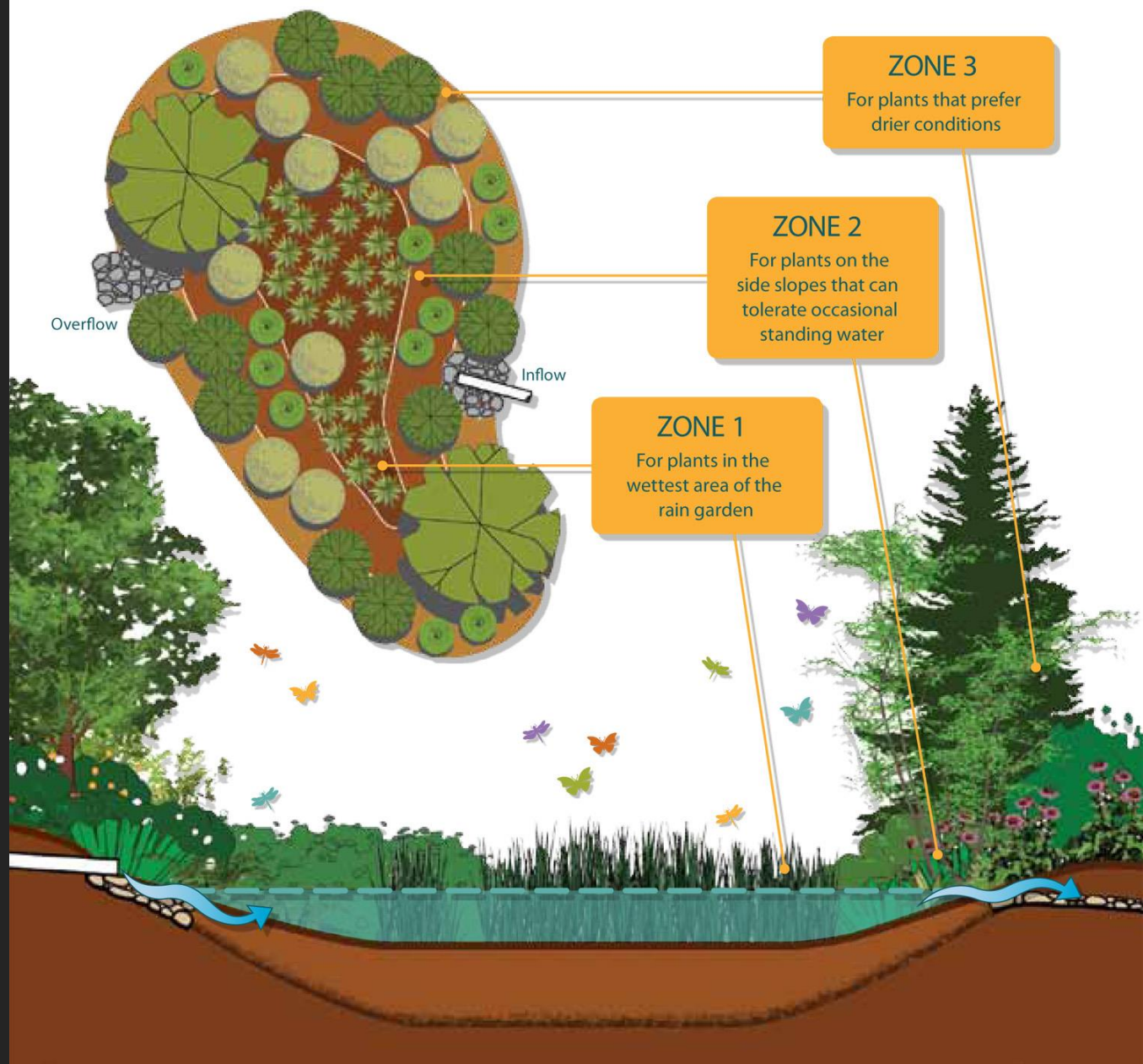
4

MAINTENANCE



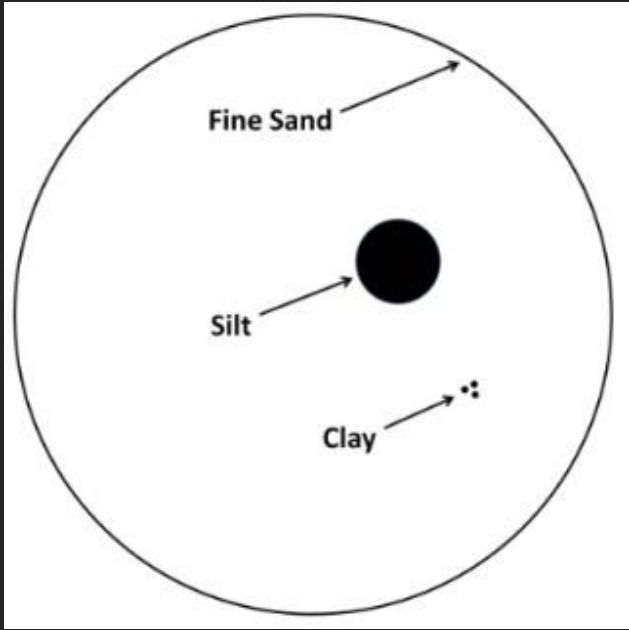
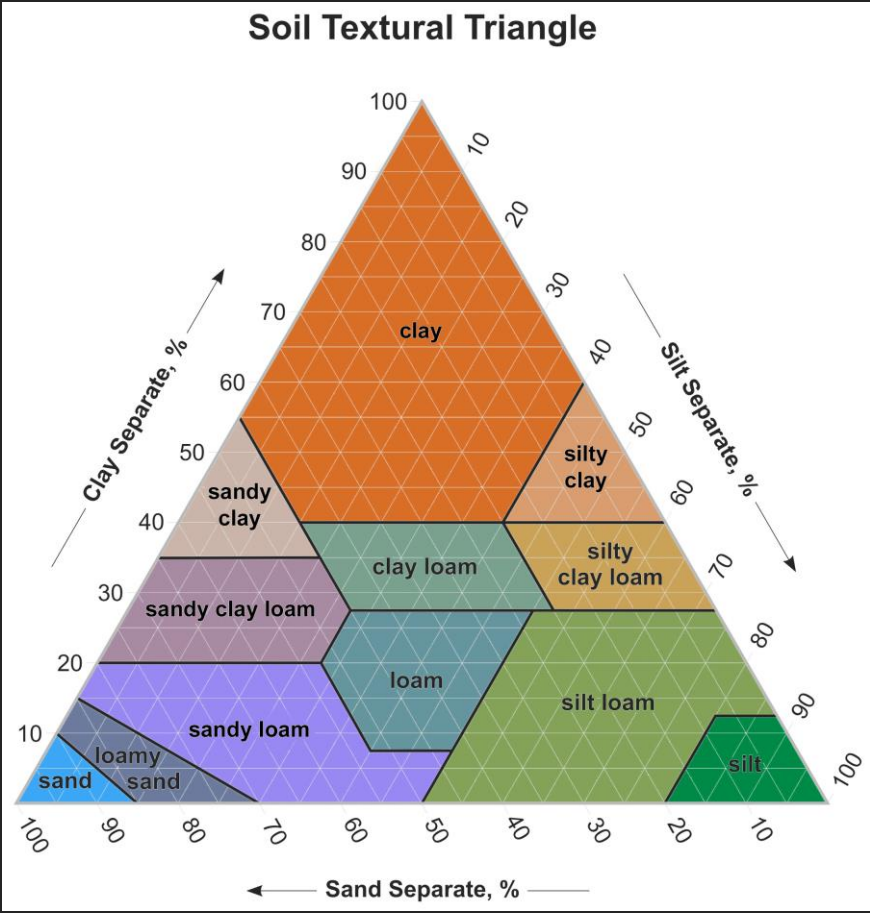
Photo: kirklandwa.gov

Planning: Inundation Zones



*Rain garden Handbook for Western Washington, Washington State
Department of Ecology, June 2013.*

Planning: Understanding Soil Texture

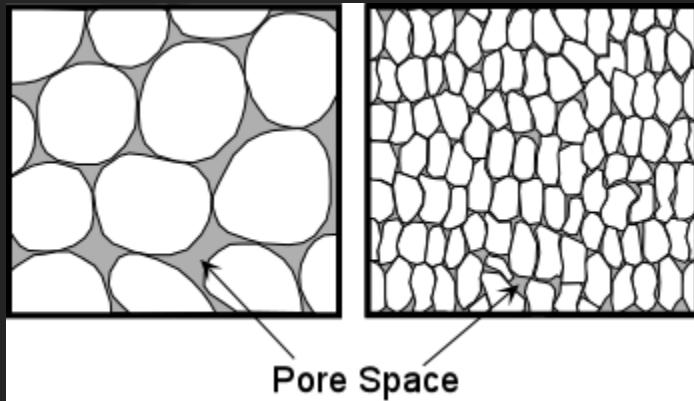


Whiting, D., Card, A., Wilson, C. Moravec, C., Reeder, J.
Managing Soil Tilth, Texture, Structure and Pore Space.
 Colorado Master Gardener Program 2011,
 Colorado State University Extension. CMG GardenNotes #213.

Planning: Soil Texture

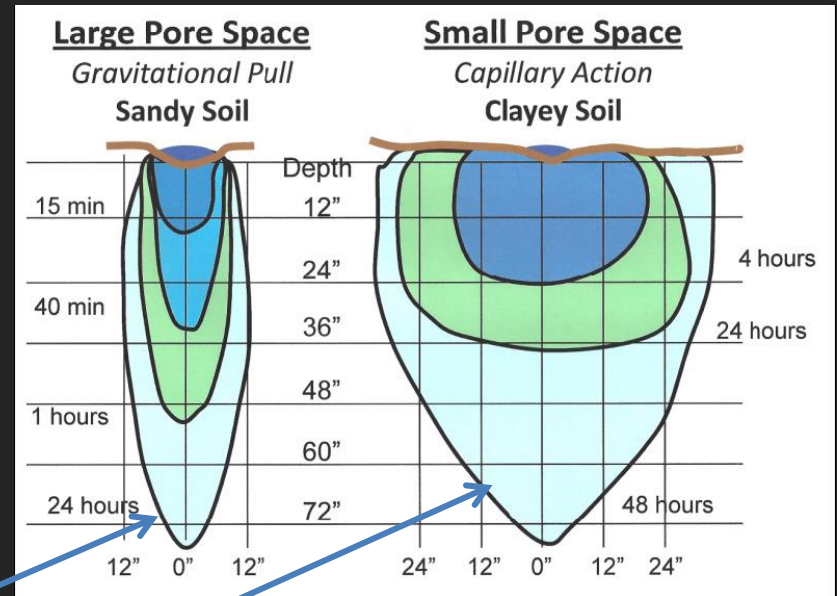
Sand

Clay



good drainage

poor drainage

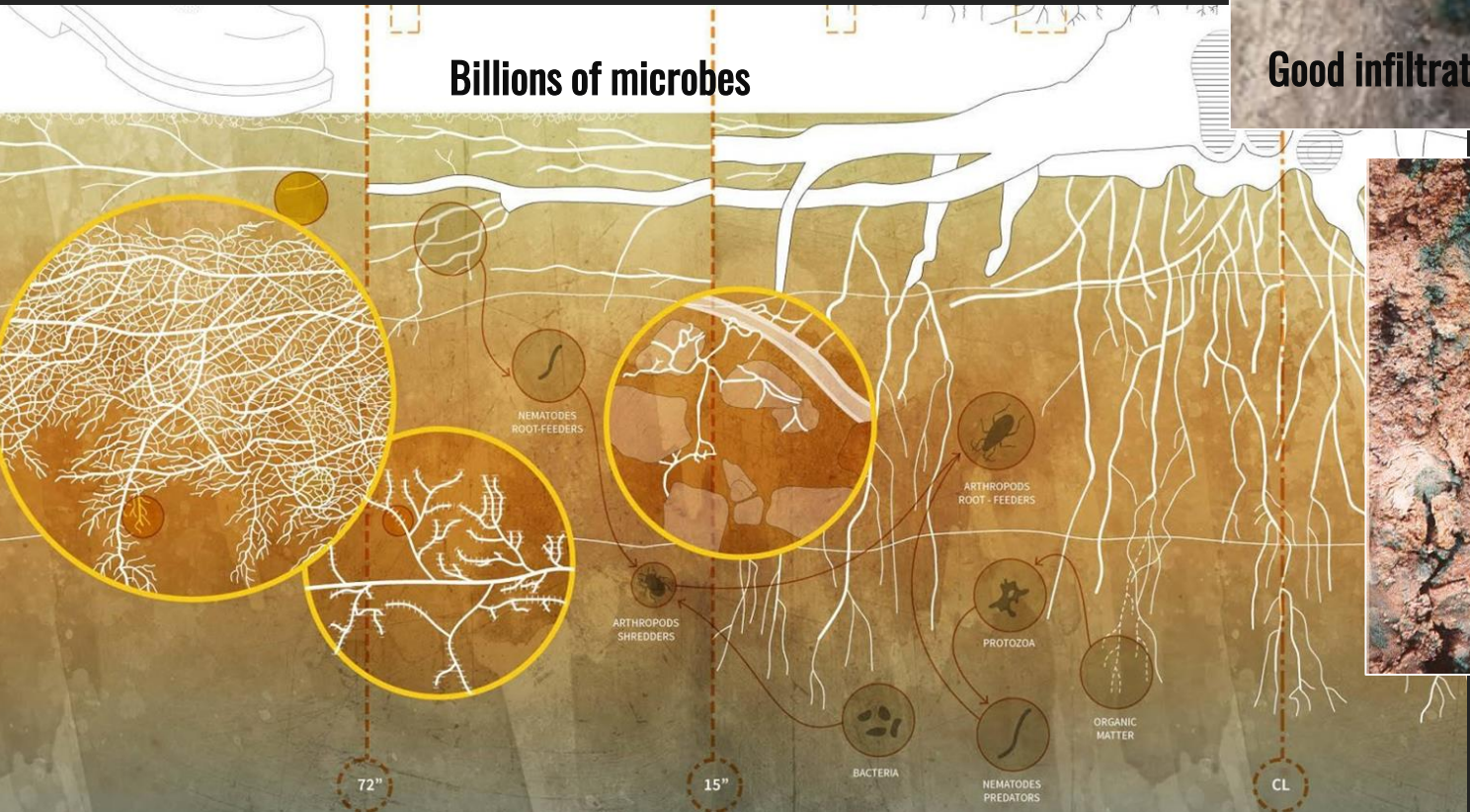


<http://www.tulane.edu/~sanelson/eens1110/groundwater.htm>

Whiting, D., Card, A., Wilson, C. Moravec, C., Reeder, J. Managing Soil Till, Texture, Structure and Pore Space. Colorado Master Gardner Program 2011, Colorado State University Extension. CMG GardenNotes #213.

Planning: Soil

Health rain garden soil has...



Planning: Exposure/Sun/Shade



PHOTOS: WPD staff, COA

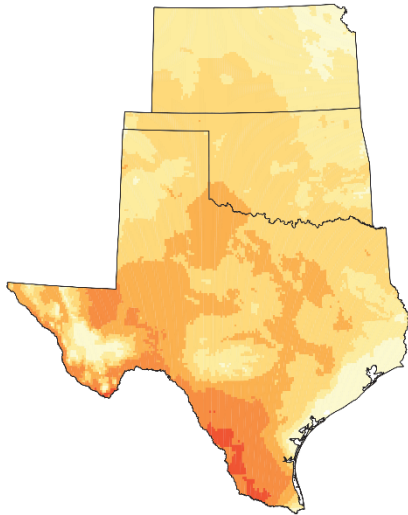
Planning: Central Texas Weather/Climate



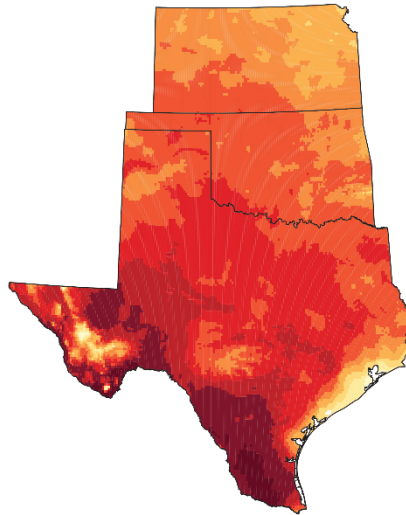
Planning: Central Texas Weather/Climate

Late 21st Century

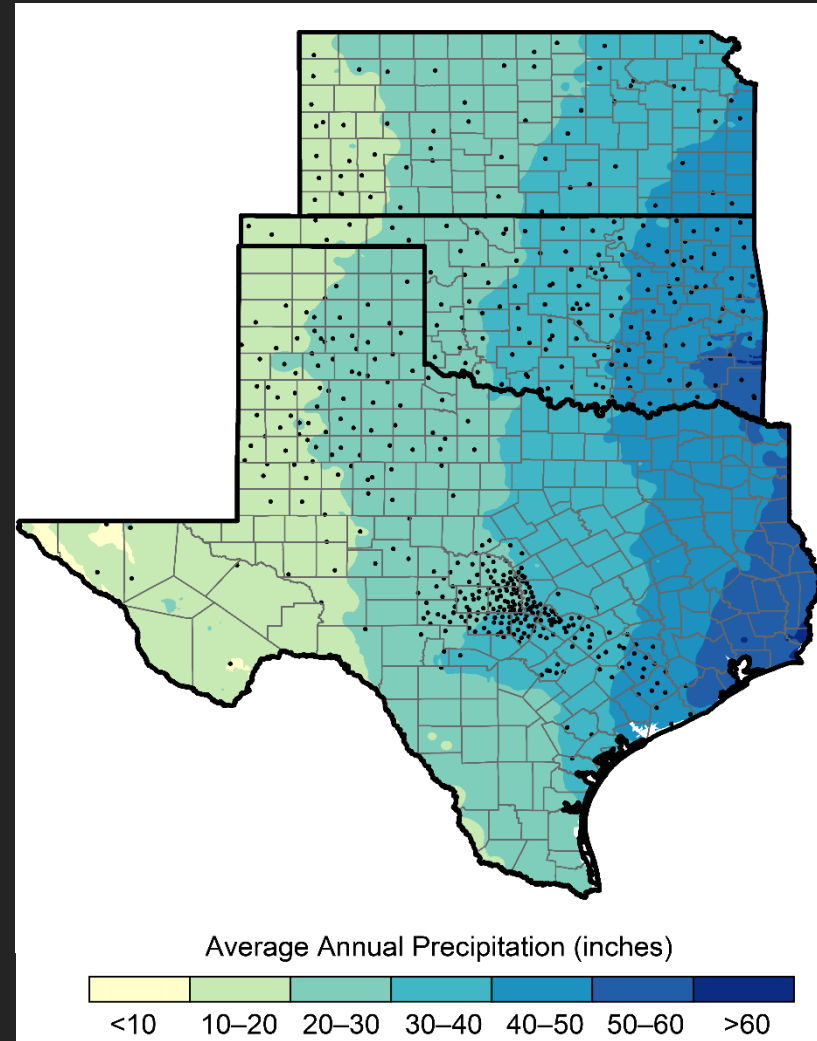
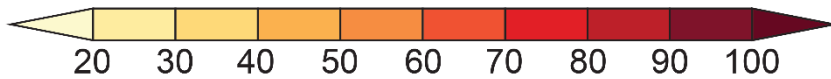
Lower Scenario
(RCP4.5)



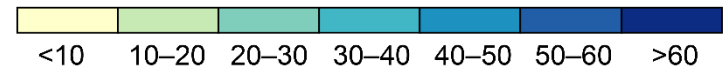
Higher Scenario
(RCP8.5)



Change in Number of Days



Average Annual Precipitation (inches)



Jan

Feb

Mar

Apr

May

Jun

Climate: Rainfall - extremely variable, comes in bursts

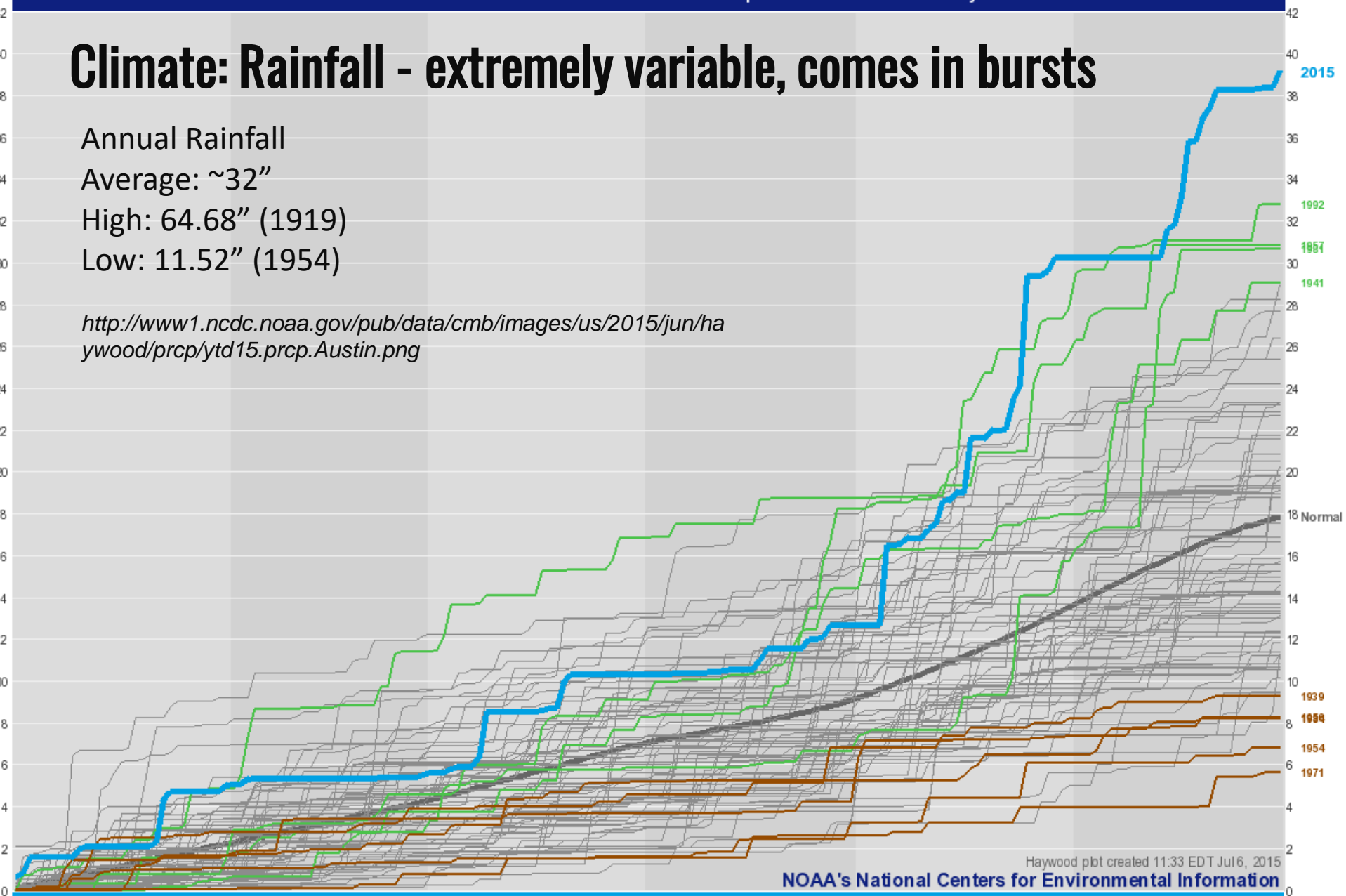
Annual Rainfall

Average: ~32"

High: 64.68" (1919)

Low: 11.52" (1954)

<http://www1.ncdc.noaa.gov/pub/data/cmb/images/us/2015/jun/haywood/prcp/ytd15.prcp.Austin.png>



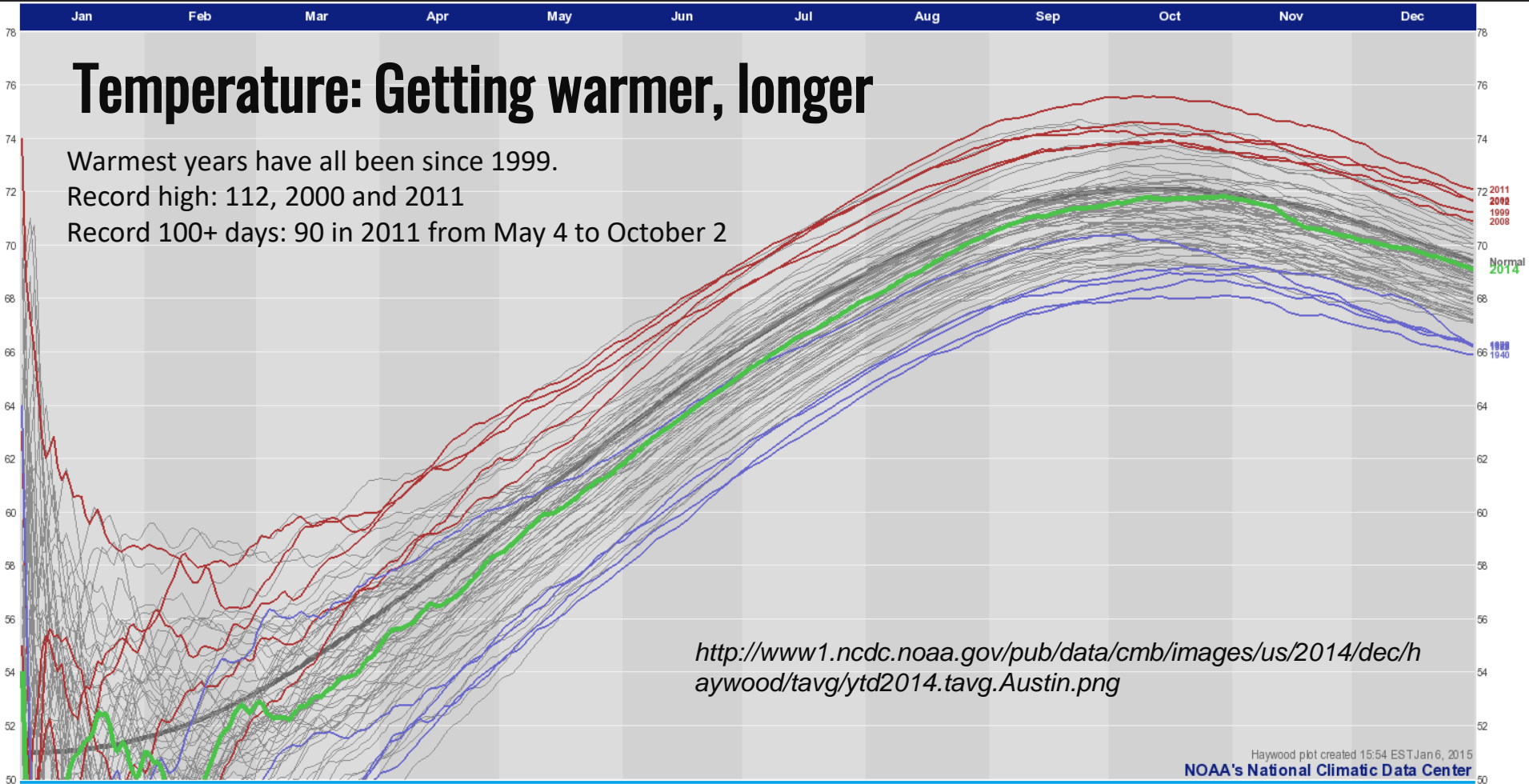
Precipitation (in) to Date for Austin, TX
 Jan 1 through Jun 30. Period of record is 1939 through 2015

5 wettest periods in mint: 2015 1992 1957 1981 1941
 5 driest periods in brown: 1971 1954 1964 1956 1939
 1981-2010 Normal underlaid in dark gray
 2015 period in NOAA Lite Blue

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Temperature: Getting warmer, longer

Warmest years have all been since 1999.
Record high: 112, 2000 and 2011
Record 100+ days: 90 in 2011 from May 4 to October 2



<http://www1.ncdc.noaa.gov/pub/data/cmb/images/us/2014/dec/haywood/tavg/ytd2014.tavg.Austin.png>

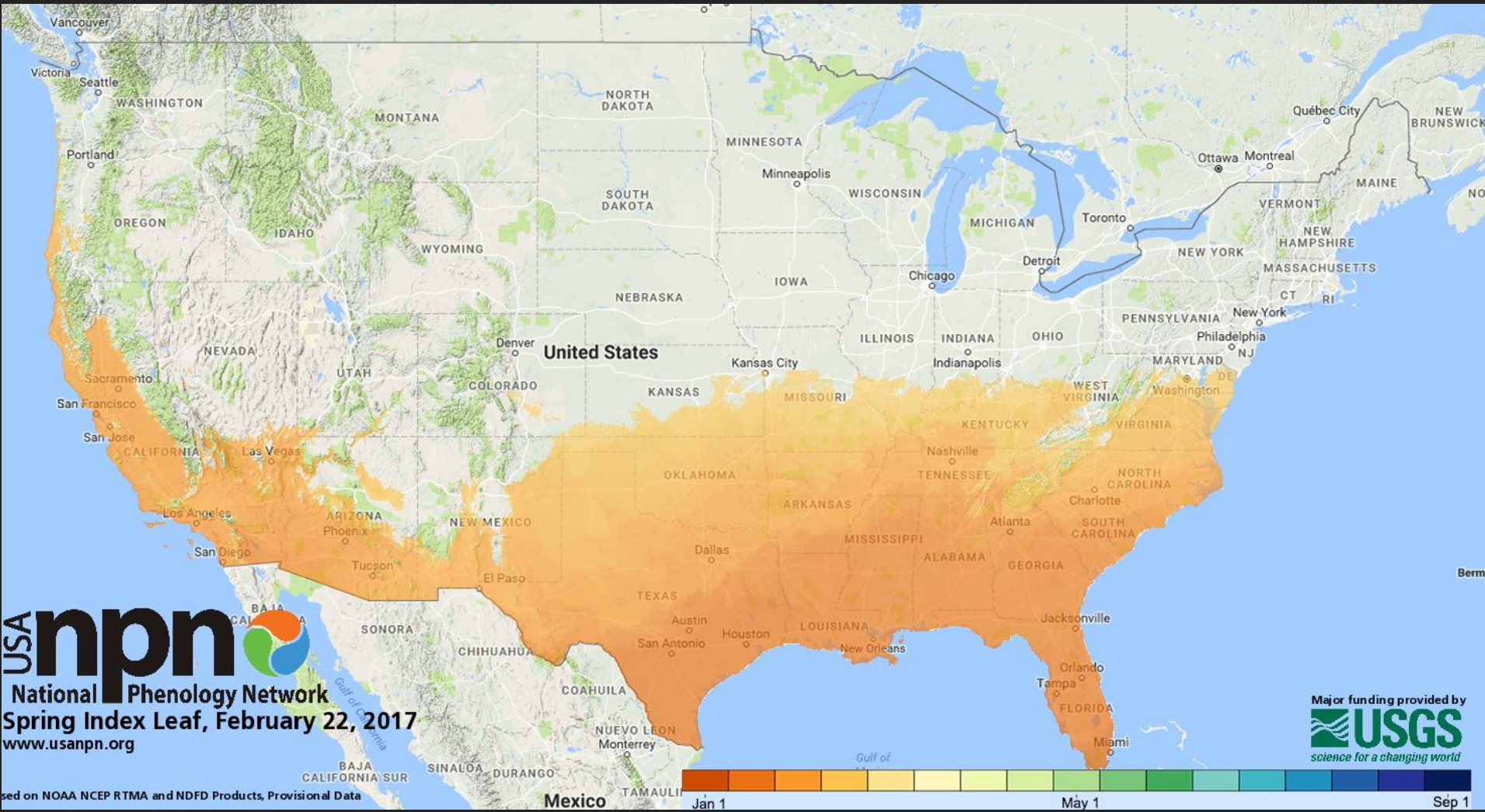
Haywood plot created 15:54 EST Jan 6, 2015
NOAA's National Climatic Data Center

5 warmest periods in crimson: 2011 2006 2012 1999 2008
5 coolest periods in cornflower: 1979 1968 1983 1976 1940
1981-2010 Normal underlaid in dark gray
2014 period in mint



Average Temperature (F) to Date for Austin, TX
Jan 1 through Dec 31. Period of record is 1939 through 2014

Plan for the Future, not the past



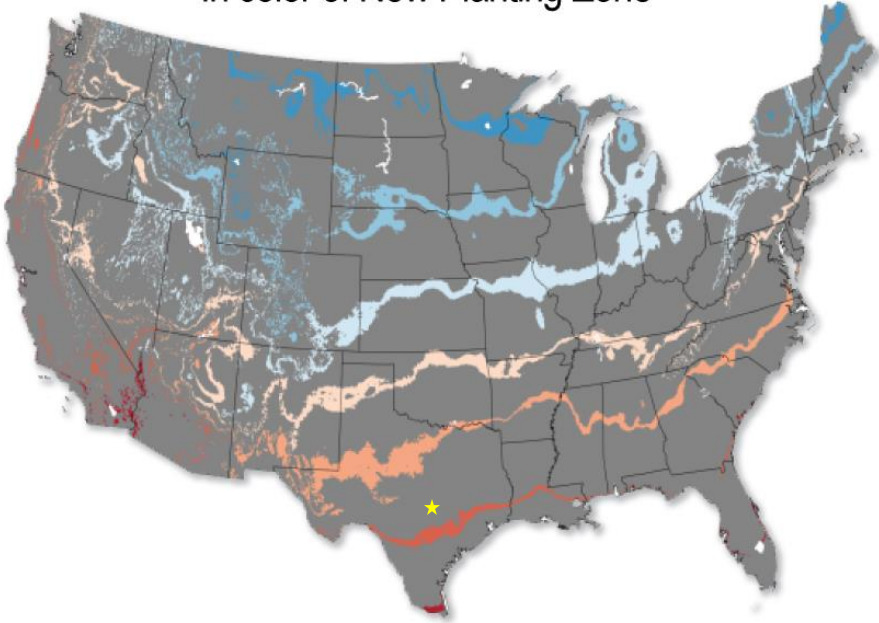
Spring index leaf-out



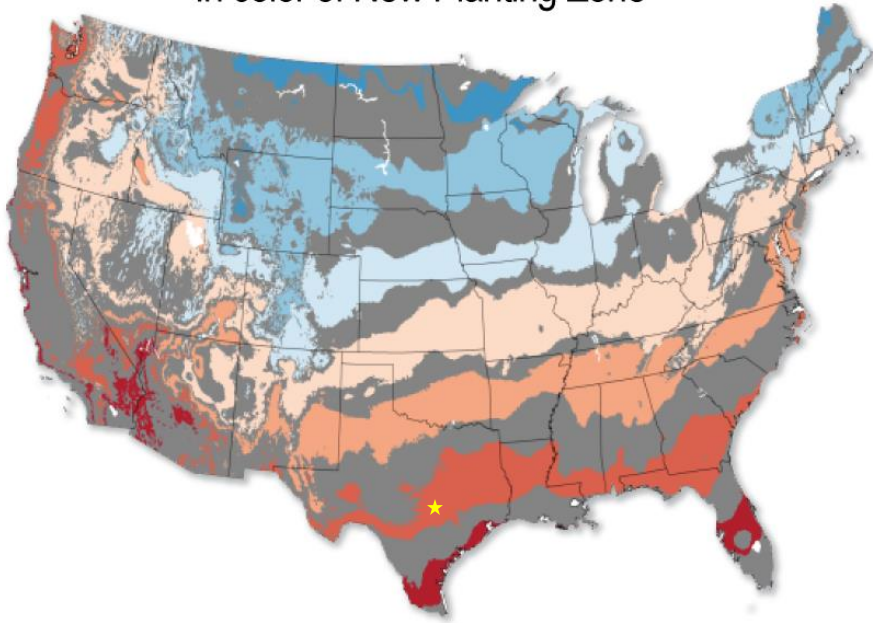
Plan for the Future, not the past

Shift in Plant Hardiness Zones

Zone Changes in Past 10 Years
In color of New Planting Zone



Zone Changes in Next 30 Years
In color of New Planting Zone



Average Annual Extreme Minimum Temperature by Climate-Related Planting Zone

- No Change in Zone
- Zone 4 (-29 to -20 °F)
- Zone 5 (-19 to -10 °F)
- Zone 6 (-9 to 0 °F)
- Zone 7 (1 to 10 °F)
- Zone 8 (11 to 20 °F)
- Zone 9 (21 to 30 °F)
- Zone 10 (31 to 40 °F)

LEFT: change in Plant Hardiness Zones calculated from those based on the 1971-2000 climate to those based on the 1981-2010 climate. **RIGHT:** greater changes over the next 30 years. (Figure source: NOAA).

Plan for the Future, not the past

National Climate Assessment (2019), put together by more than a dozen federal agencies and more than 300 scientists found that, left unchecked, climate change will have dangerous results for the Southern Great Plains, which includes Texas.

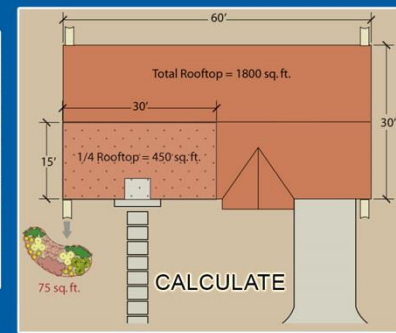
The report finds:

- Annual average temperatures will increase by 3.6°–5.1°F by the mid-21st century and by 4.4°–8.4°F by the late 21st century
- An additional 30–60 days per year above 100°F than we currently experience
- Extreme heat will pose health risks to outdoor agricultural workers
- The Edwards Aquifer will suffer from “a decrease of water supply during droughts, a degradation of habitat for species of concern, economic effects, and the interconnectivity of these impacts.”

Steps

1

PLANNING & DESIGN



2

CONSTRUCTION



3

PLANT SELECTION & INSTALLATION



4

MAINTENANCE



Photo: kirklandwa.gov

Plant Selection



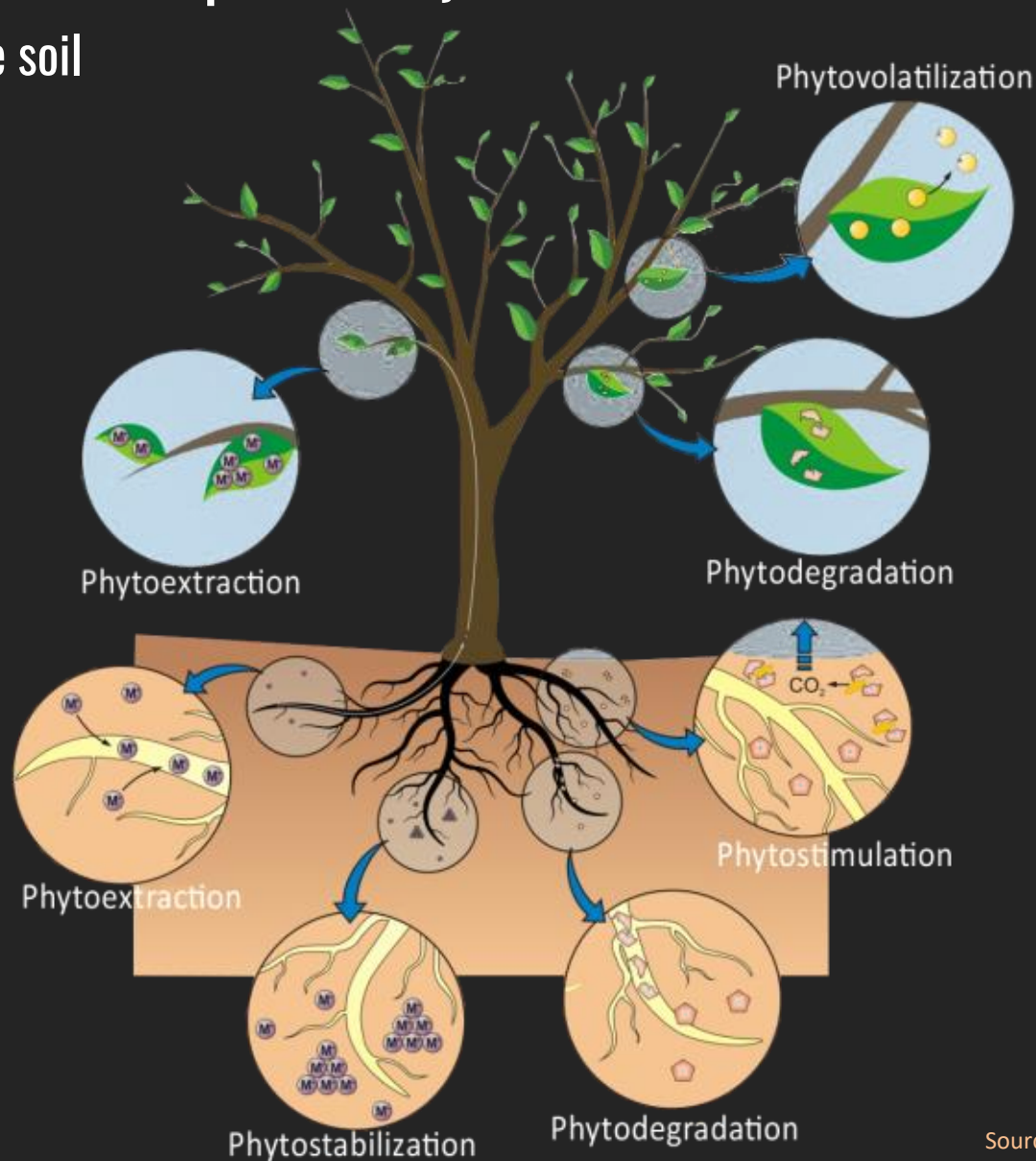
<http://beckleysanitaryboard.org/info/education/rain-garden/>



City of Austin

Plant Selection

- Plants are an *essential* component – they filter and clean stormwater & soil
- They stabilize the soil



Plant Selection

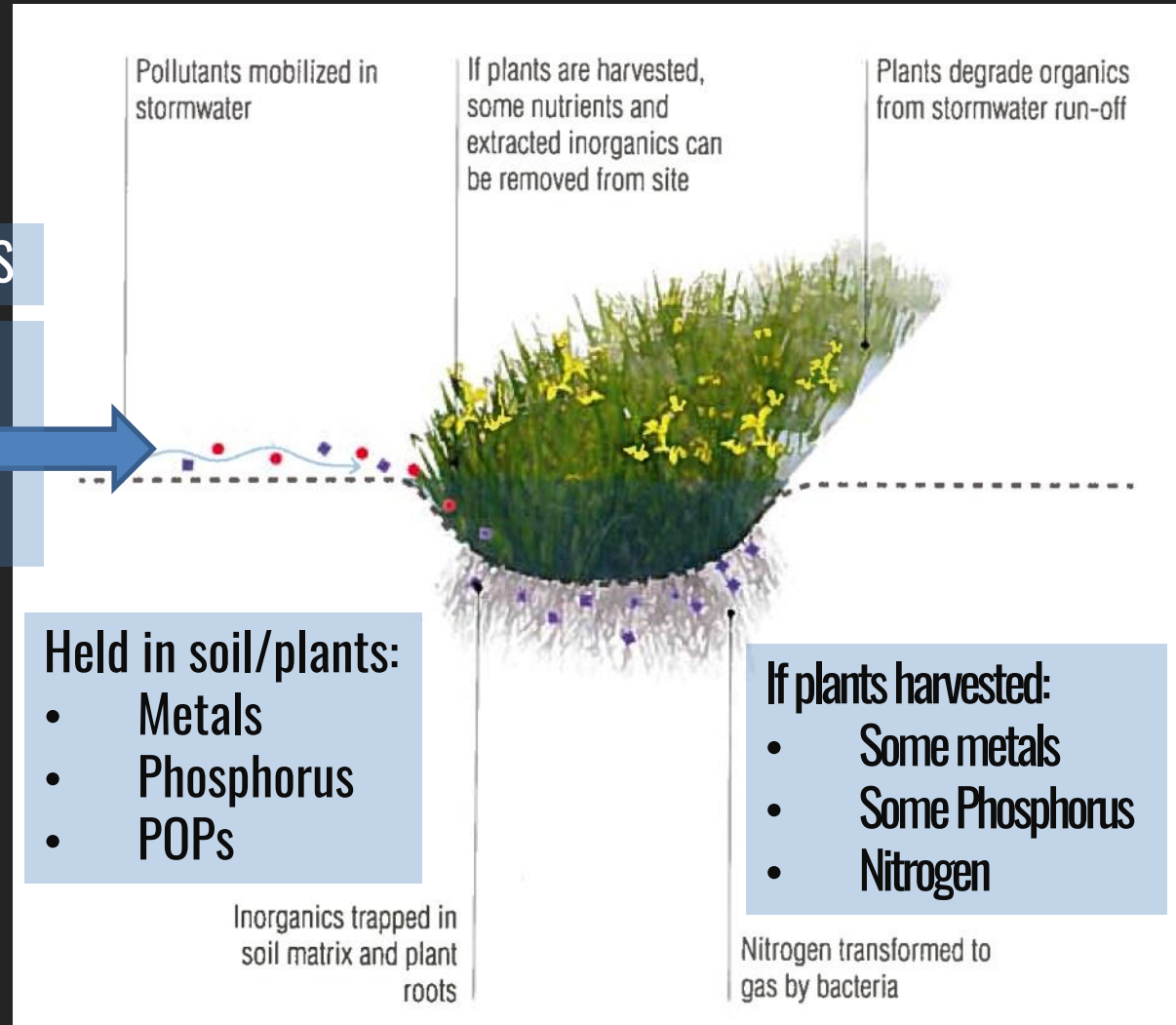
- Plants are an *essential* component – they filter and clean stormwater & soil

Stormwater Filter

ROADSIDES, PARKING LOTS

- Nutrients
- Petroleum PAHs
- Metals

PAHs = Polycyclic aromatic hydrocarbon.
POPs = Persistent Organic Pollutants.



Plant Selection

- Plants with *fibrous* root systems are very beneficial (e.g., bunch grasses, sedges)
- Plant roots will maintain and increase porosity

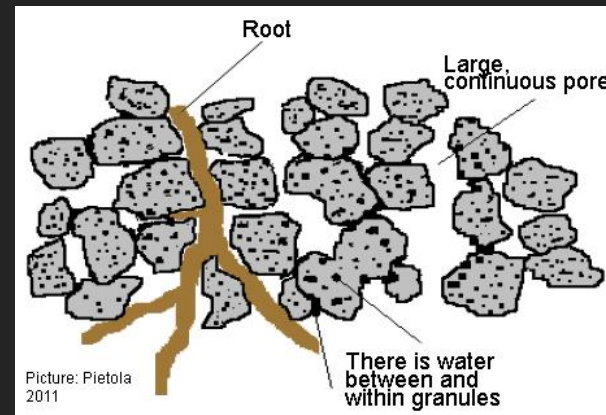
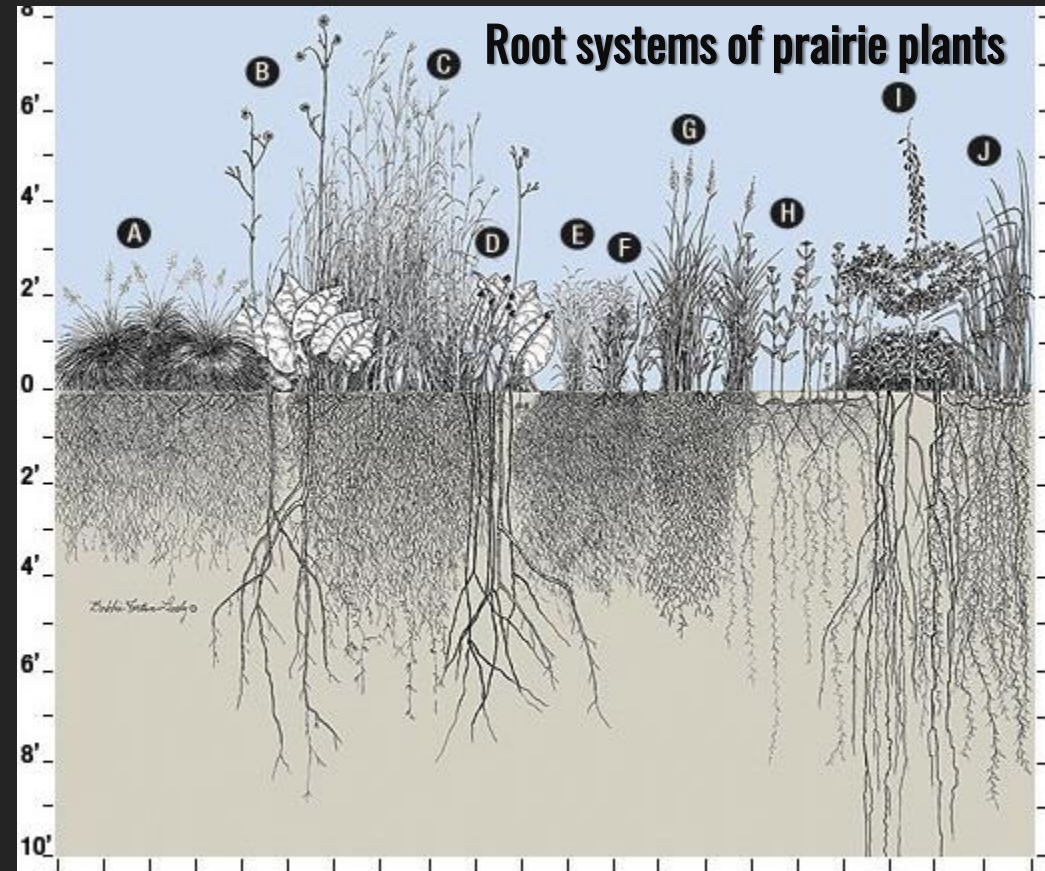


Photo: S. Kenzle, City of Austin

Sedge with fibrous roots



Source: Studio Dunn Design

- | | | | | |
|---------------------|----------------------|---------------------|--------------------|-----------------------|
| A. Prairie Dropseed | C. Big Bluestem | E. Little Bluestem | G. Indiangrass | I. White False Indigo |
| B. Prairie Dock | D. Purple Coneflower | F. Black-eyed Susan | H. Showy Sunflower | J. Prairie Cordgrass |

Plant Selection



Source: www.theareofspadeslawncare.com

Turfgrass roots

vs

Switchgrass roots



Source: www.wikipedia.org

Plant Selection

- Diversity of plant types:
 - Type: small trees, shrubs, perennials, bunch grasses, groundcover
 - Leaf Retention: evergreen, semi-evergreen, deciduous



Plant Selection: Plant Guide

grow green

Native and Adapted
Landscape Plants

Find your perfect plant with our online search tool!

an earthwise guide for Central Texas

growgreen.org

City of Austin

Texas A&M AgrLife Extension Service

Plant Selection: Other

The screenshot shows the top navigation bar of the Lady Bird Johnson Wildflower Center website. It includes icons for Shop, Interact, Rental, SITES™, and Contact. Below the navigation bar is a search bar with a 'Go' button and a language selector for 'En Español'. The main content area is titled 'NATIVE PLANT DATABASE' and features a large image of a pink and orange flower. To the left of the image is a list of links: About NPIN, Bibliography, Botanical Glossary, Drought Resources Center, How To Articles, Image Gallery, and Mr. Smarty Plants. To the right of the image is a welcome message and a link to 'Recommended Species Lists'.

BENEFIT

Use Ornamental: Showy, Attractive, Color, Pocket prairie, Perennial garden, Wildflower meadow

Use Wildlife: This species is palatable to deer and numerous species of birds who eat the seeds. It is also a useful wildlife cover plant. Nectar-Bees, Nectar-Butterflies

Conspicuous Flowers: yes

Attracts: Birds

Nectar Source: yes

Deer Resistant: Moderate

VALUE TO BENEFICIAL INSECTS

Special Value to Native Bees

Special Value to Honey Bees

This information was provided by the Pollinator Program at The Xerces Society for Invertebrate Conservation.

Duration (mespary)

All durations

- Dry - soil does not exhibit visible signs of moisture
- Moist - soil looks and feels damp
- Wet - soil is saturated with water

Bloom Characteristics

Bloom Time: Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Bloom Color: White Red Pink Orange Yellow Green Blue Purple Violet Brown Black

Leaf Characteristics

Leaf Arrangement: Alternate Opposite Whorled Fascicled

Leaf Retention: Deciduous Evergreen Semi-evergreen

Size Characteristics

Height: 0-1 ft. 1-3 ft. 3-6 ft. 6-12 ft. 12-36 ft. 36-72 ft. 72-100 ft. More than 100 ft.

Planting Design:

for Clayey Zone 1: tolerate inundation,
poor drainage:

- Switchgrass
- Indian grass
- Inland sea oats
- Eastern gamagrass
- Meadow sedge
- Fall obedient plant
- Blue Mistflower
- Frog fruit
- Turk's Cap
- Dwarf palmetto
- Wax myrtle



Fall Obedient Plant



Inland Sea Oats



Indian Grass



Blue Mistflower



Dwarf palmetto

Photos: www.wildflower.org

Planting Design:

Plants for Sandy Zone 1 or Zone 2:
Upland or tolerate inundation with
better drainage:

- Autumn sage
- Big Muhly
- Gulf Muhly
- Maximillian sunflower
- Meadow sedge
- Pigeonberry
- Sideoats Grama
- Yucca sp.
- Turk's Cap



Photos: www.wildflower.org, gulfcoastprairielcc.org

Plant Installation

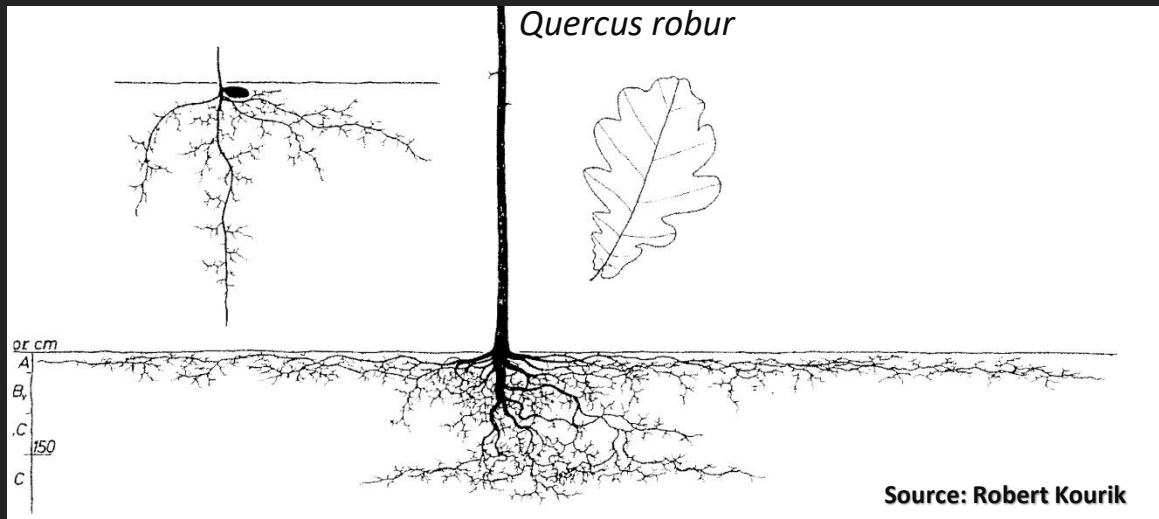


- Choose, space, and install plants with their mature size in mind. Overly large plants can require more maintenance later.
- Near roads, sidewalks, driveways – mature plants:
 - Do not block viewers for drivers, pedestrians, cyclists;
 - Do not grow over roads, sidewalks to impede travel.

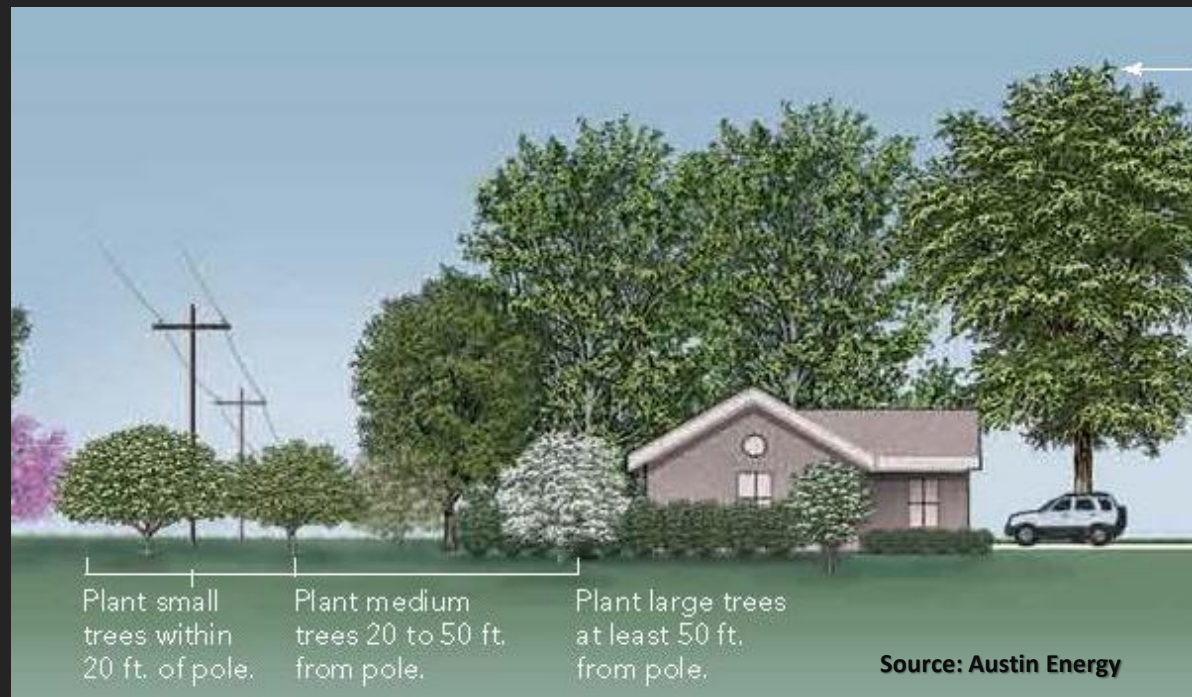
www.thedangergarden.com

Plant Installation

- Avoid planting in the root zones of existing trees. Most are shallow (8-24") & extensive.



- Be mindful of overhead and underground utilities. Call before you dig!



Plant Installation: spacing, layout



Photo: homegrownlandscapes.files

Layout plants per their mature size



OR

Do maintenance later

Photo: L. Nehring, TerraSystems

Plant Installation: irrigation

Supplemental water is essential to get plants acclimated to new home – from pampered to roughing it



Photo: blog.savatree.com

Nursery Plants – constantly watered, pampered



Photo: backtotheroots.com



Photo: robbinspark.wikispaces.com

Opportunities - Pollinators:

Pollinators = bees, butterflies, birds, bats.

“...managed honeybee colonies have seen annual losses of 42.1%, and there has been a 90% decline in the monarch butterfly population” (*National Strategy to Promote the Health of Honey Bees and Other Pollinators*, U.S. government report, 2015)

“Pollinators, most often honeybees, are also responsible for one in every three bites of food we take...” (*National Strategy to Promote the Health of Honey Bees and Other Pollinators*, U.S. government report, 2015)



Photo: Tallamy

Photo: S. Kenzie, City of Austin

Rain Garden Pollinator plant list for Central Texas

Small Trees:

- Cherry (*Prunus*)
- Anacacho Orchid (*Bauhinia lunarioides*)
- Anacua (*Ehretia anacua*)
- Arroyo Sweetwood (*Myrosporum soursanum*)
- Carolina Buckthorn (*Frangula caroliniana*)

Woody Shrubs:

- Rose (*Rosa*)
- Turk's Cap (*Malvaviscus arboreus*)

Herbaceous:

- Goldenrod (*Solidago*)
- Asters (*Aster*)
- Sunflower (*Helianthus*)
- Violets (*Viola*)
- Sedges (*Carex*)
- Black-eyed Susan (*Rudbeckia*)
- Iris (*Iris*)
- Evening Primrose (*Oenothera*)
- Milkweed (*Asclepias*) *expensive, not readily available
- Verbena (*Verbena*)
- Penstemon (*Penstemon*)
- Phlox (*Phlox*)
- Bee balm (*Monarda*)
- Little Bluestem (*Schizachyrium*)
- Cardinal flower (*Lobelia*)
- Mealy Blue Sage (*Salvia farinacea*)

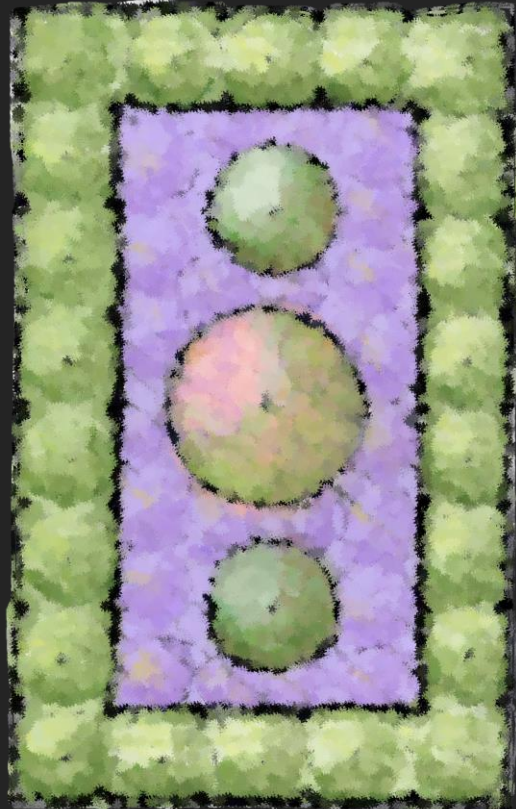


For more:

<https://www.wildflower.org/project/pollinator-conservation>

Opportunities - Aesthetics:

Formal

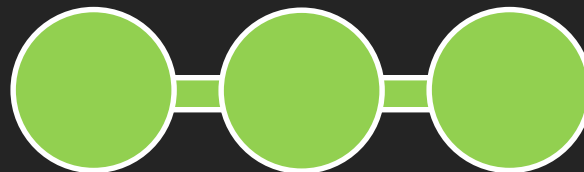


Source: Low Impact Development Center, Inc.
lowimpactdevelopment.org



Formal rain garden, Wildflower Terrace, Austin

Photo: S. Kenzle, COA

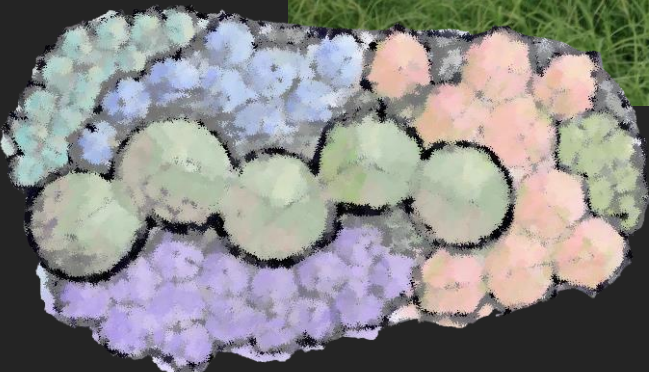


Opportunities - Aesthetics:

Informal \ Naturalized



J.J. Pickle Elementary School



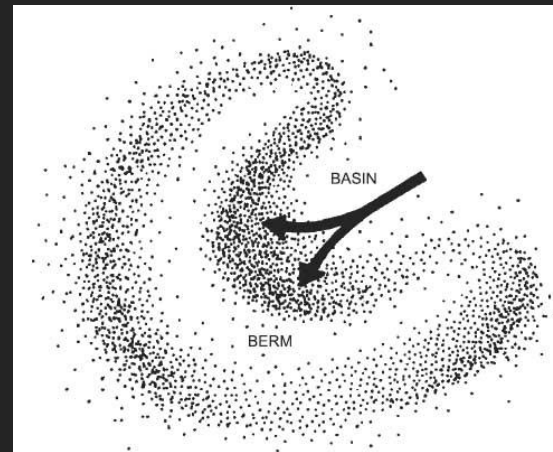
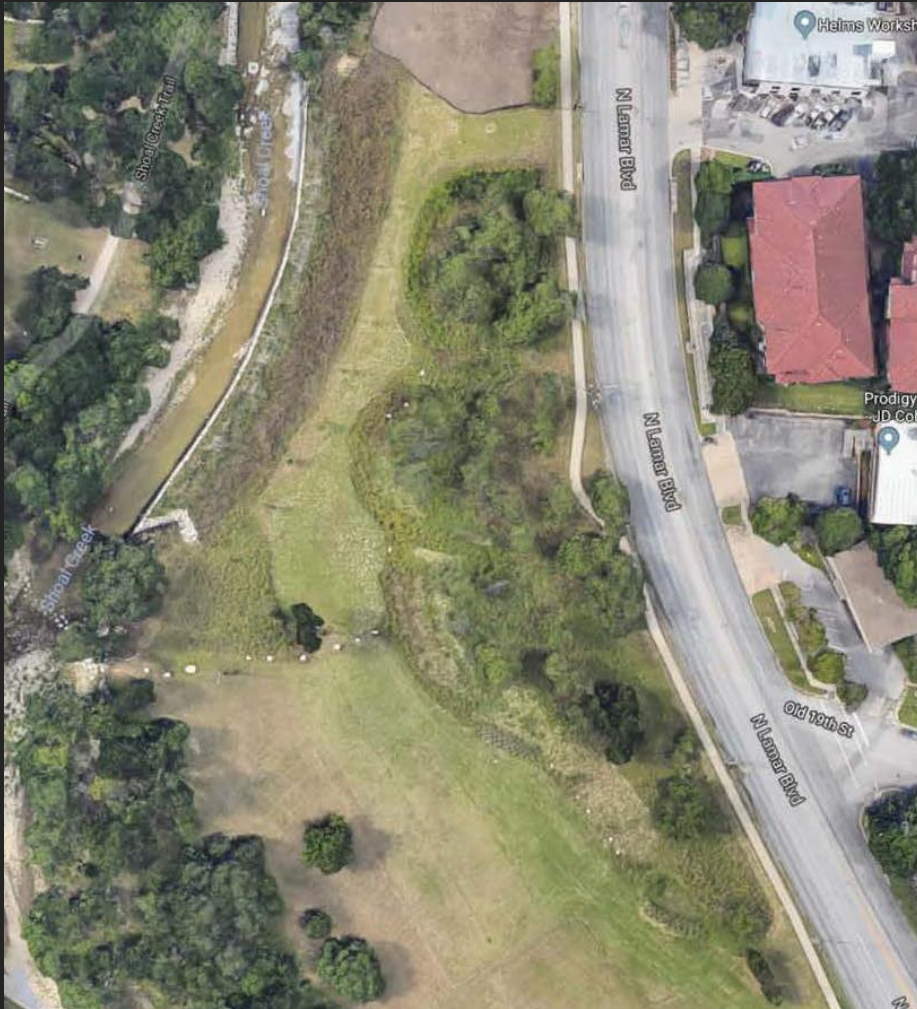
Opportunities - Aesthetics:

Fit with Topography



Photo: Susan Kenzle, City of Austin

Green Stormwater Management – Land Sculpting:



Green Stormwater Management – Land Sculpting:



slow the rain,
direct the rain,
let it soak in

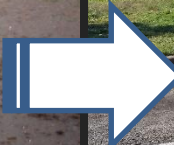
**Berms, Infiltration Meadows,
Soil Decompaction**



Zilker Disc Course - before



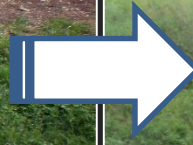
Zilker Disc Course - after



Zilker Disc Course - before



Zilker Disc Course - after



Check Dam

Green Stormwater Management – Land Sculpting:



Rain catcher
champions



Log terracing

Zilker Disc Golf



Dry Streambed

One Texas Center

Infiltration Meadow

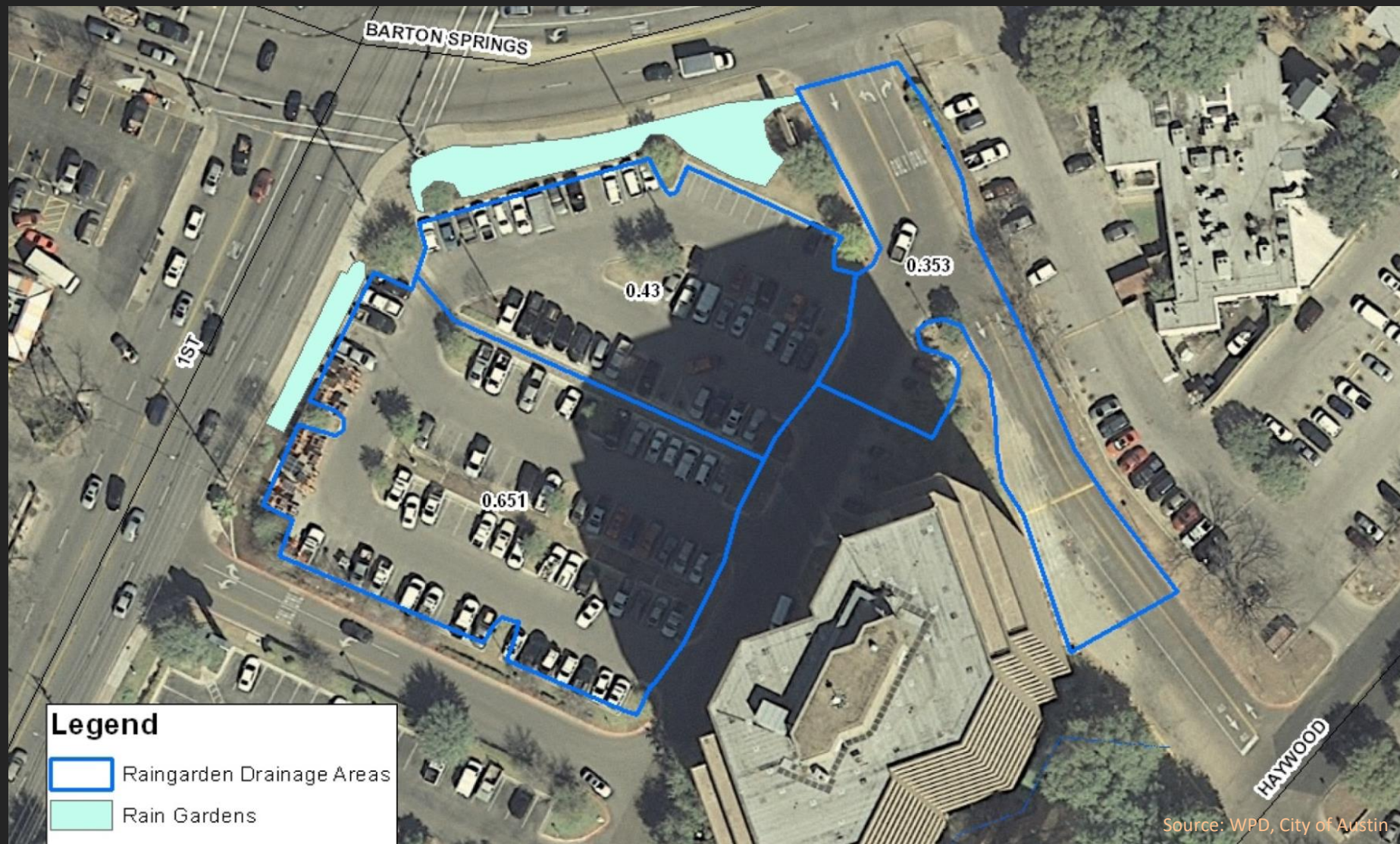


Zilker Disc Golf

PHOTO CREDITS: City of Austin

Case Study – One Texas Center rain gardens

- Constructed & planted in 2012
- irrigated for 1 year for establishment + in years of drought and new plant establishment
- gets regular maintenance : trash and leaf collection; mulching; weeding



Case Study – One Texas Center rain gardens



Case Study – One Texas Center rain gardens



Case Study – One Texas Center rain gardens



Spring



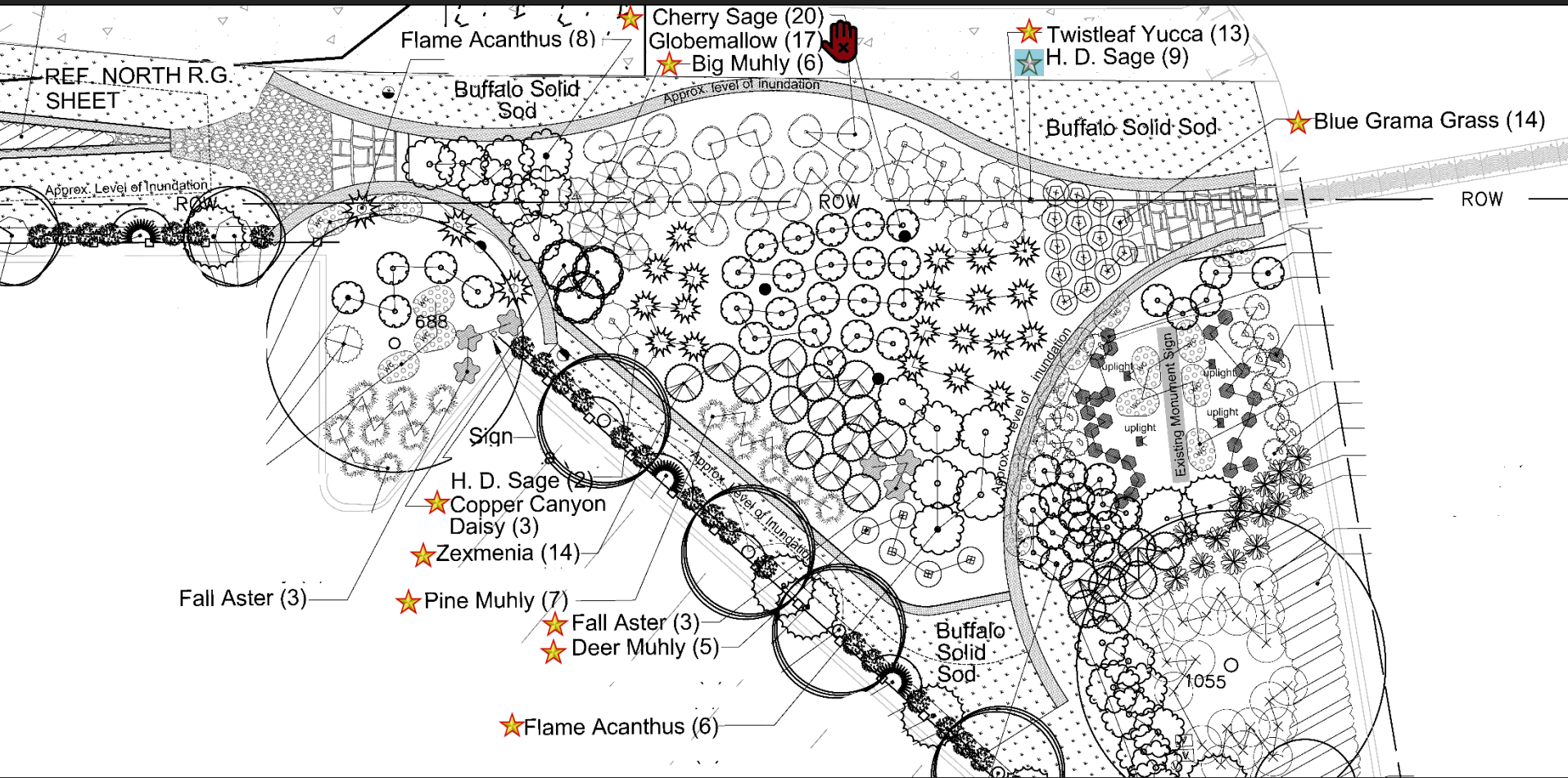
Summer



Winter

Photos: S. Kenzle, City of Austin

Case Study – One Texas Center rain gardens



 Performs well for 2-3 years.

 Consistently performs well.  Avoid.

Case Study – One Texas Center rain gardens



Big muhly



Twist-leaf yucca

Blue salvia

Blue grama



bluebonnets



Flame acanthus

Red salvia



Yaupon Holly



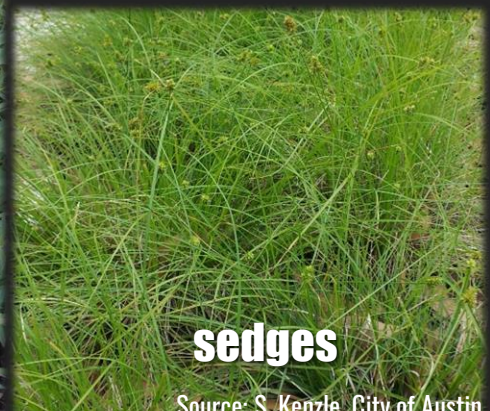
Inland seaots



Mexican hat



Zexmenia

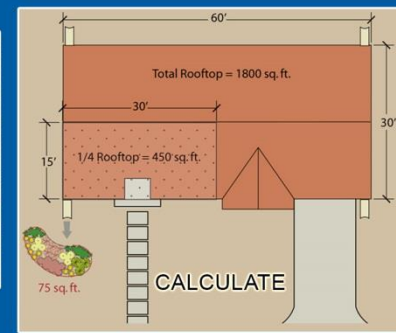


sedges

Steps

1

PLANNING & DESIGN



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Photo: kirklandwa.gov

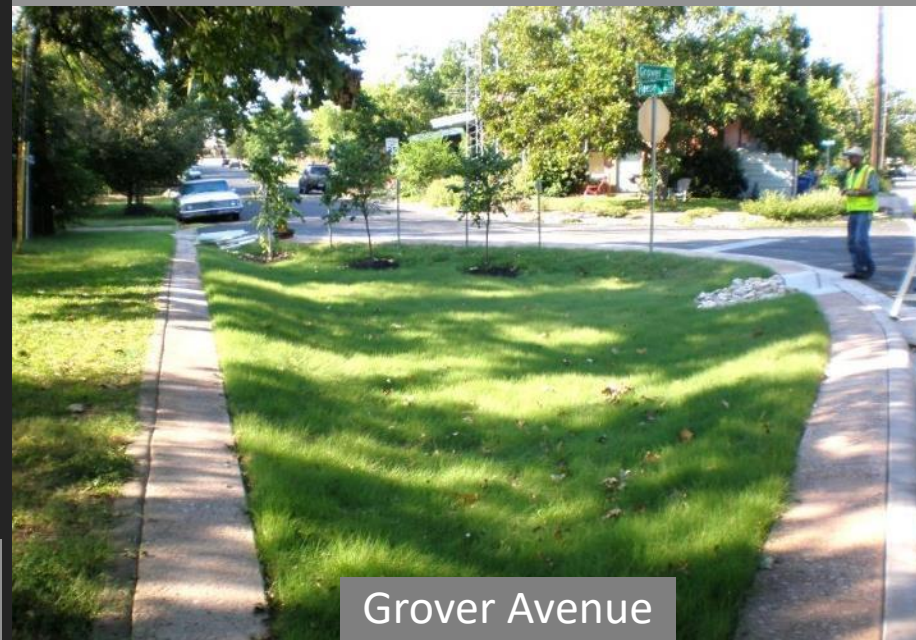


Types

Simple

- Shallow basin
- Infiltration
- Mainly turf

- Structural
- Connected to storm drain
- Plant diversity



Grover Avenue

Complex



JJ Seabrook

Types

Commercial



Harmon Ave.

Residential



Solvita
Townhomes

Parks



Bull Creek Park

Types

Roadways



Spirit of Austin Blvd

Municipal



Northwest Recreation Center

Inspection

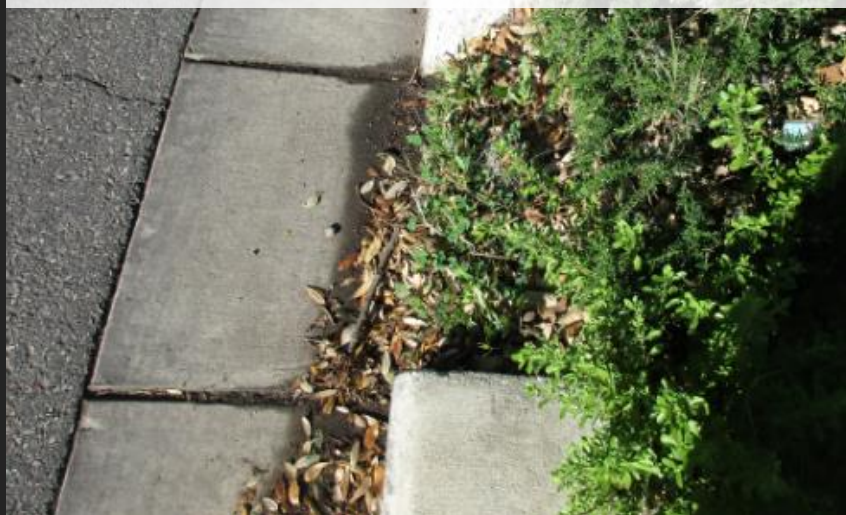
Inspections should occur after large rain events
OR at least 2-3 times per year



Inspections should look at the following:

- Vegetation blocking the inflow OR outflow
- Scoured areas OR areas where the mulch washed away
- Sediment more than 3'' deep in basin bottom
- Woody plants growing too close to inflow or walls
- Dead vegetation or bare areas >10 sq. ft.
- Function - is the rain garden draining 48 hours after storm?
- Presence of weeds OR invasives
- Sediment OR debris in the inlet
- Plants obstructing sidewalks OR access points

VEGETATION BLOCKING INFLOW



SCOURING AROUND INFLOW



SEDIMENT DEPOSITED IN BASIN



WOODY PLANTS BLOCKING INFLOW



Inspection

BARE AREAS GREATER THAN 10 SQ
FT



WEEDS OR INVASIVES



SEDIMENT BLOCKING INFLOW



PLANTS OBSTRUCTING SIDEWALKS /ACCESS



Maintenance

Leaves



Suckering plants



Fruit, Nuts (acorns)



Maintenance

Plant Replacement



Some plants do not do well. Many are not long-lived or do not seed or spread. Some succumb to drought.

Photos: S. Kenzle, City of Austin

Weeding



Plants Over Sidewalk





Questions?

Discussion

Susan Kenzle, RLA, LI, ISA
Darcy Nuffer, RLA, LI, LEED AP

susan.kenzle@austintexas.gov
darcy.nuffer@austintexas.gov

