

# **Quality of Life in Boerne**

## **Rainwater Harvesting**

### **Boerne – Samuel V. Champion High School**

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Jeff Haberstroh – Boerne Independent School District

Kent Niemann, AIA – Pfluger Associates Architects

Mark Oppelt, AIA, LEED-AP, REFP – O'Neill, Conrad, Oppelt Architects



# Design Parameters

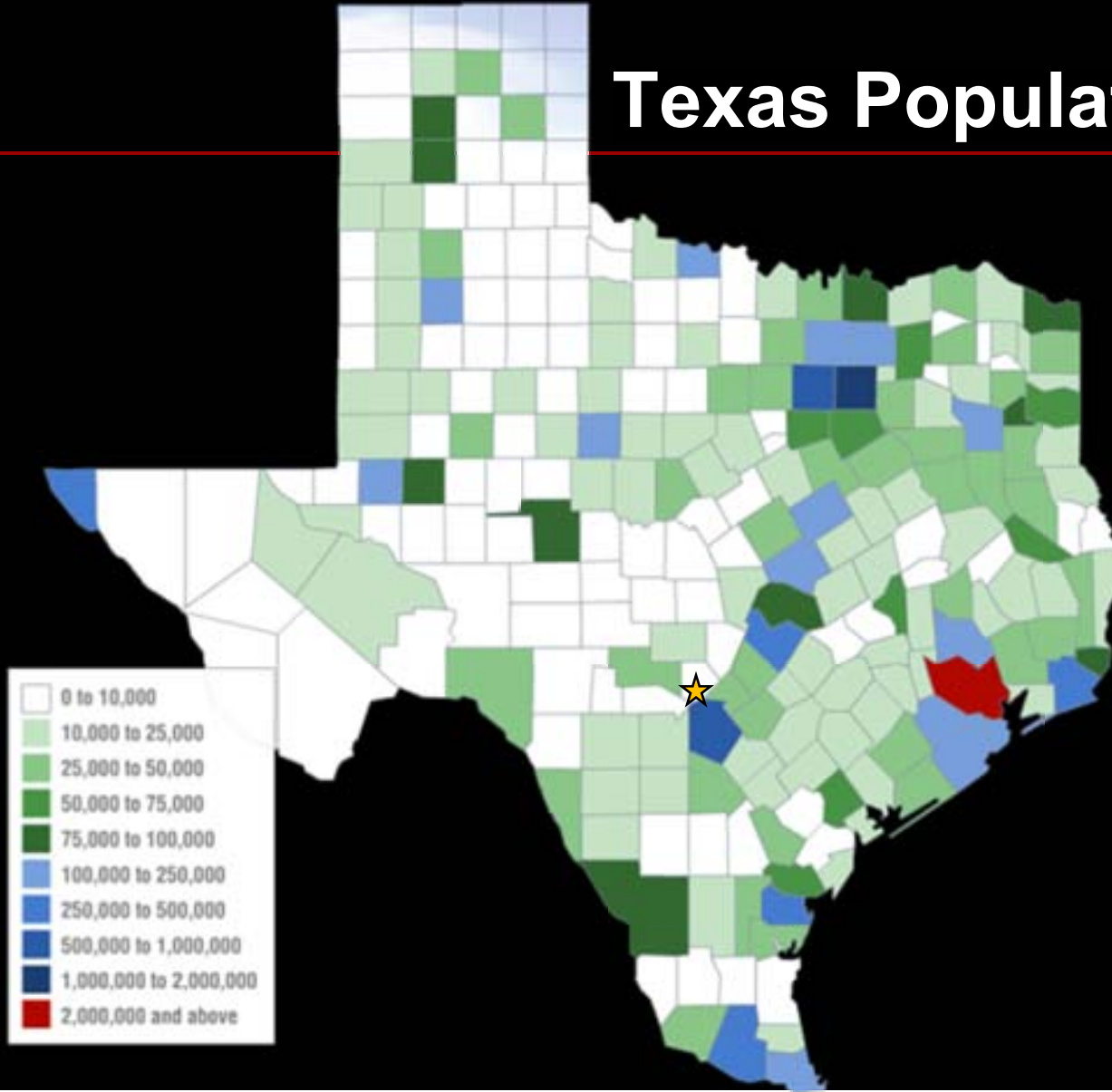
# Boerne Growth Factors

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- Adjacent to San Antonio, the nation's 7<sup>th</sup> largest city
- Fast growth Recognized school district
- Located on the Interstate 10 corridor
- Idealized Texas Hill Country lifestyle
- 3<sup>rd</sup> "Fastest Jobs Growth" in *Money Magazine's* 2005 Best Places to Live

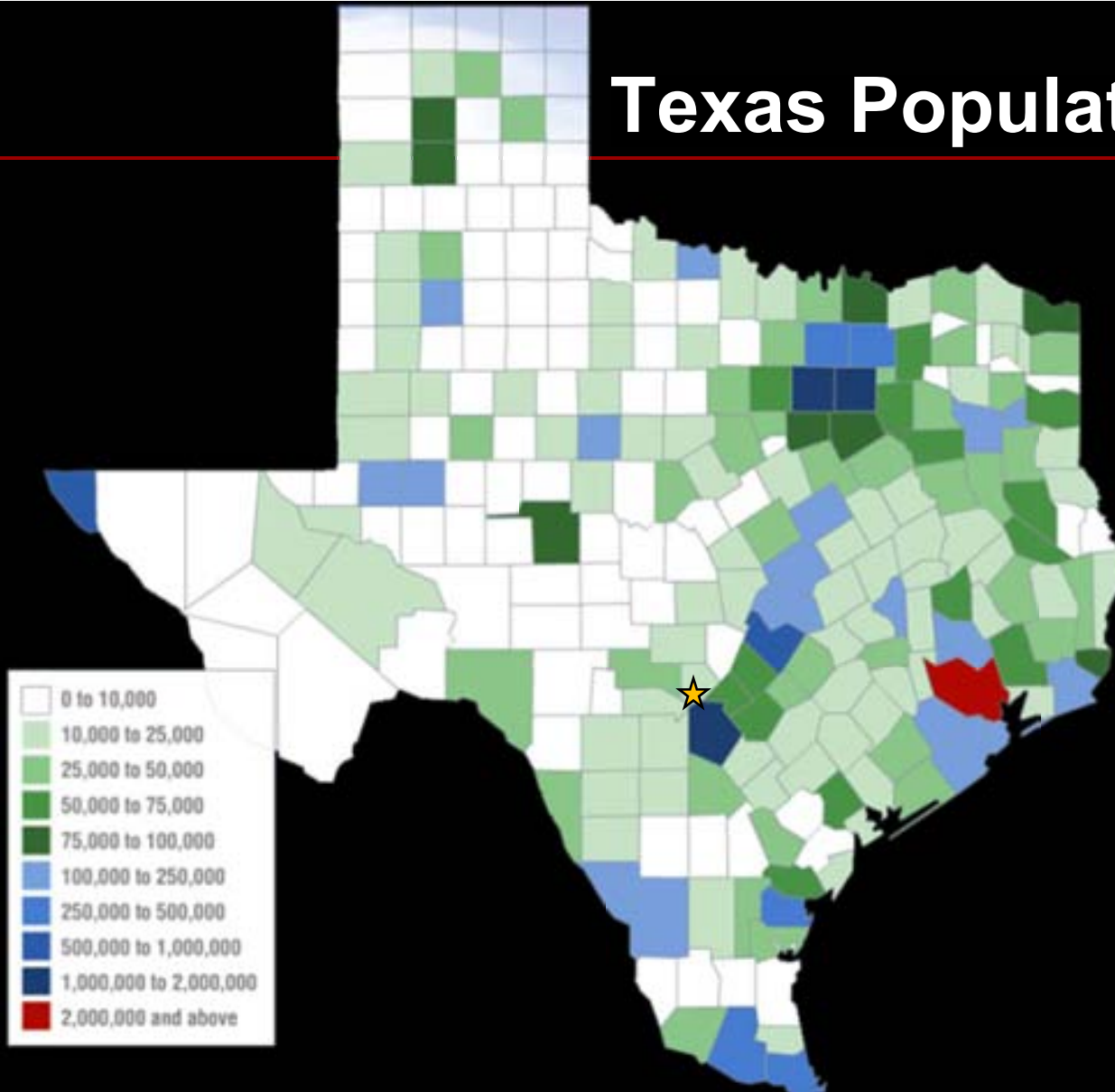
# Texas Population Growth

1980



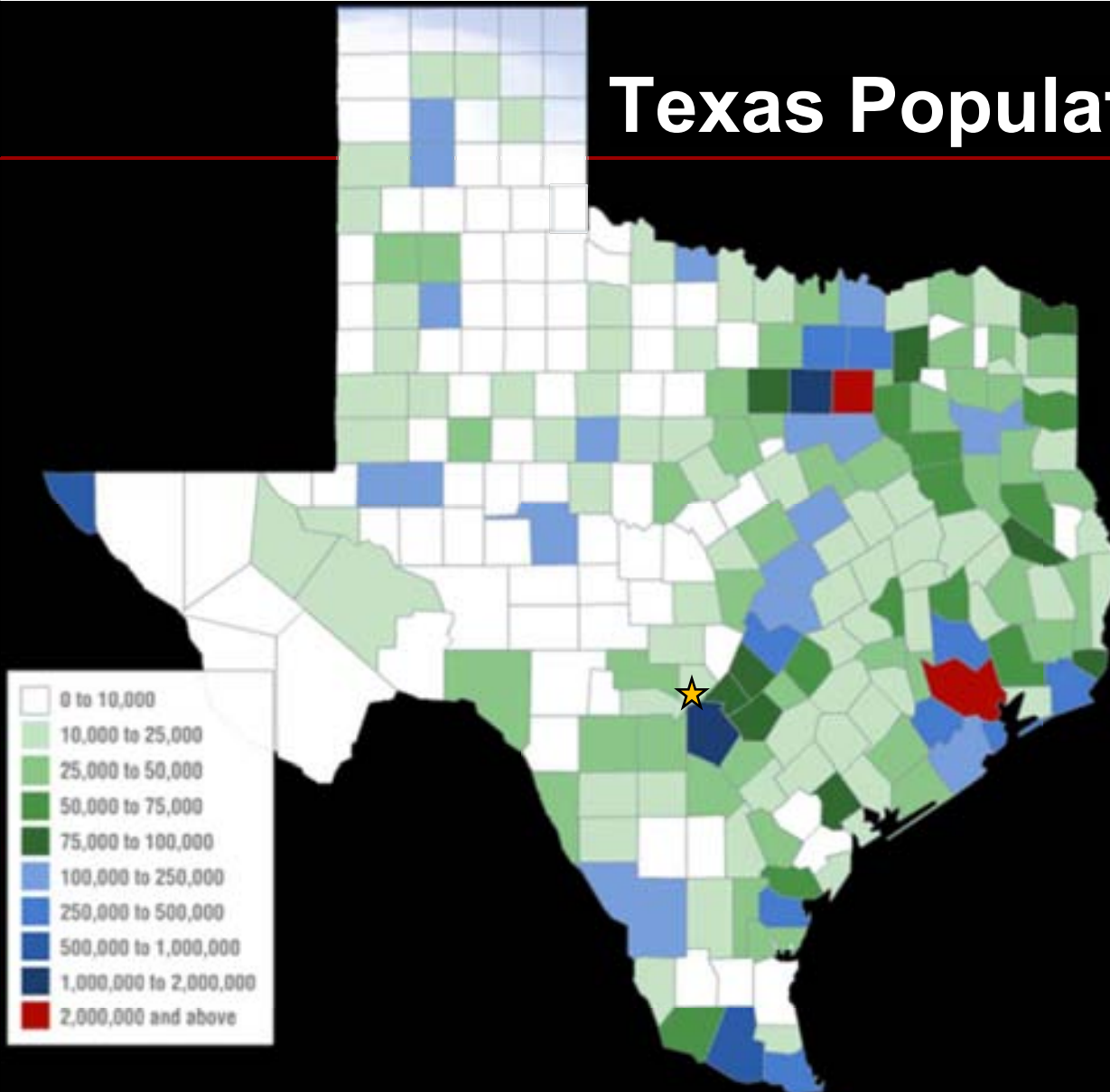
# Texas Population Growth

1990



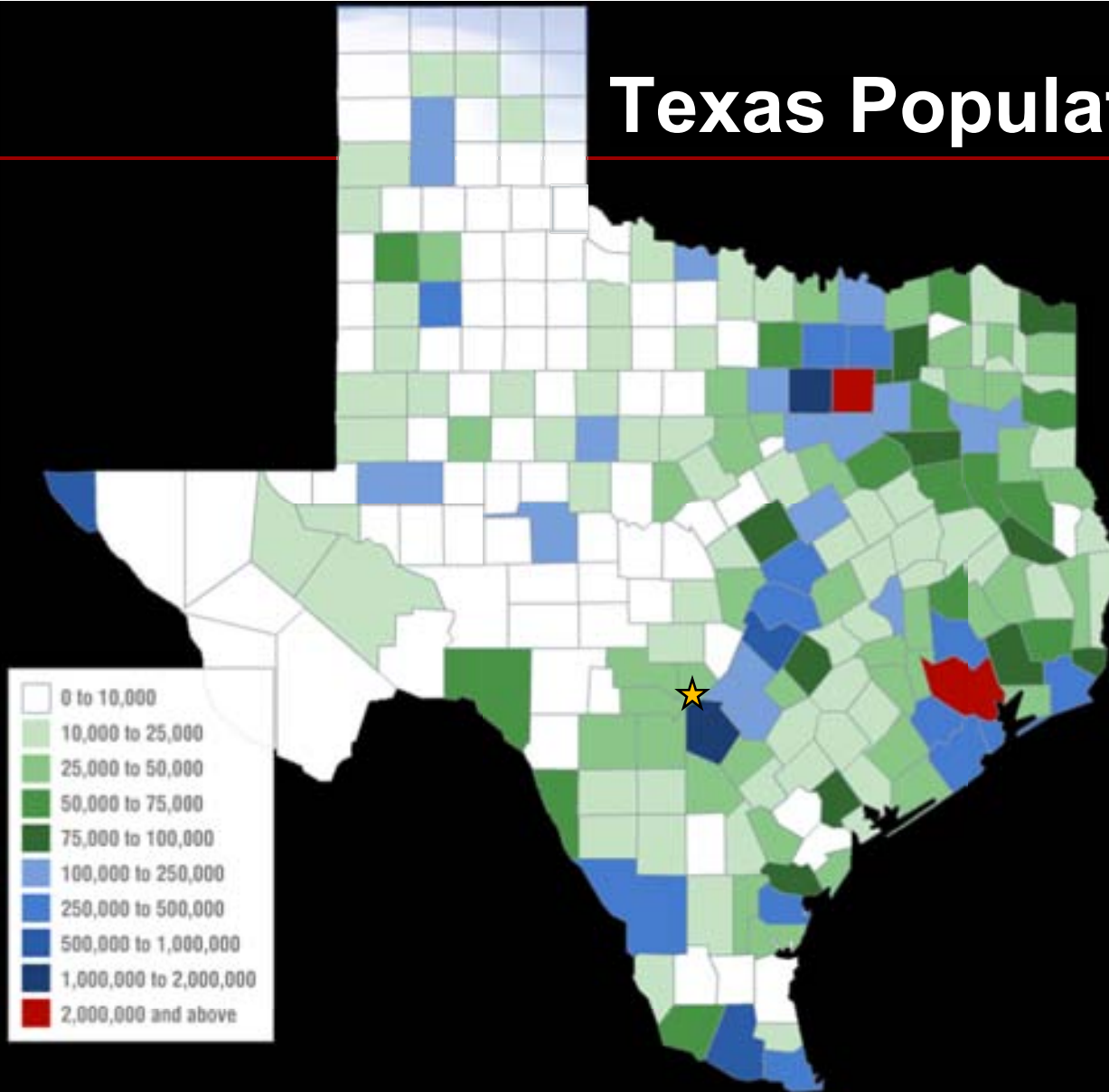
# Texas Population Growth

2000



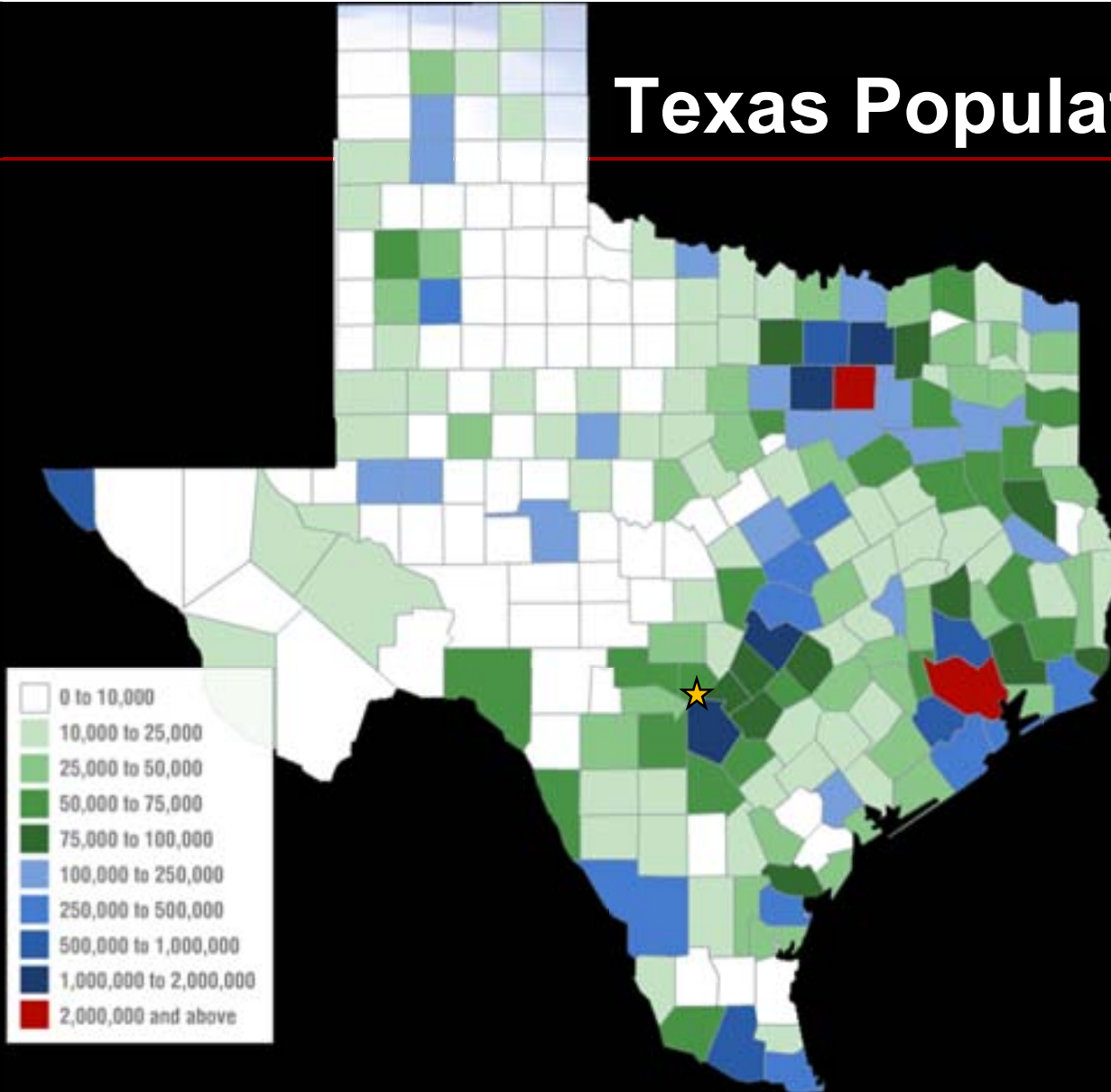
# Texas Population Growth

2010

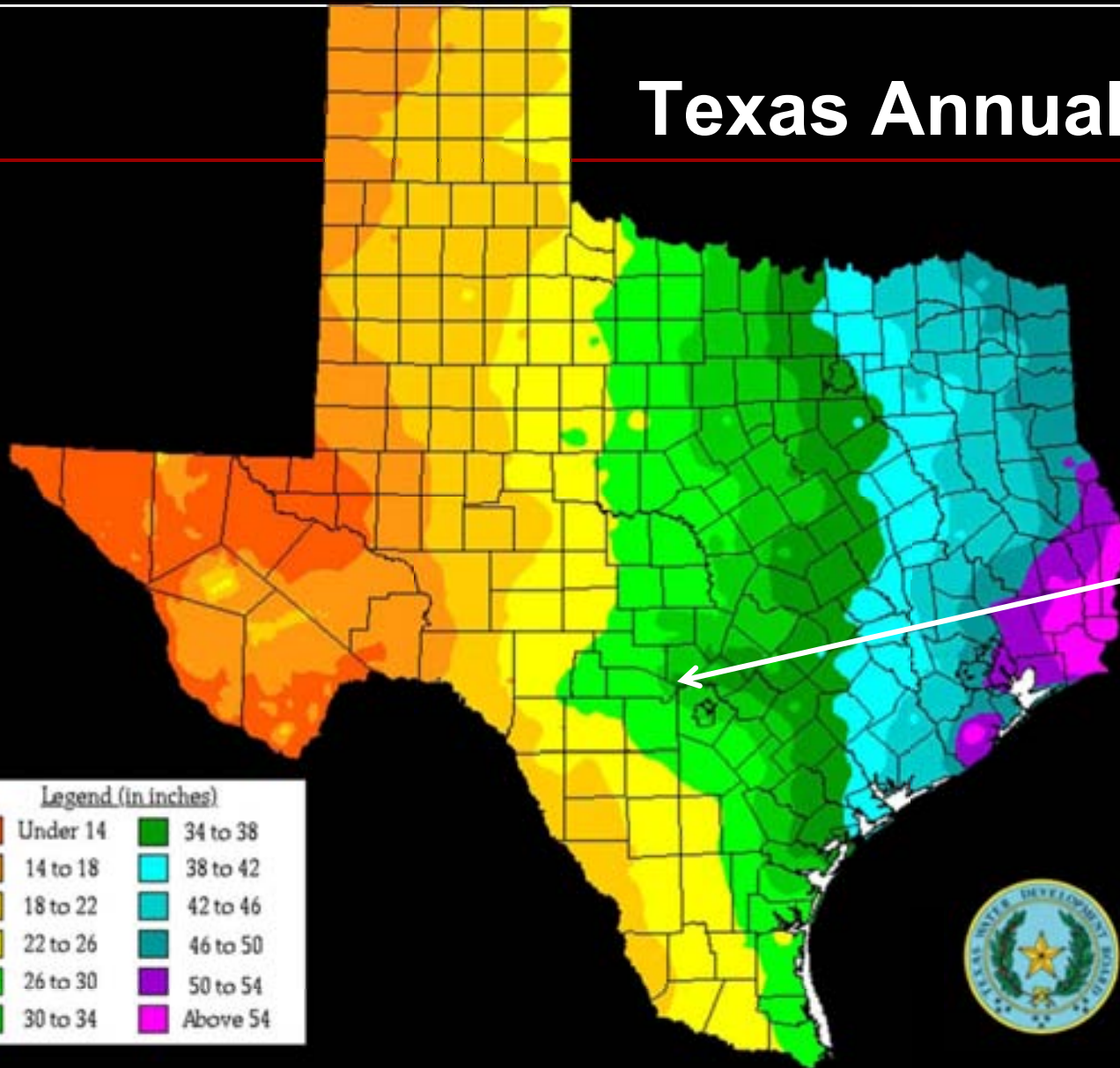


# Texas Population Growth

2020



# Texas Annual Rainfall



Project Site

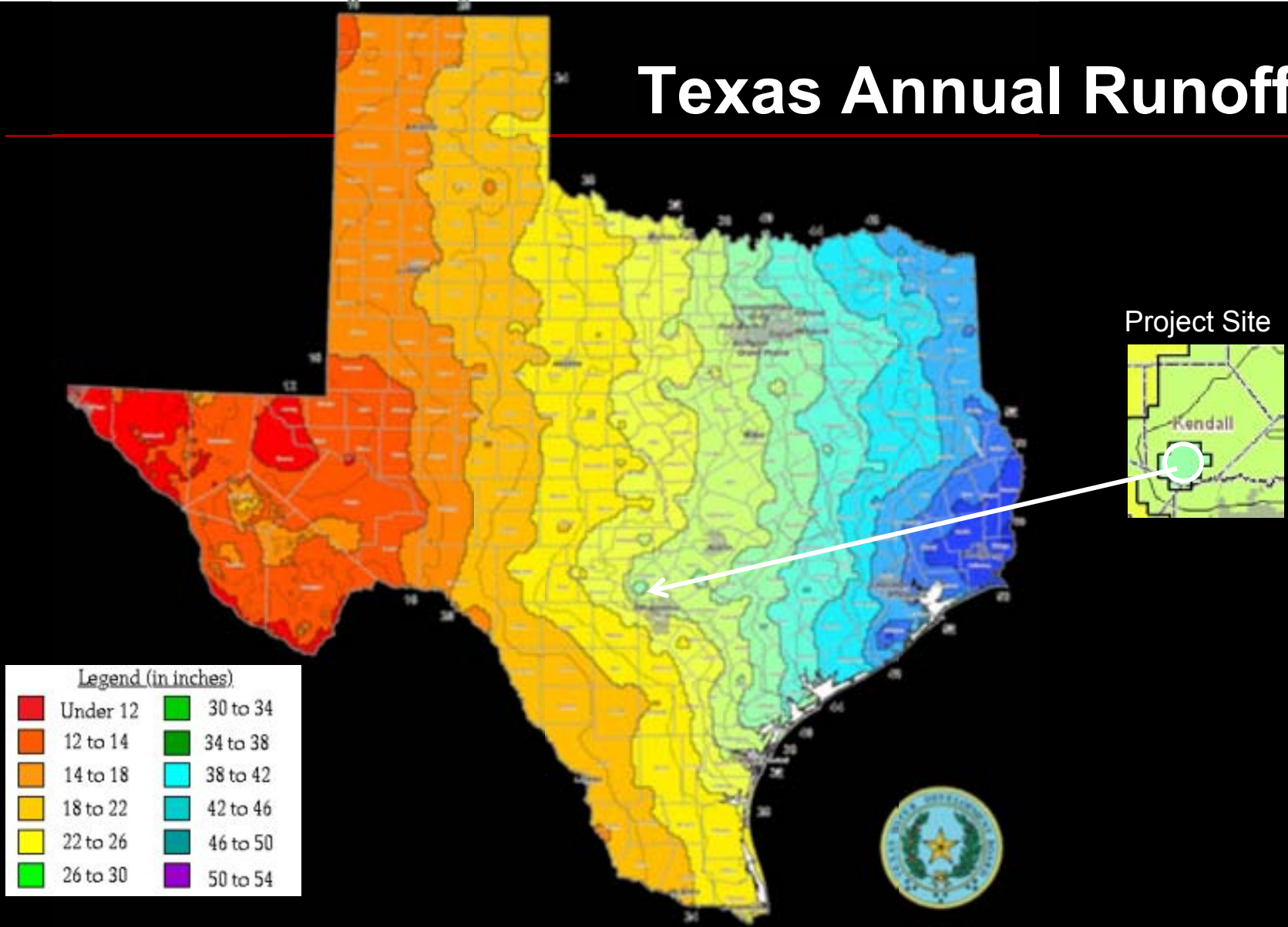


## Legend (in inches)

Under 14	34 to 38
14 to 18	38 to 42
18 to 22	42 to 46
22 to 26	46 to 50
26 to 30	50 to 54
30 to 34	Above 54



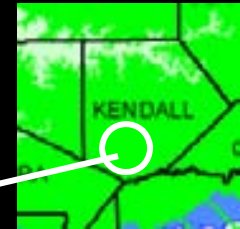
# Texas Annual Runoff



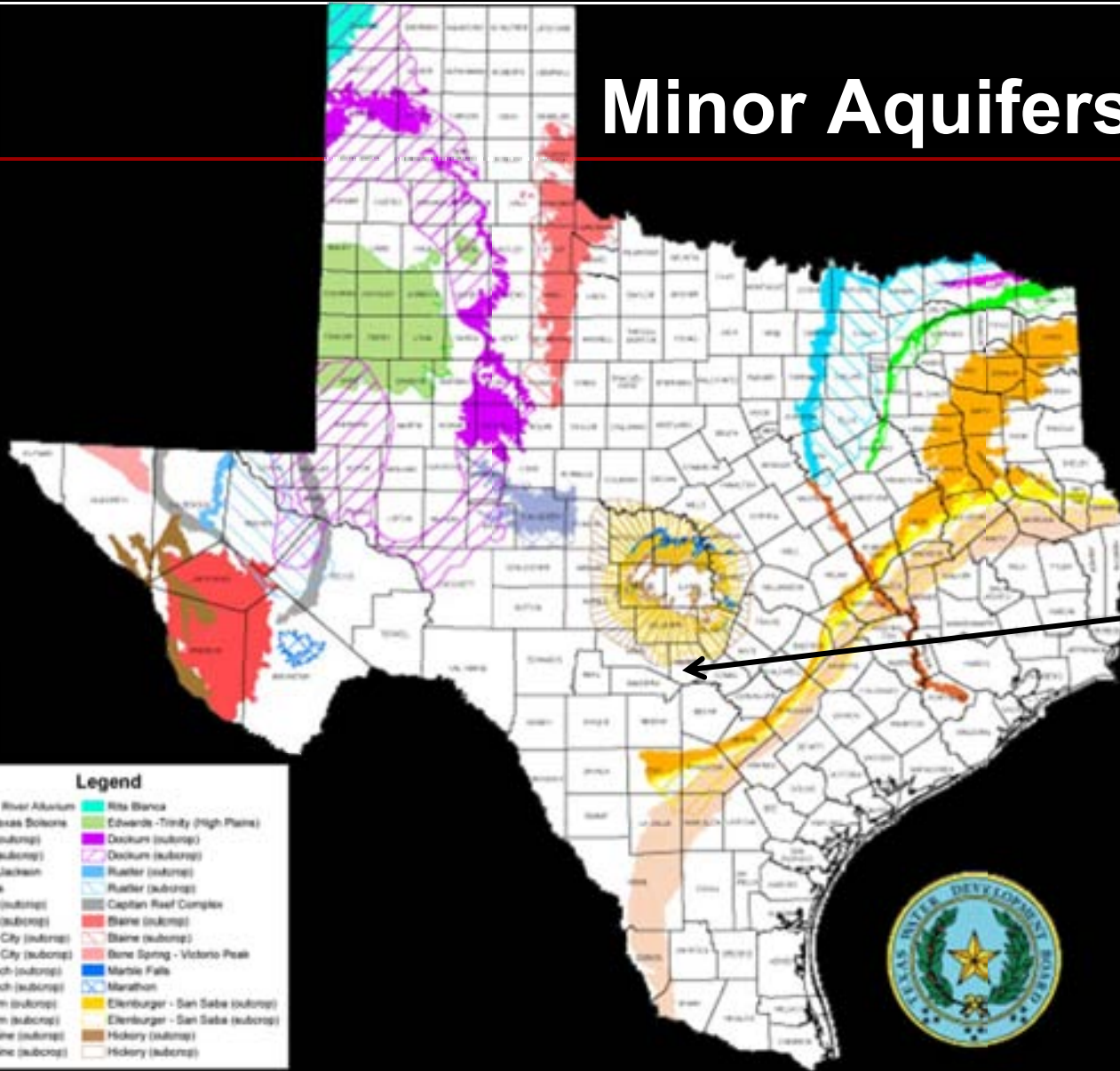
# Major Aquifers of Texas



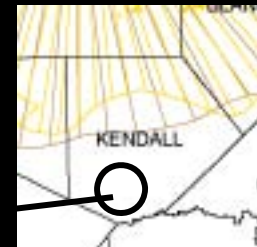
Project Site



# Minor Aquifers of Texas



Project Site



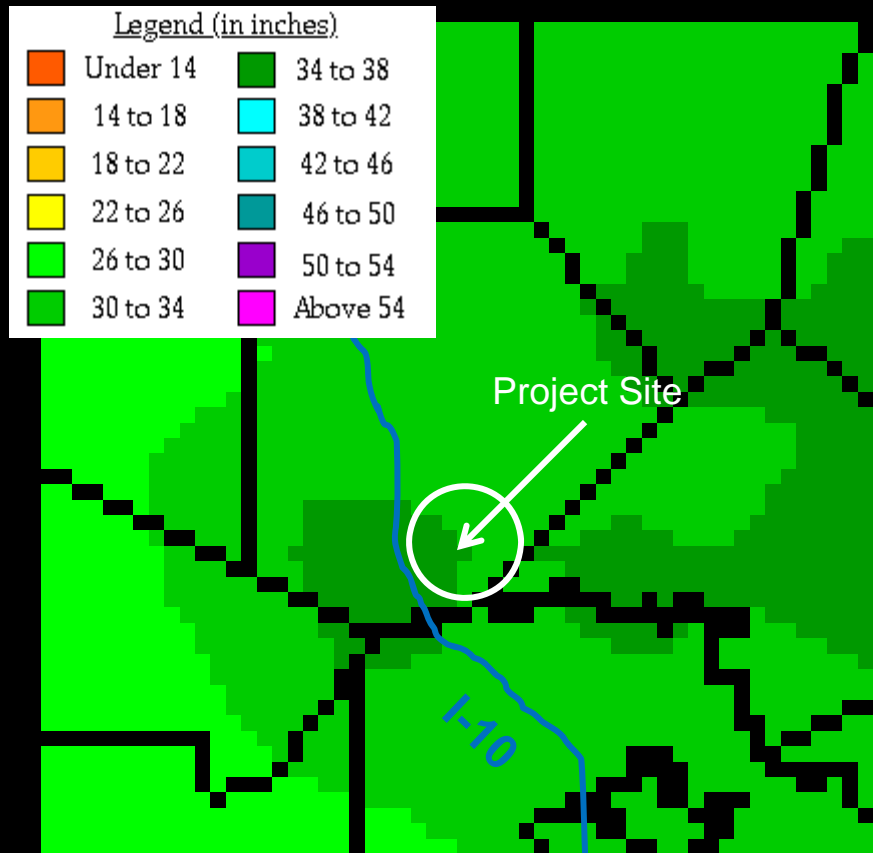
## Legend

- |                      |                                  |
|----------------------|----------------------------------|
| Brown River Alluvium | Rita Blanca                      |
| West Texas Solonch   | Edwards - Trinity (High Plains)  |
| Lipan (outcrop)      | Dockum (outcrop)                 |
| Lipan (outcrop)      | Dockum (outcrop)                 |
| Yegua Jackson        | Rueller (outcrop)                |
| Ignacia              | Rueller (outcrop)                |
| Sparta (outcrop)     | Capitan Reef Complex             |
| Sparta (outcrop)     | Blaine (outcrop)                 |
| Queen-City (outcrop) | Blaine (outcrop)                 |
| Queen-City (outcrop) | Blaine Spring - Victoria Peak    |
| Nacatoch (outcrop)   | Marble Falls                     |
| Nacatoch (outcrop)   | Marathon                         |
| Brewster (outcrop)   | Ellenburger - San Saba (outcrop) |
| Brewster (outcrop)   | Ellenburger - San Saba (outcrop) |
| Woolbline (outcrop)  | Hickory (outcrop)                |
| Woolbline (outcrop)  | Hickory (outcrop)                |

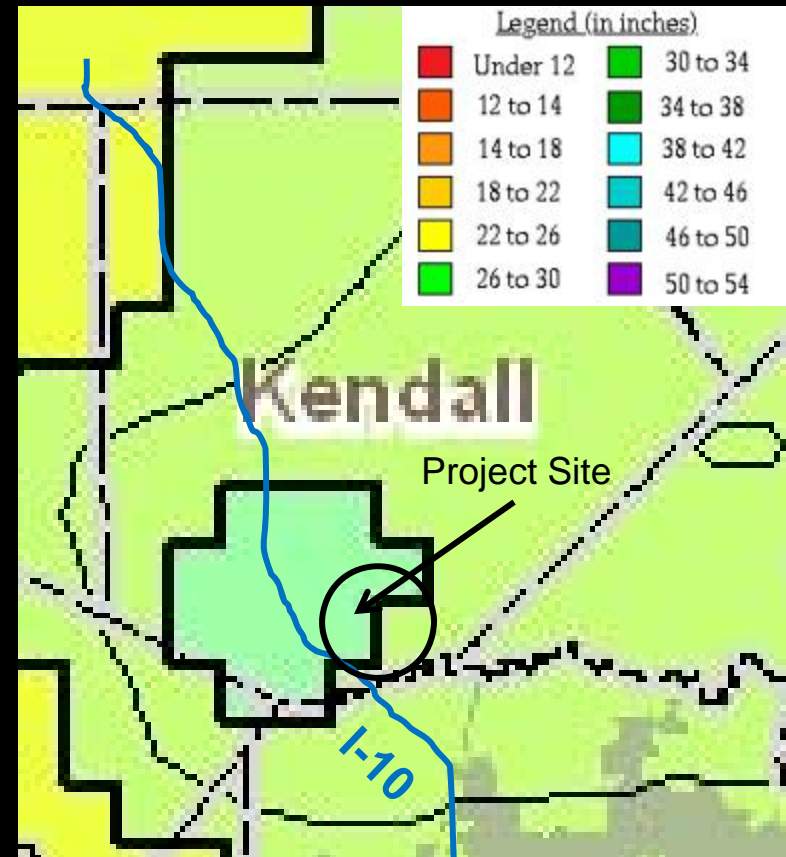


# Kendall County Rainfall & Runoff

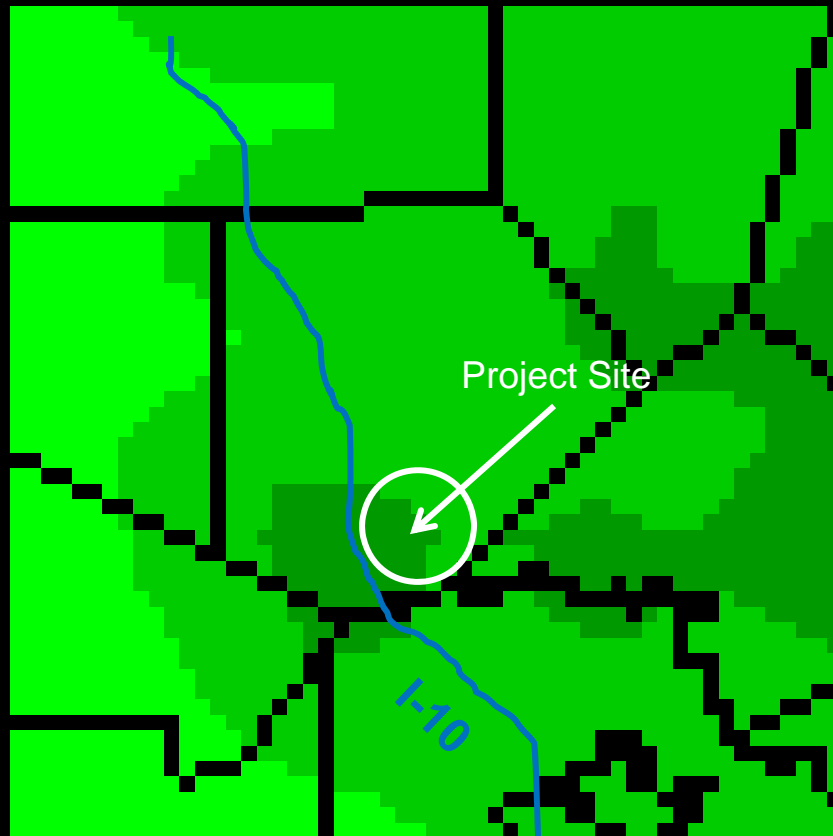
## Rainfall



## Runoff



# Kendall County Water Story

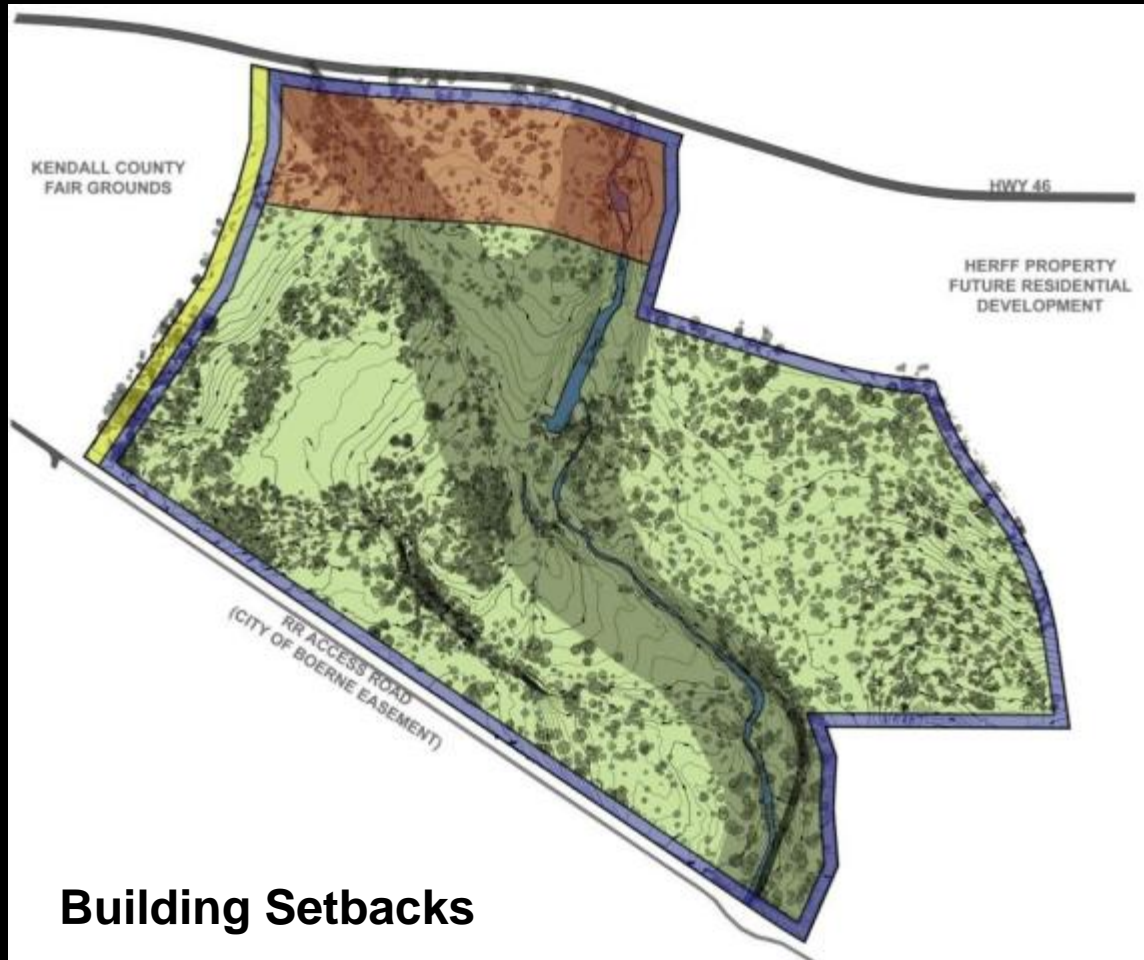


- Limited availability of water
- Restrictions of ground water usage by Cow Creek Groundwater Conservation District
- Introduction of G.B.R.A. water to system – higher cost of water
- Future City of Boerne water reclamation

# Site Predevelopment



# Site Analysis



**Building Setbacks**



# Sustainability Goals

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- Minimize negative ecological impacts
- Be responsible to down stream ecosystems & neighbors
- Maximize passive solar, water, and land design concepts
- Reduce dependence on potable water
- Maximize water re-usage & capture

# The Site Development Concept



# Water Harvesting Defined\*

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- Passive – The redirection of rainwater for beneficial use to decrease runoff and prevent erosion
- Active – The collection, temporary storage and redirection of rainwater for beneficial use



# Water Harvesting Goals

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## ■ Passive

- Minimize site development footprint
- Utilize natural water sheds – no channelization or comprehensive re-sculpting of the existing land forms
- Minimize disturbance of existing forested areas
- Use natural ground cover & xeriscape wherever possible
- Avoid damaging historic & aquifer recharge features



# Water Harvesting Goals

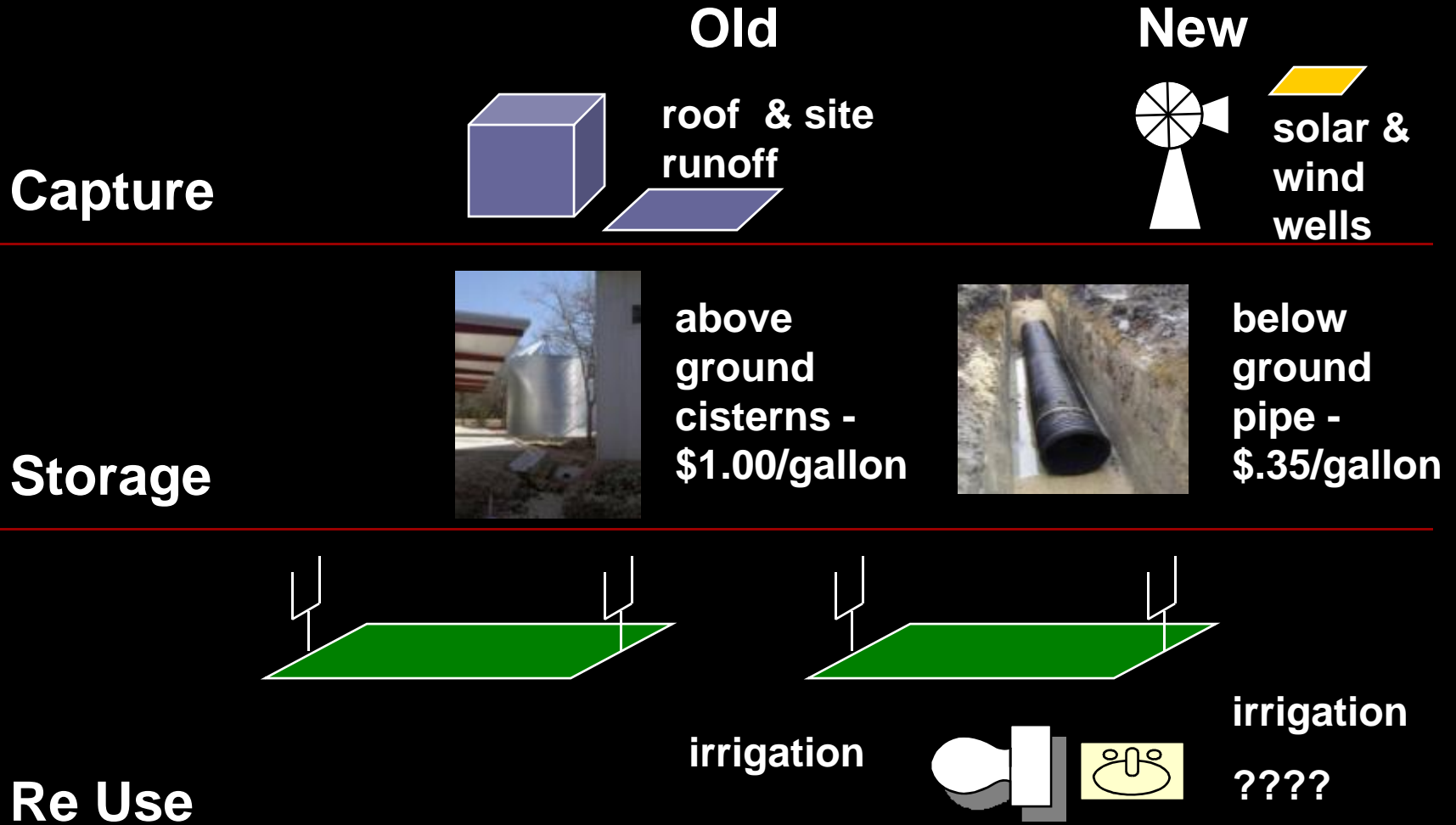
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## ■ Active

### ■ Capture and reuse:

- Storm water from the roof areas as well as the site
- Condensate from HVAC systems
- Reduce consumption of potable water by:
  - Utilizing low flow fixtures
  - Utilizing drought resistant planting while minimizing irrigation areas
- Plan for future connections to City of Boerne reclaimed water
- Supplement harvested water by utilizing a wind power on site well
- Develop a design concept strategy that makes economic sense
- The end product should serve as a community and regional example of how to conserve our natural resources.
- Provide Capture System that is User Friendly

# Water Harvesting Evolution





# Design Approach

# Cost Method

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- City of Boerne Water Rates
  - BISD is the Largest Water User in the City
  - BISD at Top of the Rate Scale .844/100 Gallons
- A High School Annual Usage - 7.8 Mil-8 Mil Gallons per Year
  - Or 23.937 Acre/Feet per Year
  - Irrigation usage 3.8 mil-5.7 mil
  - Based on 1750 core Students and Staff (250)
- Annual Expense-\$60,000-\$65,000 Per Year

# Systems Storage Parameters

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Elevated Tank = 13,750 Gallons

The Ranch = 15,500 Gallons

Underground = 195,000 Gallons\*

Total = 224,250 Gallons

- Assumed Annual Usage for Irrigation Water = 3.8 Mil Gal./Yr.
  - Or 316,000 Gal./Mo.
- 2005-2006 Actual Usage for Irrigation Water = 5.7 Mil Gal./Yr.
- 648 Gallons/Day of Infiltration...(Spring Flow)\*
  - Or 240,000 Gal./Yr.
  - Water Table Levels Not Constant
  - Drought of Record 10.29" in 1954

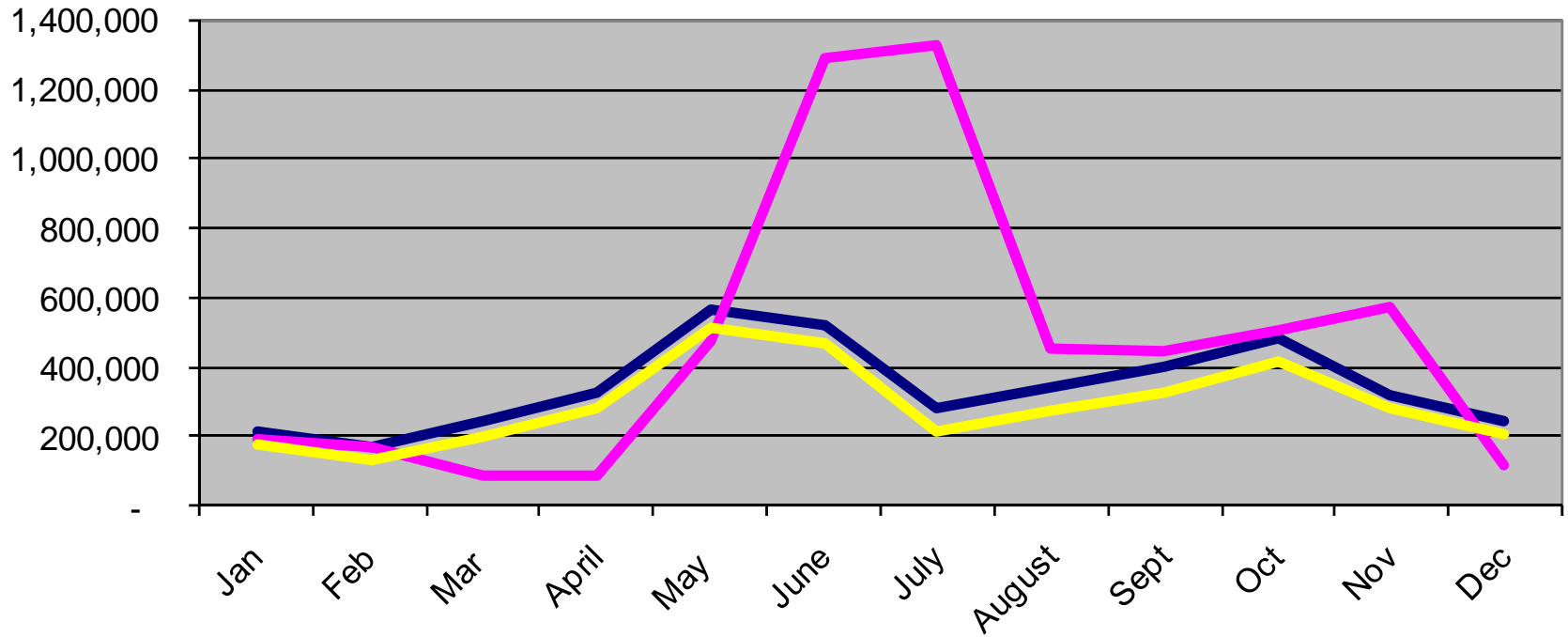
\* Actual pipe volume does not include actual infiltration

# Potential Water Harvest Sources

Sources	Average	Drought of Record
<b>Ground Storm Water Runoff</b> 313,270 s.f. @ 1" rainfall = 625 Gal/1000 s.f.	6,069,606 gal/yr	2,063,669 gal/yr
<b>HVAC Condensate</b> 1,000 Gal/Day x 365 days	365,000 gal/yr	365,000 gal/yr
<b>Roof Capture</b> 211,800 s.f. @ 1" rainfall = 625 Gal/1000 s.f.	4,103,625 gal/yr	1,395,233 gal/yr
<b>Spring Flow</b> 648 gal/day x 365 days	236,520 gal/yr	0 gal/yr
<b>Total</b>	<b>10,778,231 gal/yr</b>	<b>3,823,902 gal/yr</b>

Calculations are based on a 31" average annual rainfall

# Drought Year Impact



— total inflow through drought of record

— actual storage in drought year

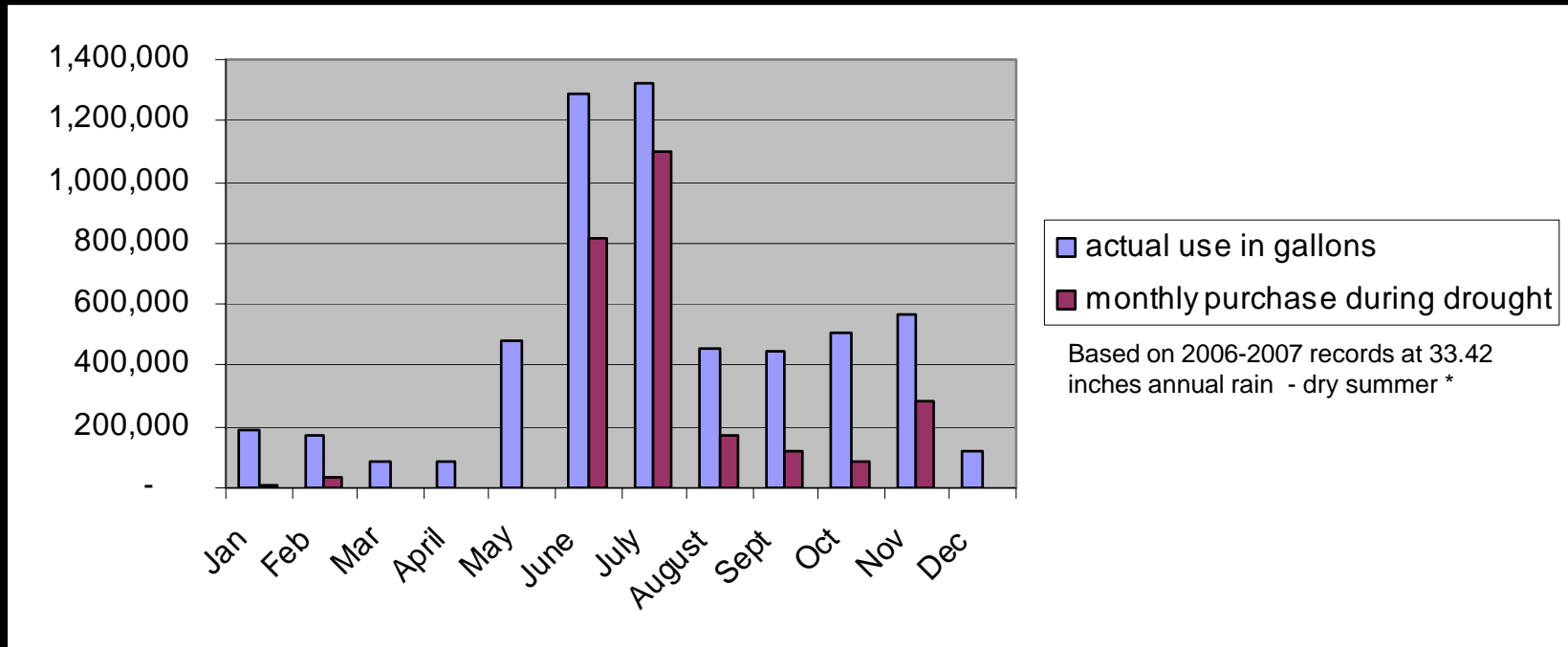
— actual use in gallons

Based on 2006-2007 records at 33.42 inches annual rain - dry summer \*

\*Credit: National Weather Service:

<http://www.srh.noaa.gov/ewx/html/cli/sat/satmonpcpn.htm>

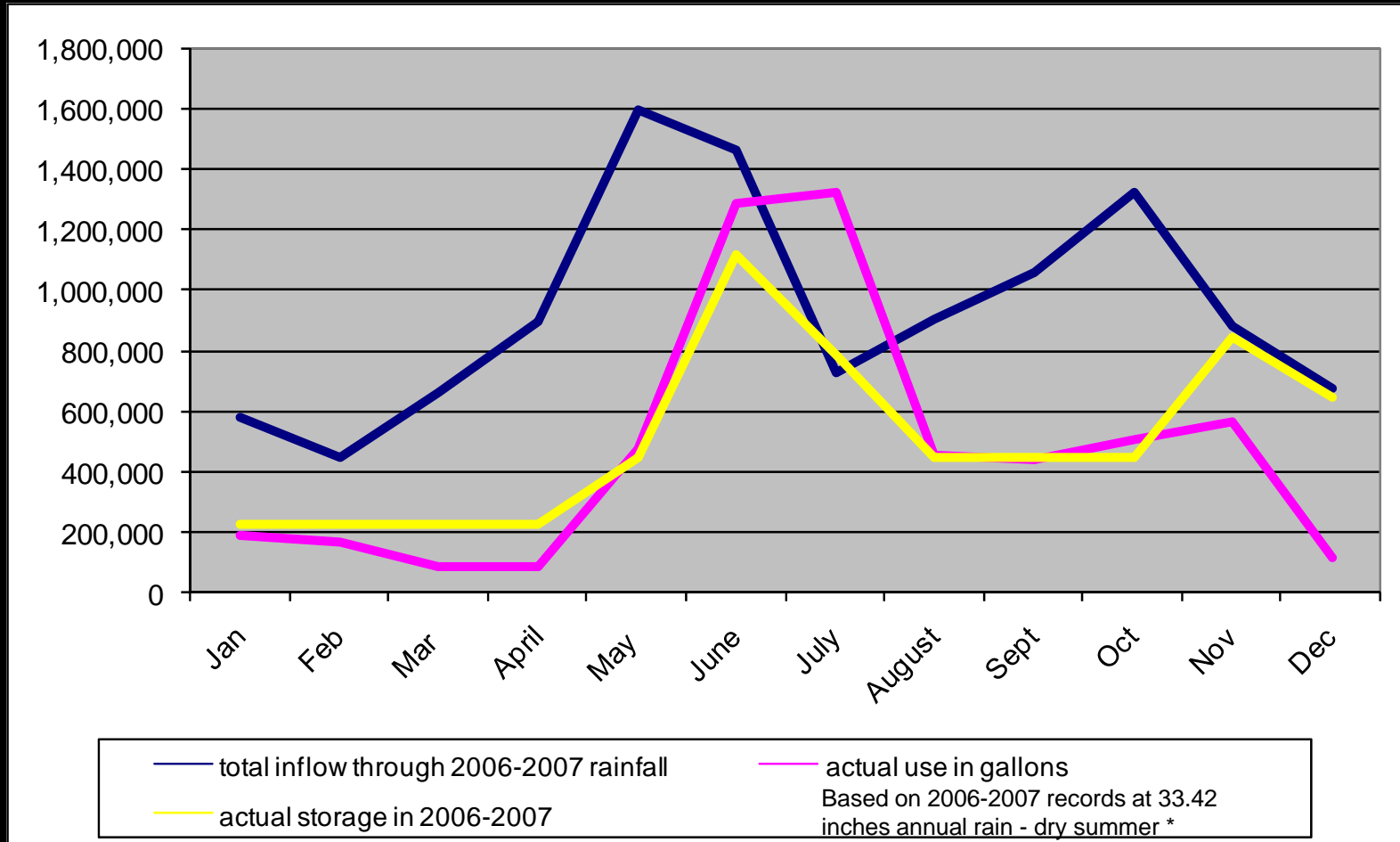
# Drought Year Impact (10.8" per year)



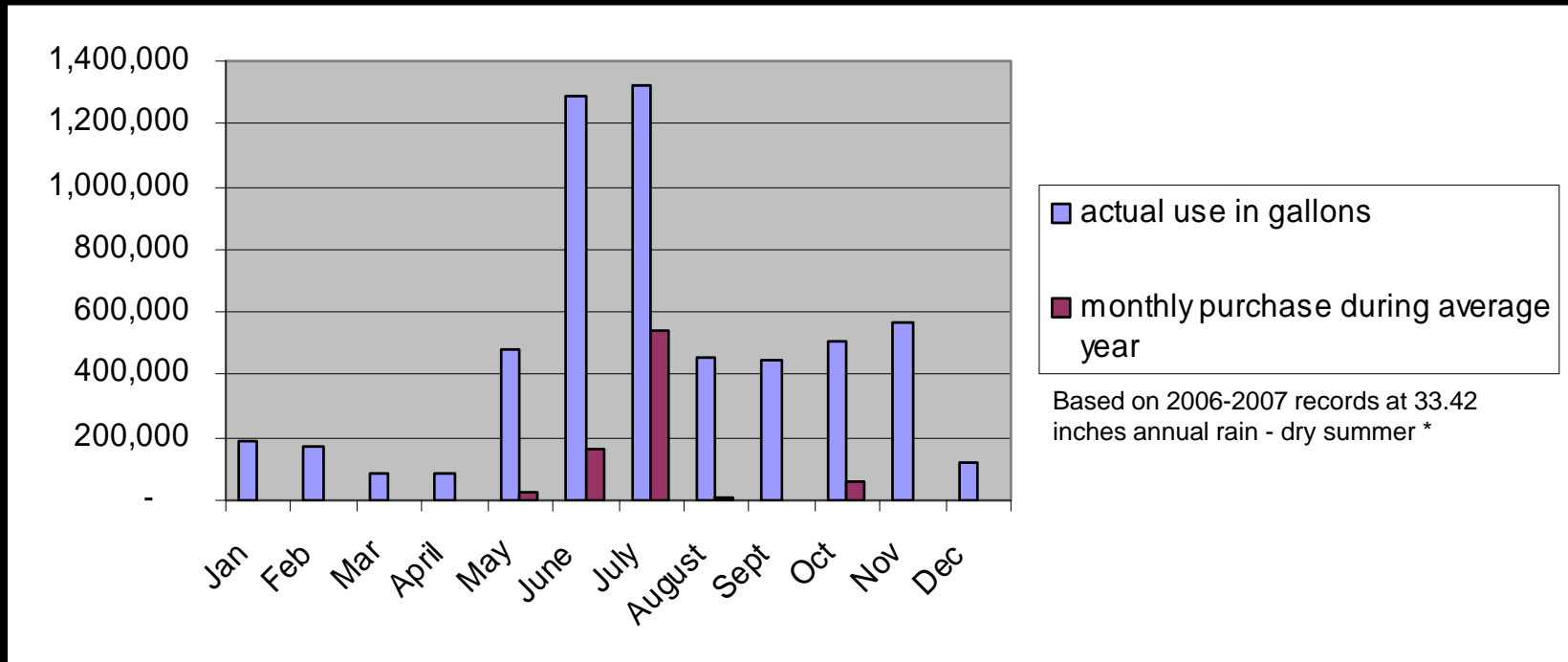
**Annual Irrigation Requirement = 5,718,000 gallons**

**Annual Irrigation Purchase = 2,625,000 gallons (46% of total)**

# 2006-2007 Impact (33.42" per year)



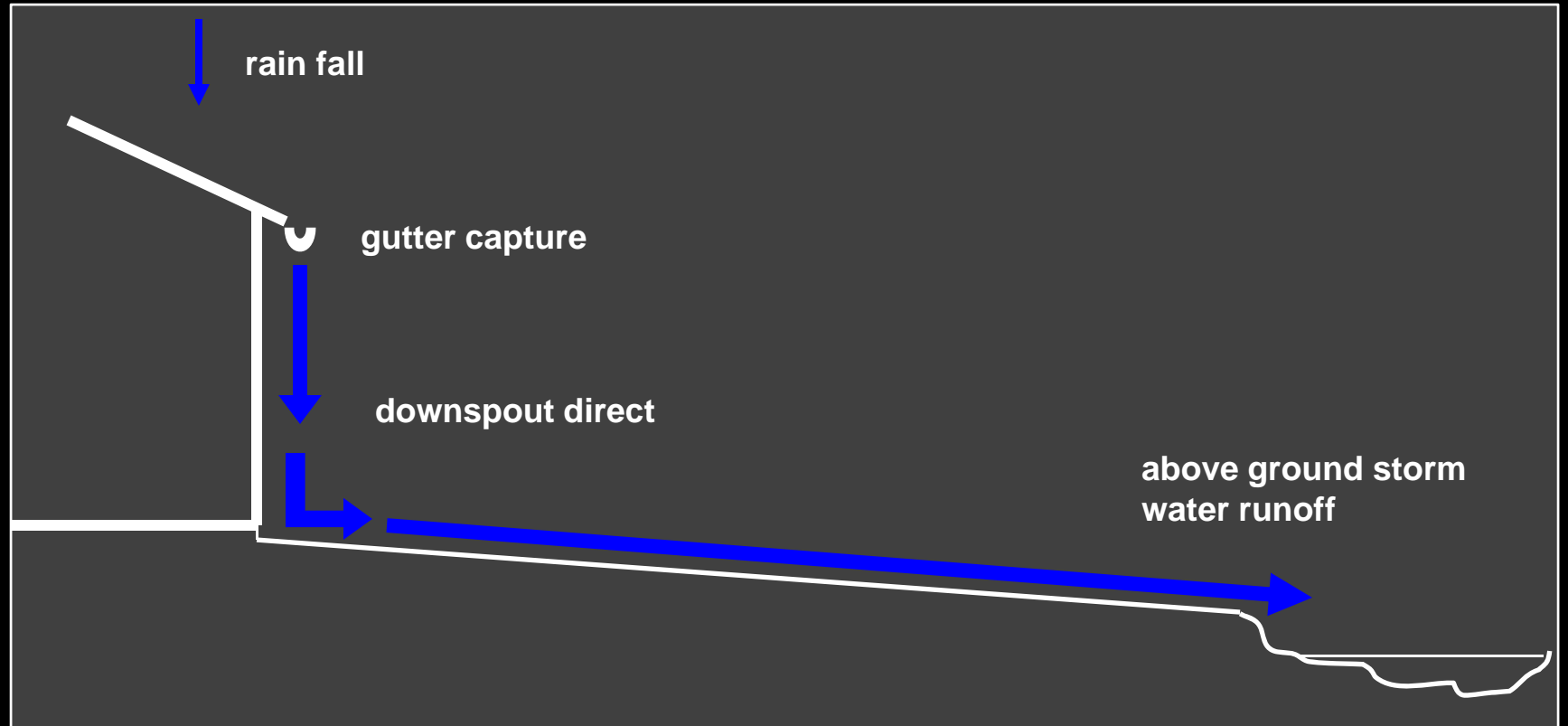
# 2006-2007 Impact (33.42" per year)



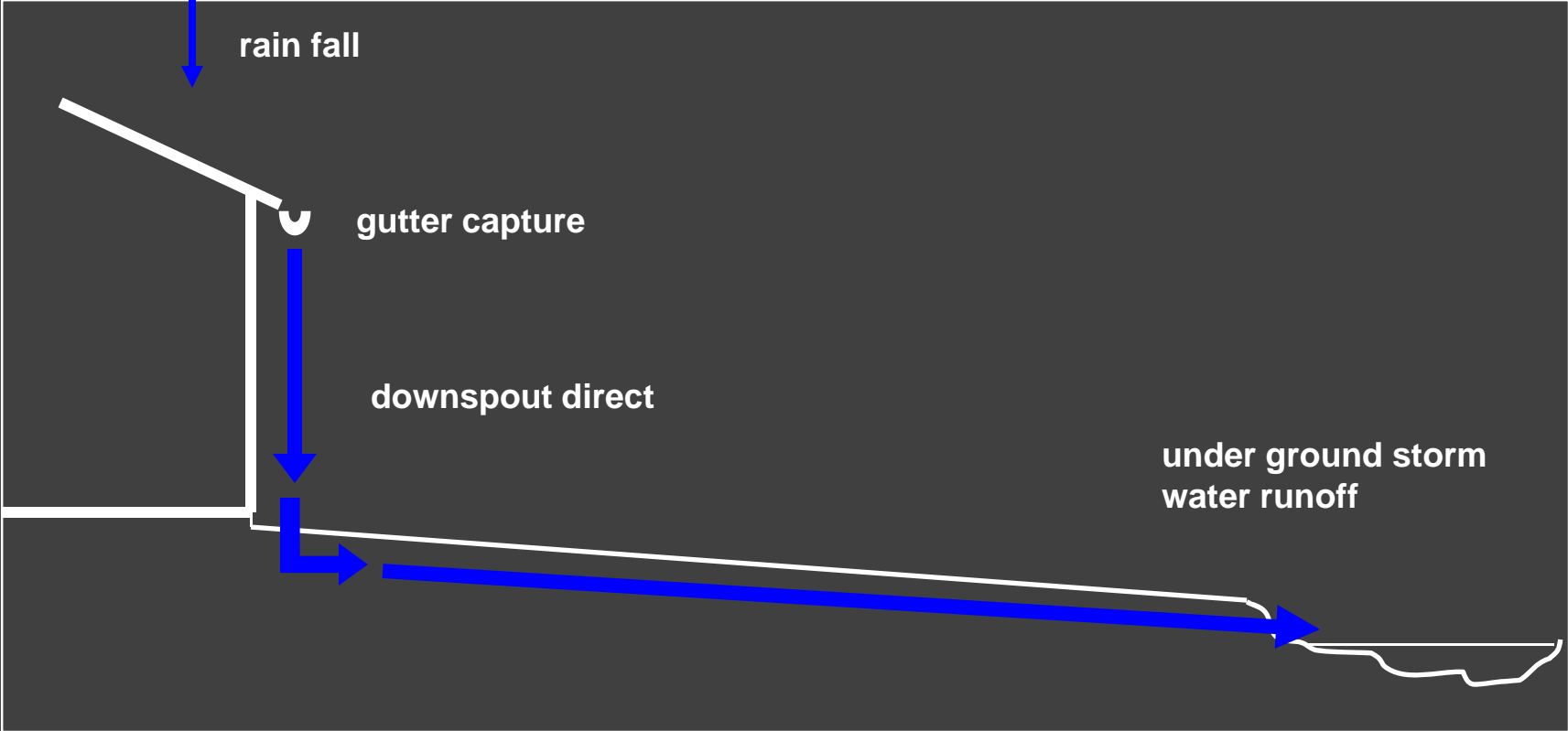
**Annual Irrigation Requirement = 5,718,000 gallons**

**Annual Irrigation Purchase = 801,500 gallons (14% of total)**

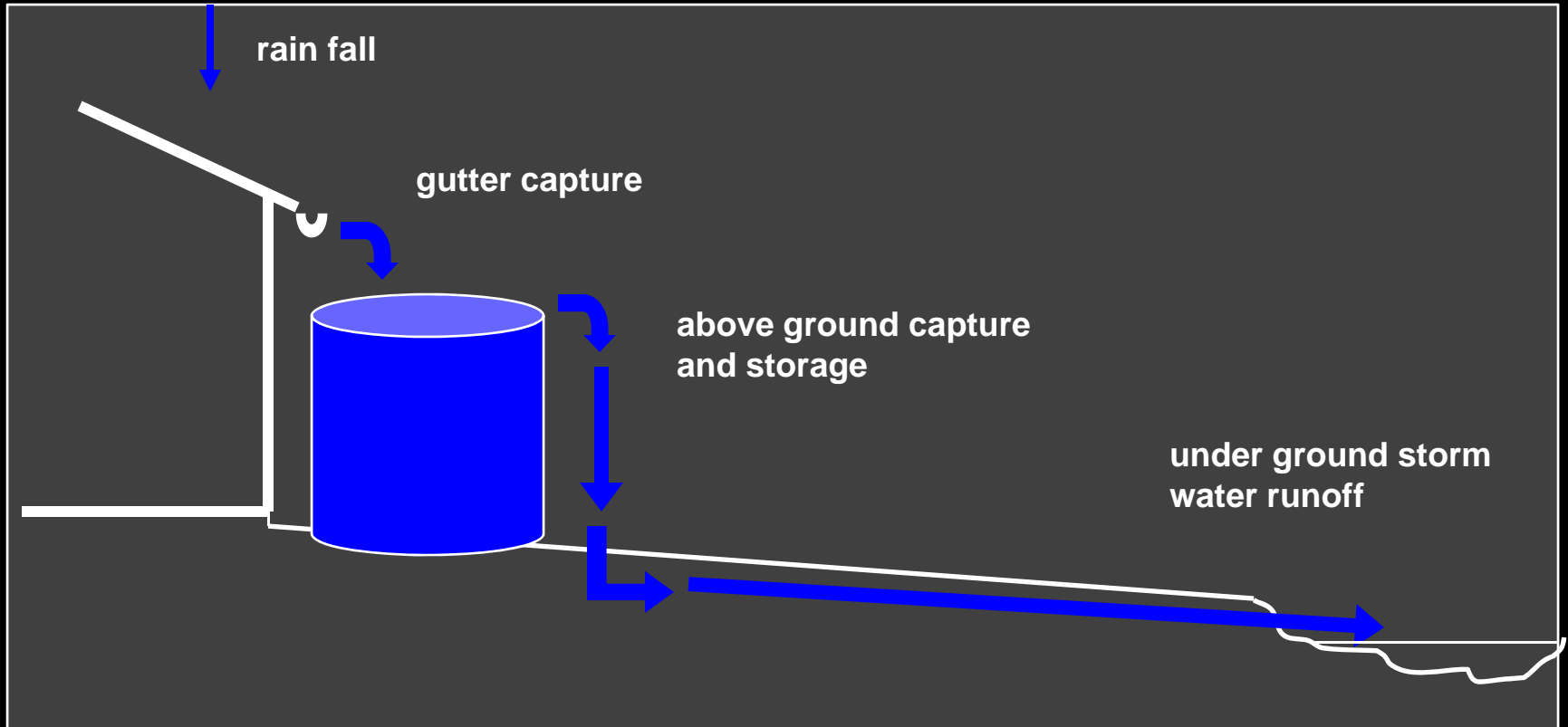
# Traditional Approach



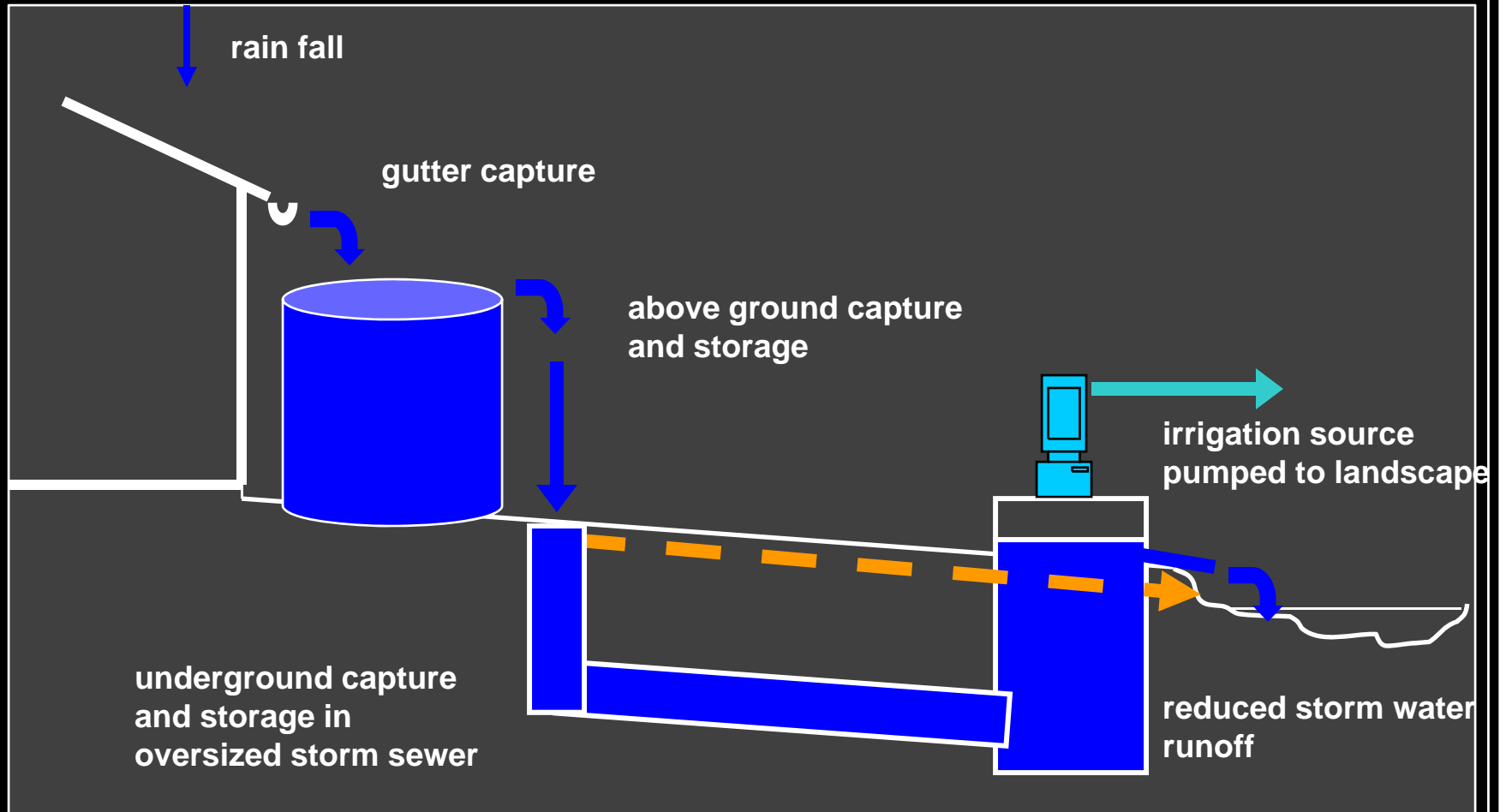
# Improved Approach



# Better Approach



# Boerne ISD Approach

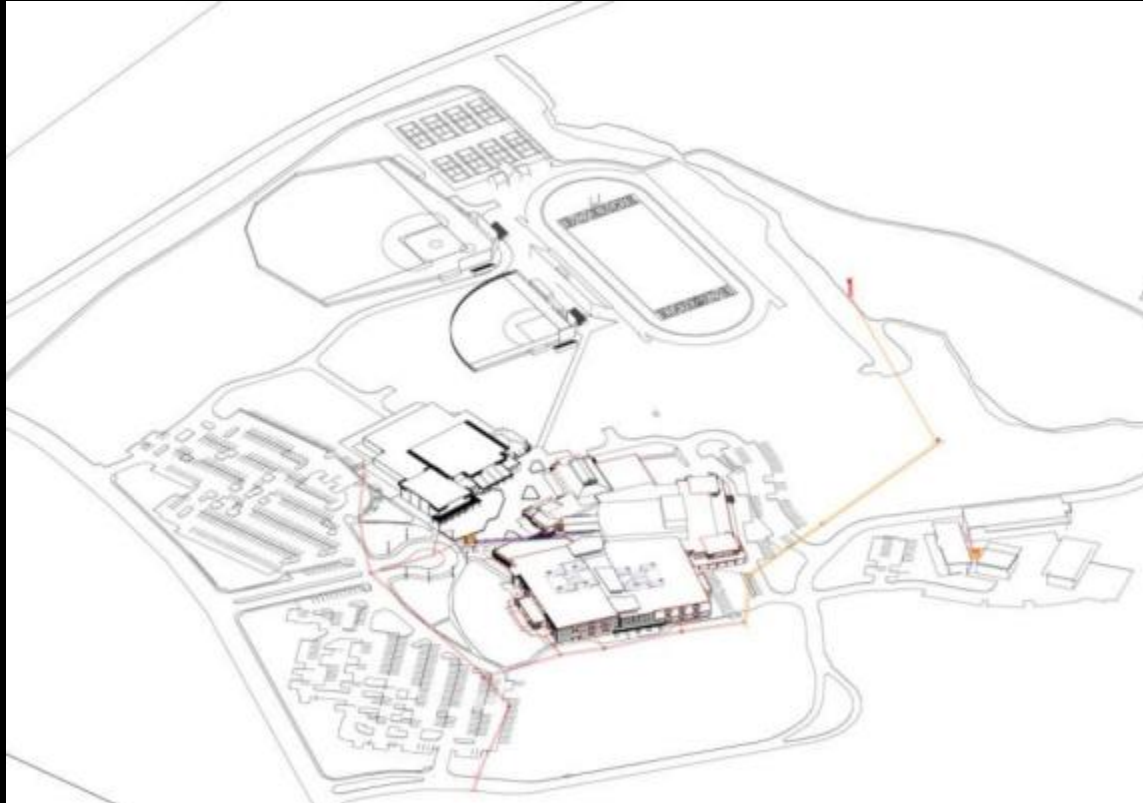




# Design Solutions

# Campus Overview

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# Elevated Tank and Roof Capture System

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Roof Area Square Footage 187,770

# Elevated Tank & Condensate Capture

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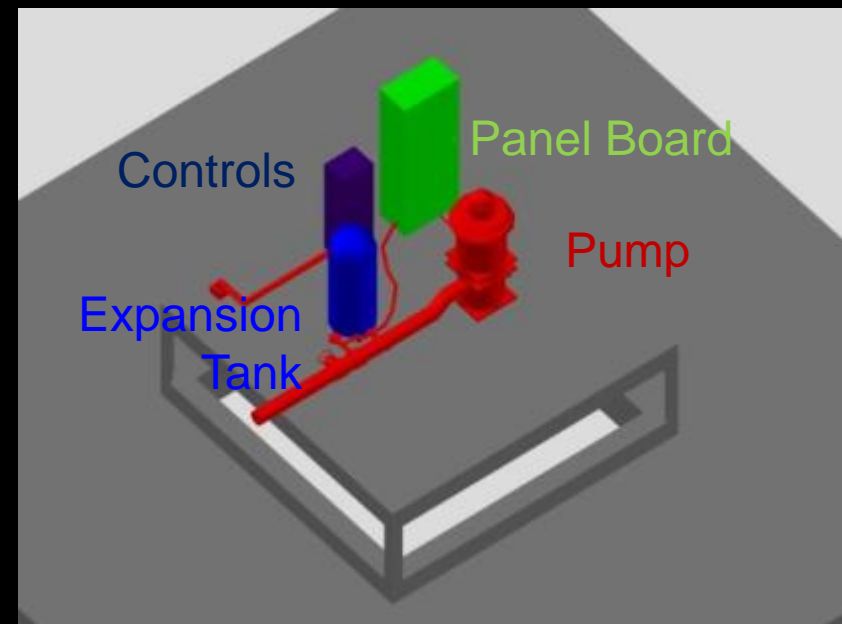
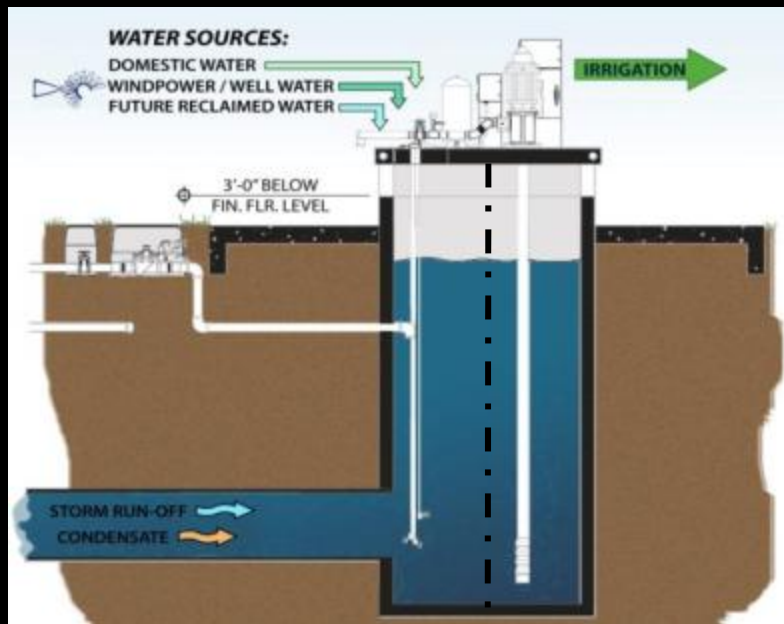
# Roof Drains & Relationship to Storage

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# Underground Storage Delivery System

- The Weir Structure
- Provides pressurization for all irrigation systems
- Irrigation Mains used as recirculation
- Tied to Building Automated System (BAS)



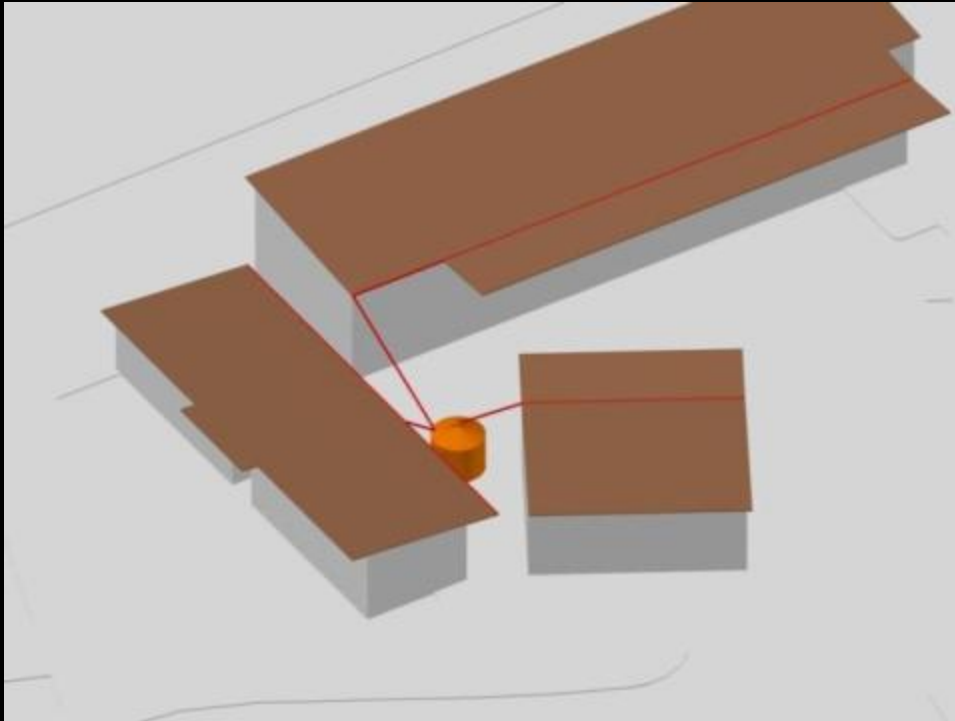
# Underground Storage System

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# The Ranch Tank and Capture System

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Roof Area Square Footage 24,030

# The Delivery

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# The Investment

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Underground Piping Premium	\$ 65,000
Elevated Storage Tanks	\$ 45,000
Wier Structure	\$ 73,400
Irrigation Piping, Pumps, & Controls	<u>\$ 82,400</u>
Total	\$265,822



# The Cost Benefits Analysis

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- Budgeted Cost \$306,000
- Est. Annual Electric Cost \$5,350
- Est. Annual Maintenance Cost \$3,000
- Potential Savings \$35,000/Yr.
- Pay Back in 5 to 7 years



# What Is Next

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- Treated Reclaimed Water
  - The City of Boerne Discharges Approximately 816,000 Gallons/Day
  - Currently Not Rated for Human Contact (Phosphate Levels)
  
- When....
  - Long Term Goal
  - Construction or Irrigation
  - \$\$\$ To Build Distribution System
  
- Similar System @ Boerne Greyhound Campus
  
- Lobby for Regulatory Changes



## Recap

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- Investment \$265,800
- Savings Over Time \$32,000 to \$35,000/Year
- Payback in 5 to 7 Years
- Reduce Dependency on City Water
- Good Community Example
- Met Sustainability Goals
- Set The Example
- Largest at any high school in Texas
- BISD First K-12 attempt on this scale

# Credits

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Board of Trustees  
123 W. Johns Road  
Boerne, TX 78006  
830-357-2000



114 Cevallos Street  
San Antonio, TX 78204  
210-829-1737



1917 N. New Braunfels Avenue, Suite 201  
San Antonio, TX 78208  
210-227-2724



12770 Cimarron Path, Suite 100  
San Antonio, TX 78249  
210-698-5051

Garza Consulting & Irrigation

Joeris General Contractor

City of Boerne



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# Questions