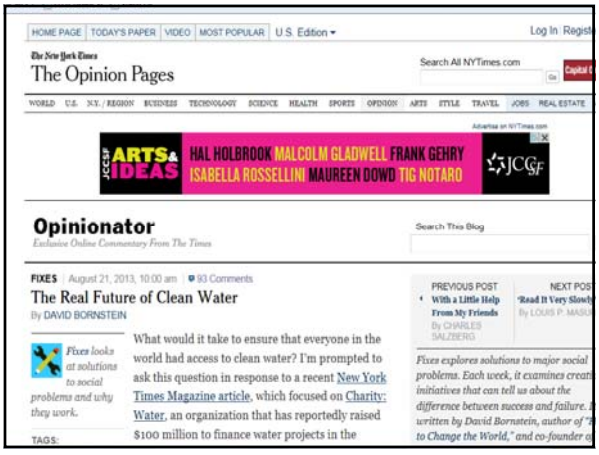
schools connect the drops

water is precious

Pauline Souza, AIA, LEED Fellow
USGBC National Green Schools Chair | WRNS Studio

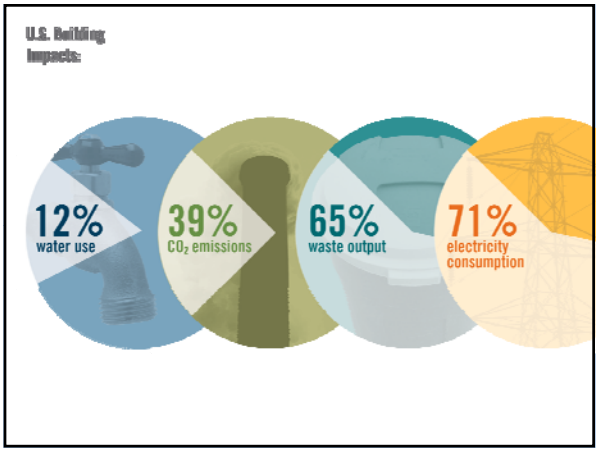
Wendy Rogers, AIA, LEED AP BD+C
USGBC Orange County Chapter Green Schools Chair | LPA, Inc.

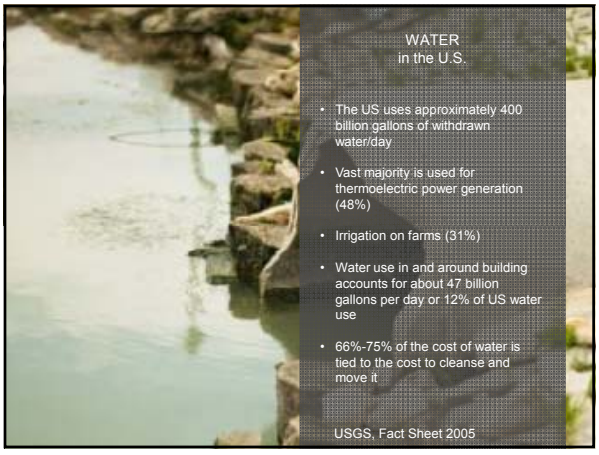
Saving California's water supply one school at a time



OVERDRAFT AND SHORTAGES

- Lehi Utah experienced unexpected emergency shortages in June 2013 – on June 21, a restriction on culinary uses was in effect
- The Middle East lost 117 million acre feetof freshwater between 2003-2009 – enough to fill the Dead Sea
- Groundwater levels are below sea level causing sea water from the Pacific to move inland where it mixes with fresh groundwater
- Average national intensity of public water is 2.3 – 3.3 kWh per thousand gallons – corresponding to .7% -1% of the electricity generated by all power plants each year.



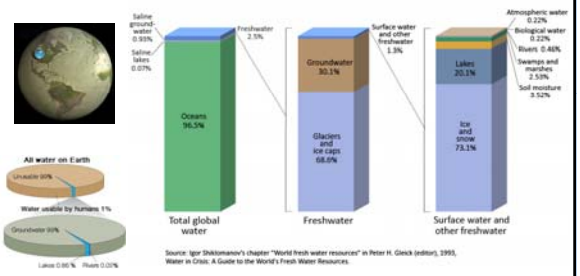


WATER in the U.S.

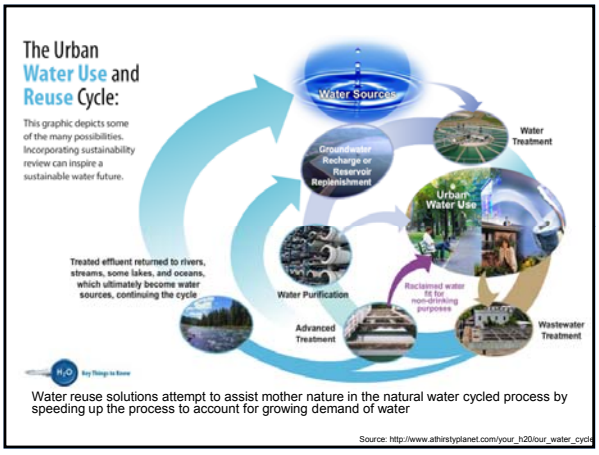
- The US uses approximately 400 billion gallons of withdrawn water/day
- Vast majority is used for thermoelectric power generation (48%)
- Irrigation on farms (31%)
- Water use in and around building accounts for about 47 billion gallons per day or 12% of US water use
- 66%-75% of the cost of water is tied to the cost to cleanse and move it

USGS, Fact Sheet 2005

DISTRIBUTION OF EARTH'S WATER

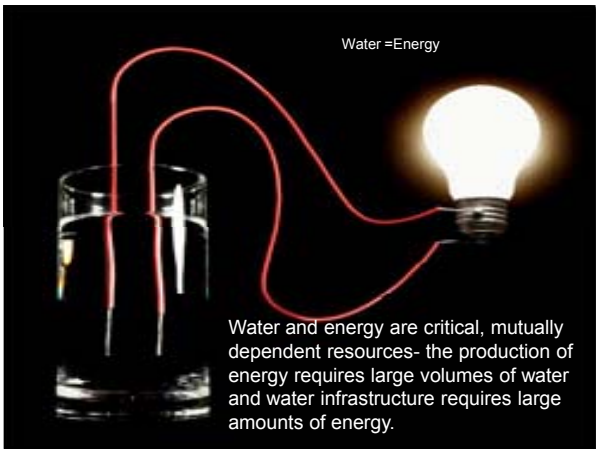


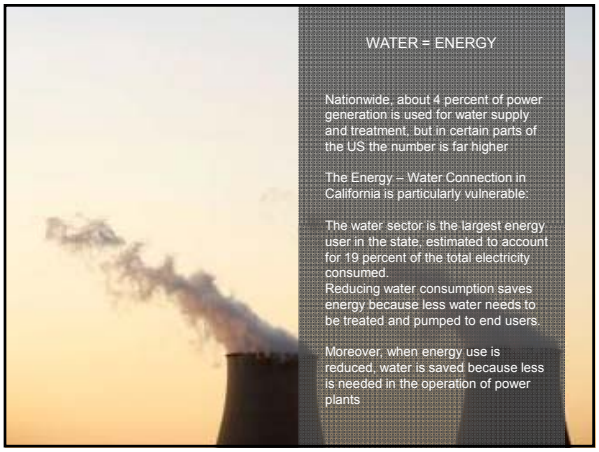
Source: Igor Shiklomanov's chapter "World fresh water resources" in Peter H. Gleick (editor), 1993, Water in Crisis: A Guide to the World's Fresh Water Resources.

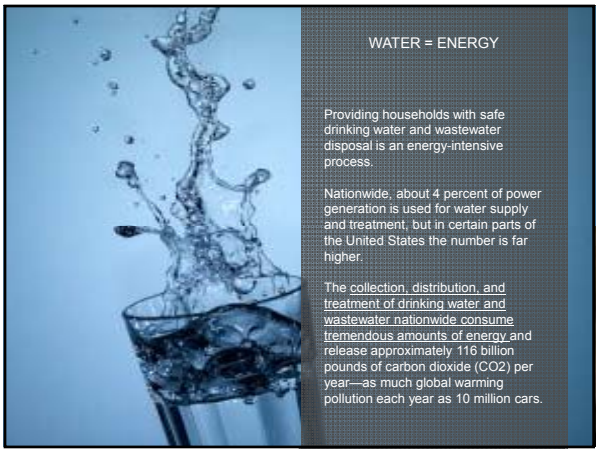


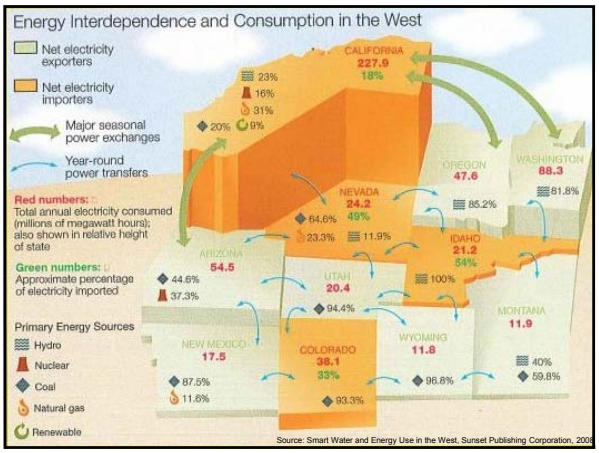
Water reuse solutions attempt to assist mother nature in the natural water cycled process by speeding up the process to account for growing demand of water

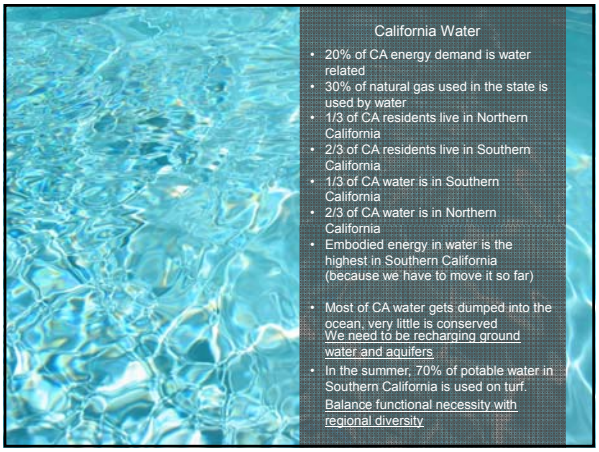
Source: http://www.athirstyplanet.com/your_h20/our_water_cycle


Water =Energy
Water and energy are critical, mutually dependent resources- the production of energy requires large volumes of water and water infrastructure requires large amounts of energy.


WATER = ENERGY
Nationwide, about 4 percent of power generation is used for water supply and treatment, but in certain parts of the US the number is far higher
The Energy – Water Connection in California is particularly vulnerable:
The water sector is the largest energy user in the state, estimated to account for 19 percent of the total electricity consumed.
Reducing water consumption saves energy because less water needs to be treated and pumped to end users.
Moreover, when energy use is reduced, water is saved because less is needed in the operation of power plants


WATER = ENERGY
Providing households with safe drinking water and wastewater disposal is an energy-intensive process.
Nationwide, about 4 percent of power generation is used for water supply and treatment, but in certain parts of the United States the number is far higher.
The collection, distribution, and treatment of drinking water and wastewater nationwide consume tremendous amounts of energy and release approximately 116 billion pounds of carbon dioxide (CO2) per year—as much global warming pollution each year as 10 million cars.





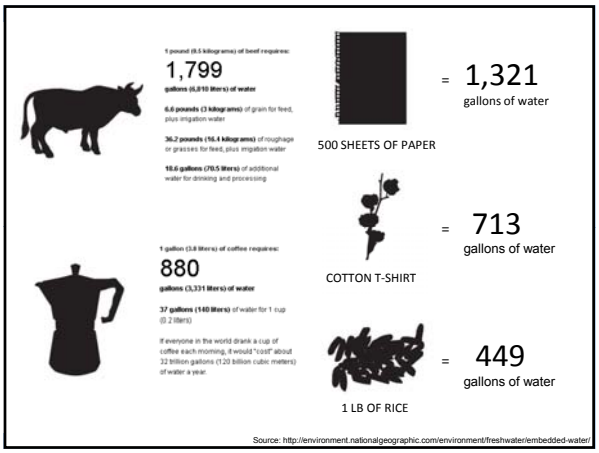
California Water

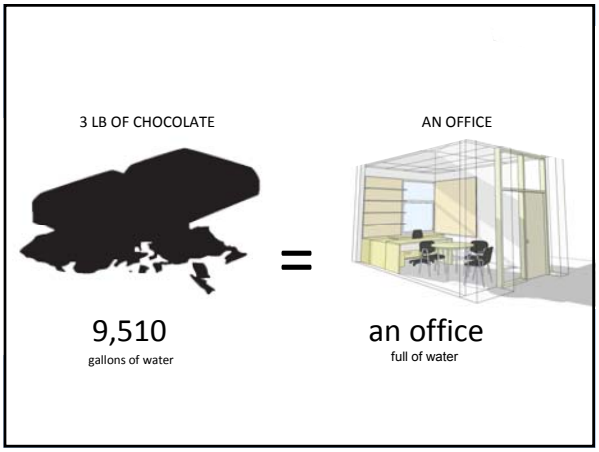
- 20% of CA energy demand is water related
- 30% of natural gas used in the state is used by water
- 1/3 of CA residents live in Northern California
- 2/3 of CA residents live in Southern California
- 1/3 of CA water is in Southern California
- 2/3 of CA water is in Northern California
- Embodied energy in water is the highest in Southern California (because we have to move it so far)
- Most of CA water gets dumped into the ocean, very little is conserved
  We need to be recharging ground water and aquifers
- In the summer, 70% of potable water in Southern California is used on turf.
  Balance functional necessity with regional diversity

WATER = LIFE

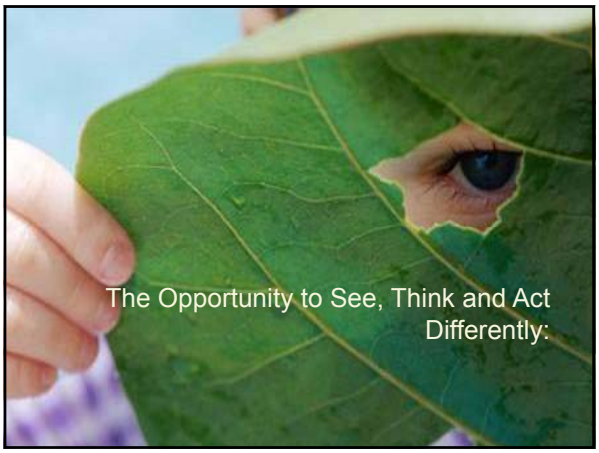
- We are 97% water
- A gallon of gasoline takes nearly 13 gallons of water to produce. Combine your errands, car pool to work, or take public transportation to reduce both your energy and water use.
- The water it takes to produce the average American diet alone—approximately 1,000 gallons per person per day—is more than the global average water footprint of 900 gallons per person per day for diet, household use, transportation, energy, and the consumption of material goods.
- Energy Star dishwashers use about 4 gallons of water per load, and even standard machines use only about 6 gallons. Hand washing generally uses about 20 gallons of water each time.

Source: http://environment.nationalgeographic.com/environment/freshwater/embedded-water/

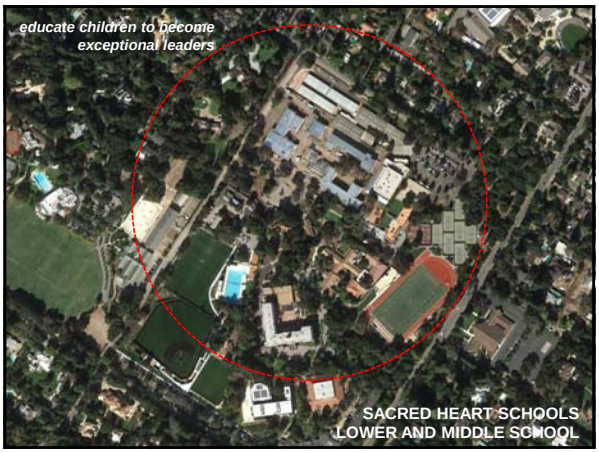

1,799
880
500 SHEETS OF PAPER
= 1,321 gallons of water
COTTON T-SHIRT
= 713 gallons of water
1 LB OF RICE
= 449 gallons of water
Source: http://environment.nationalgeographic.com/environment/freshwater/embedded-water/


3 LB OF CHOCOLATE
AN OFFICE
=
9,510
gallons of water
an office
full of water


VALUE



Case Study: SACRED HEART SCHOOL



63 acres plus

Local code requirements:
2 year storm
25 year storm

Stormwater cleansed through landscape based natural treatment – meets C3 regulatory requirements

Stormwater flow rates are reduced through maximized pervious paving and

Site water management 02

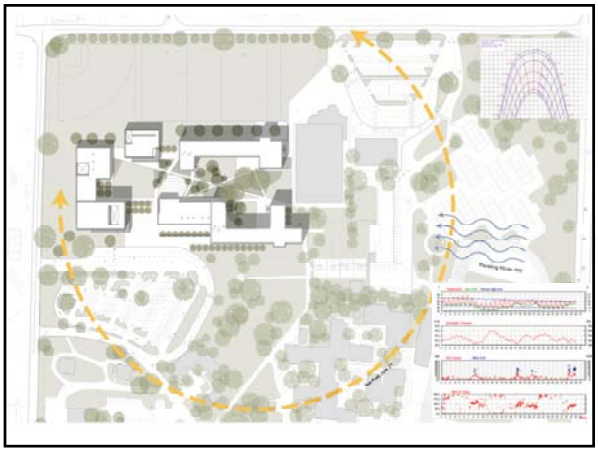
63 acres plus

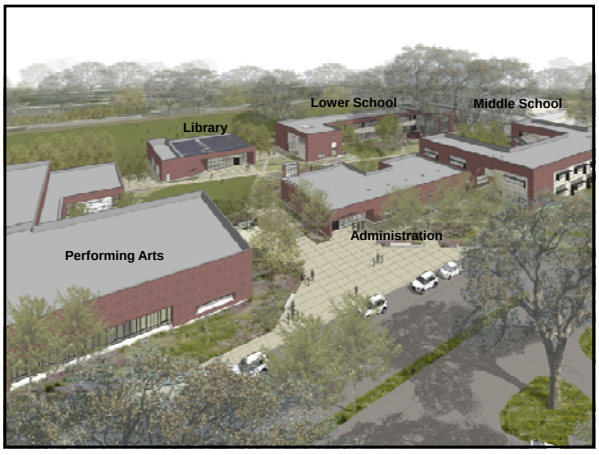
Local code requirements:
- 2 year storm
- 25 year storm

Stormwater cleansed through landscape based natural treatment – meets C3 regulatory requirements

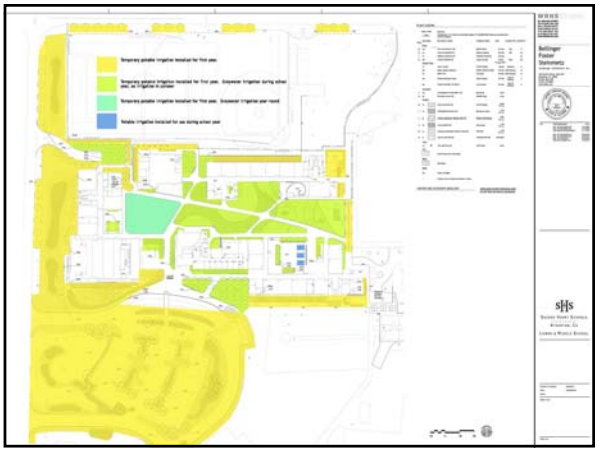
Stormwater flow rates are reduced through maximized pervious paving and

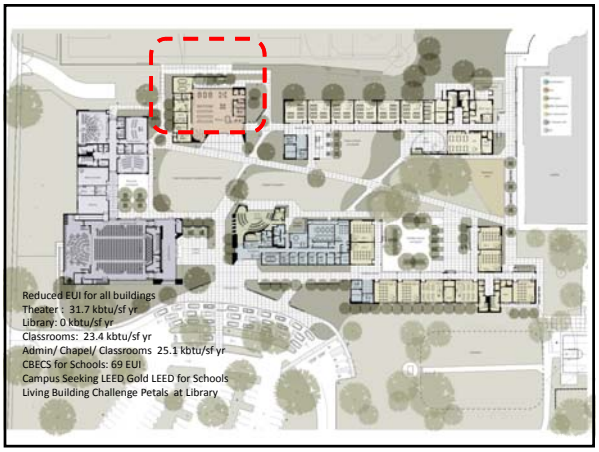
Site water management

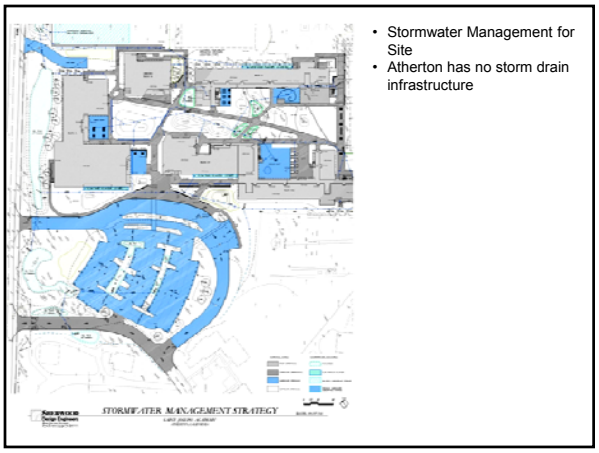




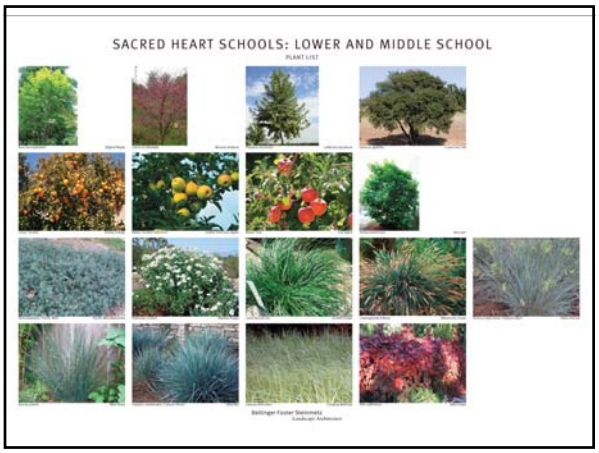

Stormwater Diagram
SAINT JOSEPH ACADEMY

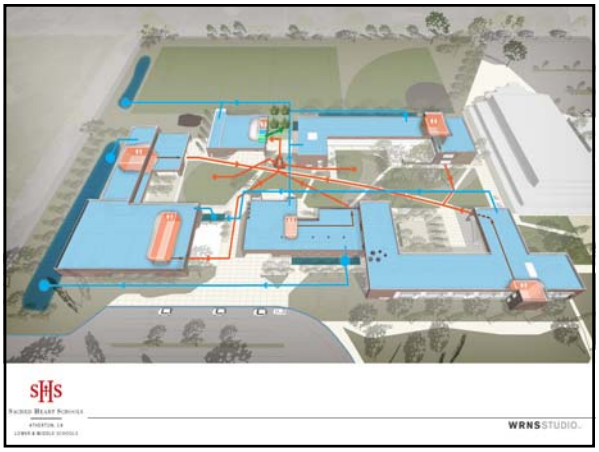


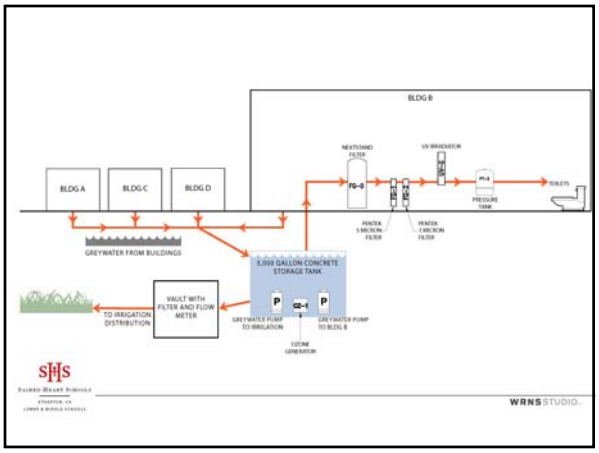


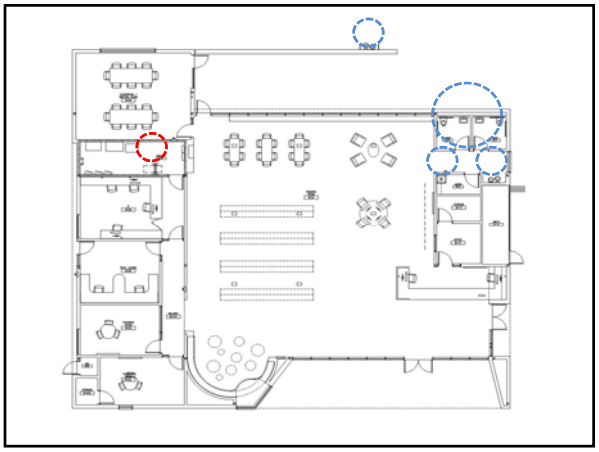


- Stormwater Management for Site
- Atherton has no storm drain infrastructure


SACRED HEART SCHOOLS: LOWER AND MIDDLE SCHOOL
PLANT LIST


SHS
WRNSSTUDIO


BLDG B
BLDG A
BLDG C
BLDG D
GREYWATER FROM BUILDINGS
5,000 GALLON CONCRETE STORAGE TANK
VAULT WITH FILTER AND FLOW METER
TO IRRIGATION DISTRIBUTION
GREYWATER PUMP TO IRRIGATION
GREYWATER PUMP TO BLDG B
OZONE GENERATOR
TOILETS
PRESSURE TANK
SHS
WRNSSTUDIO

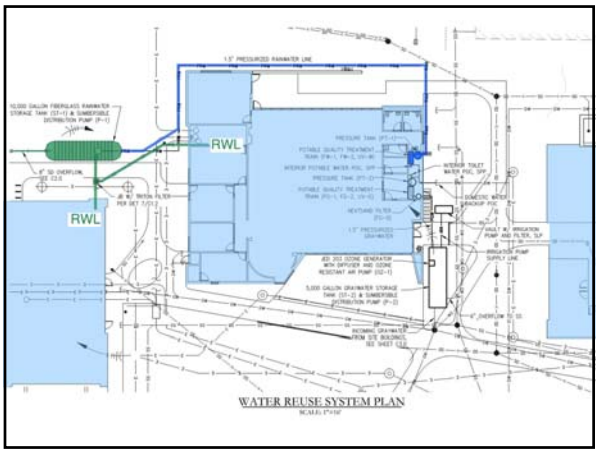


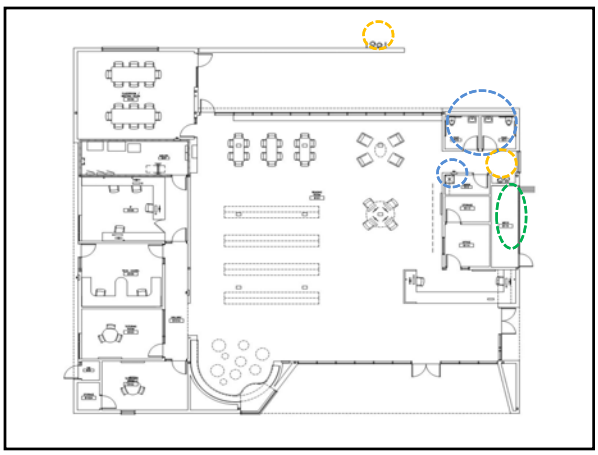
6300 sq ft library

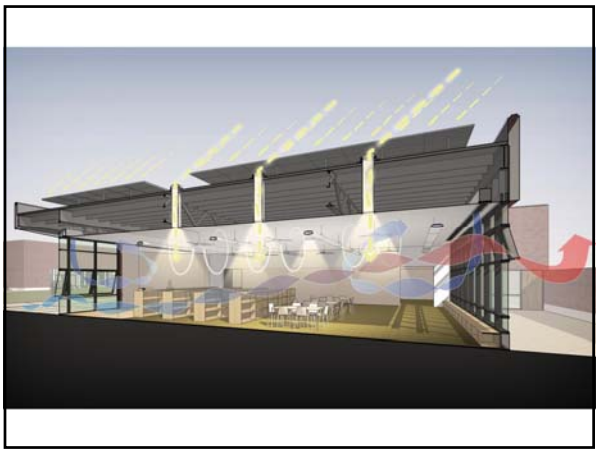
Demand:
water 2 lavatory sinks, I service sink, 2 fountains
113 gallons a day
33,750 gallons per year
Max Flow: 4 gpm

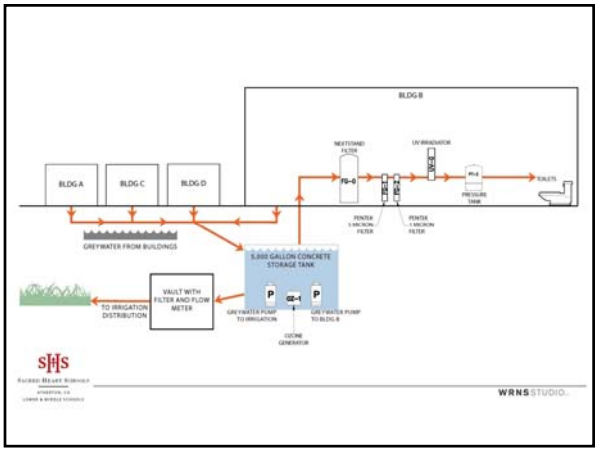
Rainwater supply available
in peak month – 18,600 gallons
In driest month – 150 gallons
Harvest from library roof approx 80,000 gal assuming 70% capture

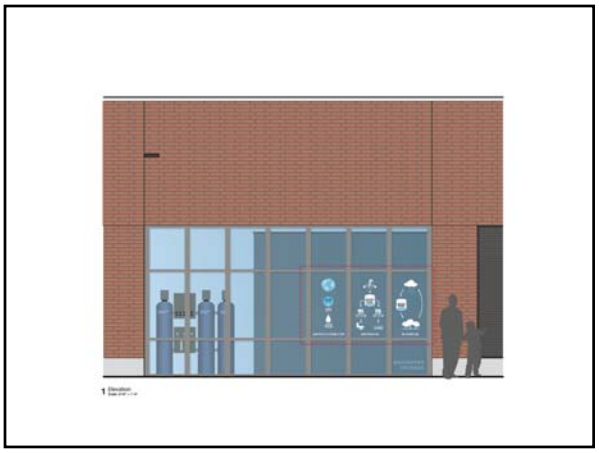
building water


RWL
RWL
WATER REUSE SYSTEM PLAN





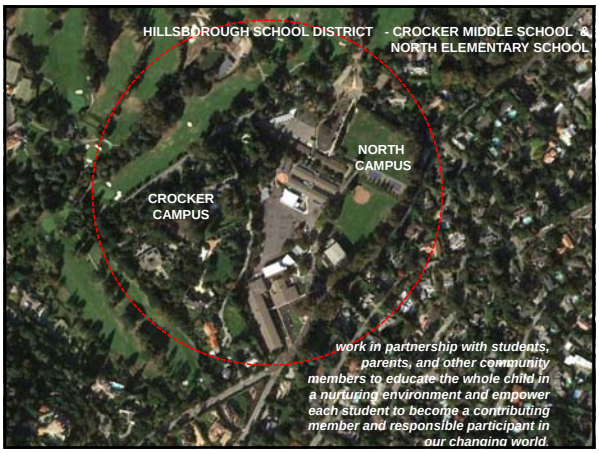

BLDG B
BLDG A
BLDG C
BLDG D
GREYWATER FROM BUILDINGS
5,000 GALLON CONCRETE STORAGE TANK
VAULT WITH FILTER AND FLOW METER
TO IRRIGATION DISTRIBUTION
GREYWATER PUMP TO IRRIGATION
GREYWATER PUMP TO BLDG B
OZONE GENERATOR
TOILETS
WRNSSTUDIO



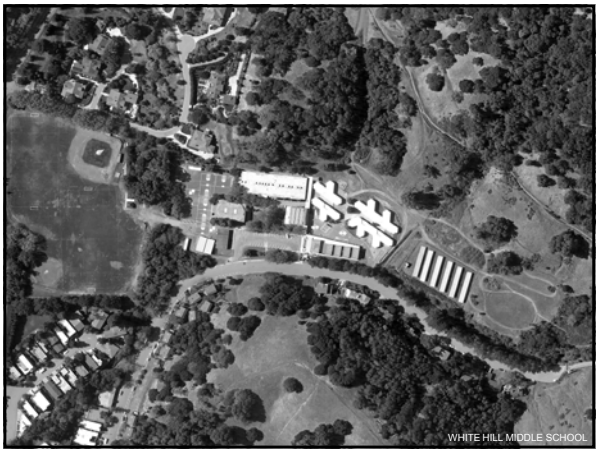
TO DATE SUCCESSES

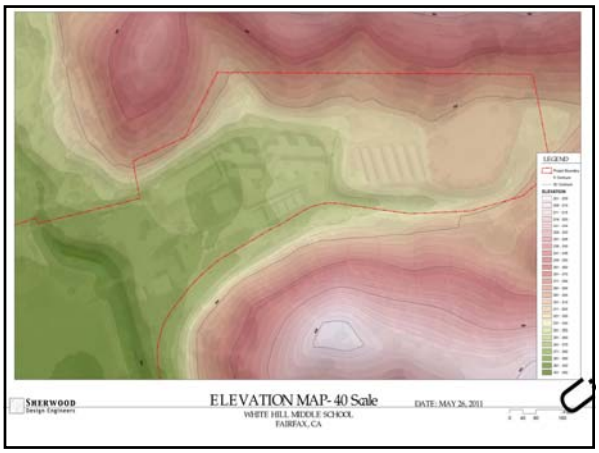
- Estimated EUI is 27 before PVs - 0 with PVs
- Drought tolerant and native landscape – over 40% better – WEc1
- 100% of irrigation uses grey water
- Potable water consumption reduced by 60%
- Site Paving includes Large pervious paved surfaces
- Analyzing Library with PGE Net Zero Pilot program
- Integrated sustainable elements are TEACHING MOMENTS

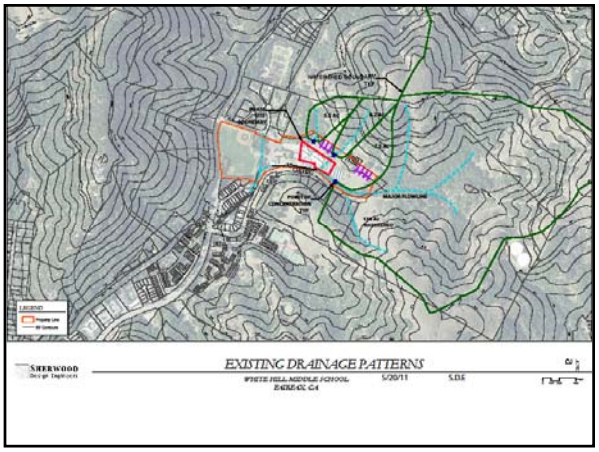
Case Study: ROSS VALLEY UNIFIED SCHOOL DISTRICT – WHITE HILL MIDDLE SCHOOL

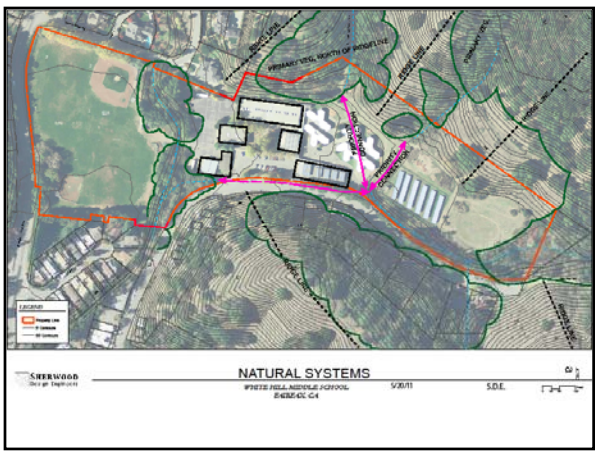

HILLSBOROUGH SCHOOL DISTRICT - CROCKER MIDDLE SCHOOL & NORTH ELEMENTARY SCHOOL
NORTH CAMPUS
CROCKER CAMPUS
work in partnership with students, parents, and other community members to educate the whole child in a nurturing environment and empower each student to become a contributing member and responsible participant in our changing world.

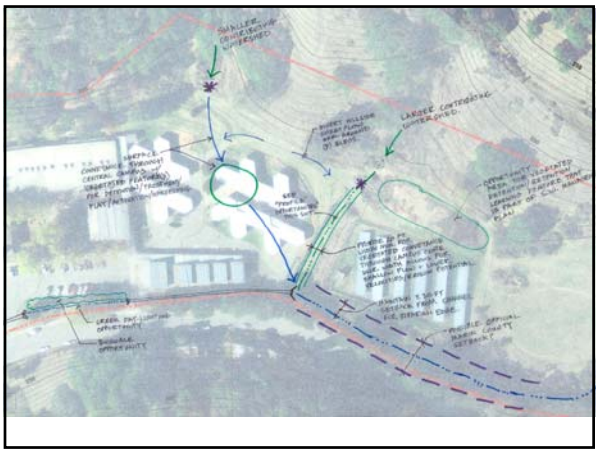

White Hill Middle School

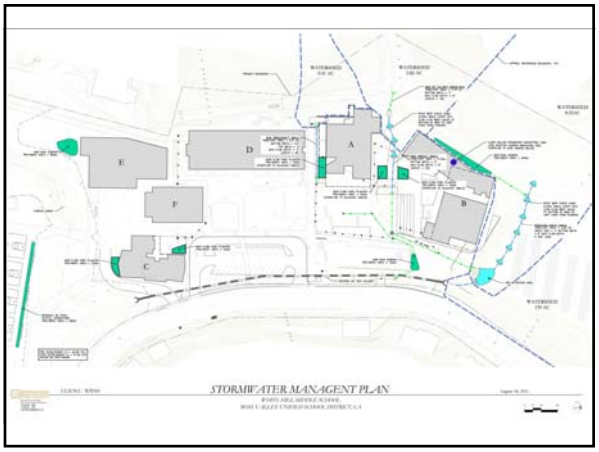

WHITE HILL MIDDLE SCHOOL


ELEVATION MAP- 40 Scale
WHITE HILL MIDDLE SCHOOL
FAIRFAX, CA
DATE: MAY 26, 2011


EXISTING DRAINAGE PATTERNS

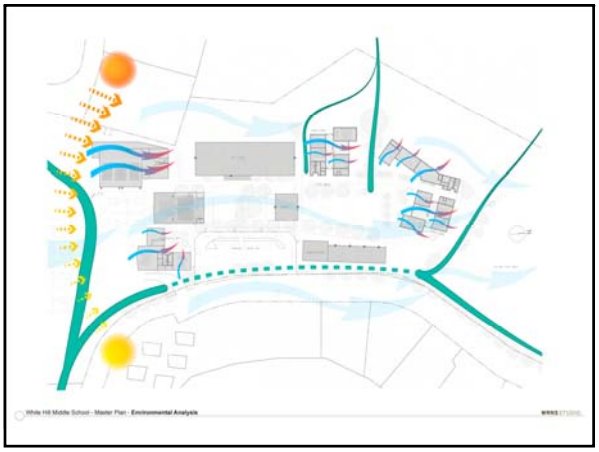

NATURAL SYSTEMS

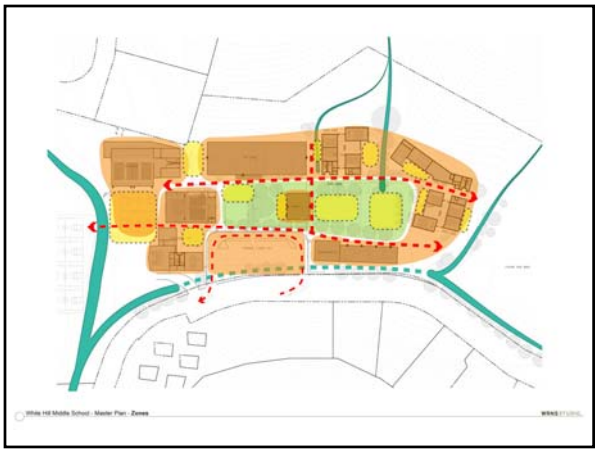


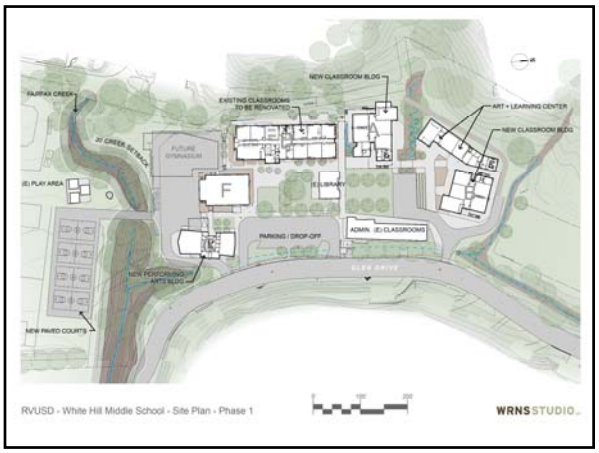

STORMWATER MANAGEMENT PLAN


OPTION 4B


OPTION A3
OPTION G2
WHITE HILL MIDDLE SCHOOL


White Hill Middle School - Master Plan - Environmental Analysis


White Hill Middle School - Master Plan - Zones

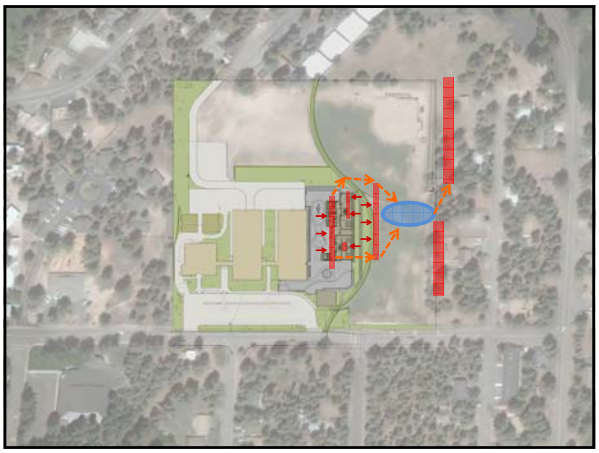

NEW CLASSROOM BLDG
EXISTING CLASSROOMS TO BE RENOVATED
ART + LEARNING CENTER
NEW CLASSROOM BLDG
FUTURE GYMNASIUM
(E) PLAY AREA
F
(E) LIBRARY
PARKING / DROP-OFF
ADMIN (E) CLASSROOMS
NEW PAVED COURTS
RVUSD - White Hill Middle School - Site Plan - Phase 1
WRNSSTUDIO

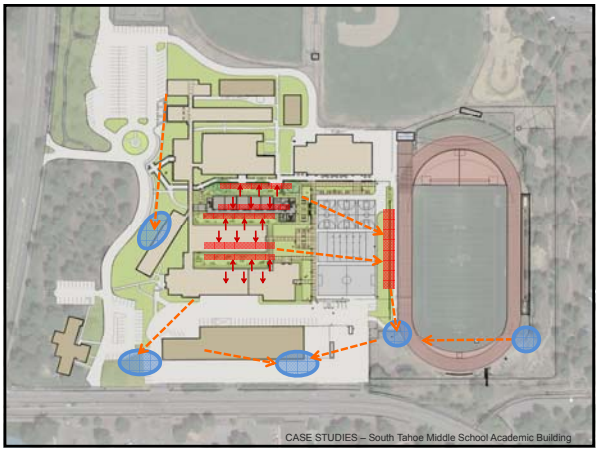

D
E
A
F
B
C
WHITE HILL MIDDLE SCHOOL

Case Study: LAKE TAHOE UNIFIED SCHOOL DISTRICT


south lake tahoe
Mark Twain, described Lake Tahoe as ". . . a noble sheet of blue water lifted six thousand three hundred feet above sea level and walled in by a rim of snow-clad mountain peaks that towered aloft full three thousand feet higher . . . I thought it must be the fairest picture the earth affords."
CASE STUDIES – South Lake Tahoe Unified School District

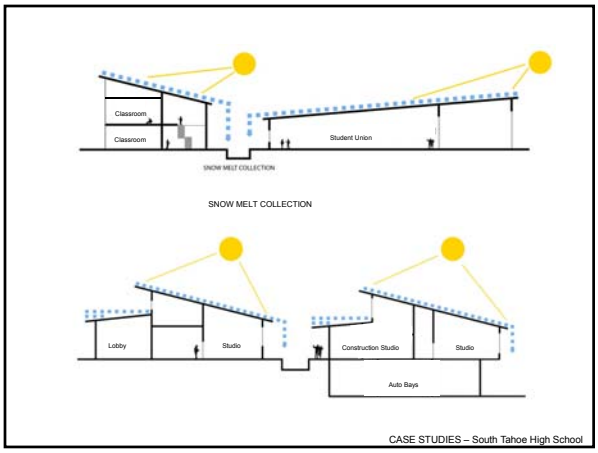

south lake tahoe
1 bijou elementary school
2 south tahoe middle school
3 south tahoe high school
1
2
3
CASE STUDIES – South Lake Tahoe Unified School District




CASE STUDIES – South Tahoe Middle School Academic Building

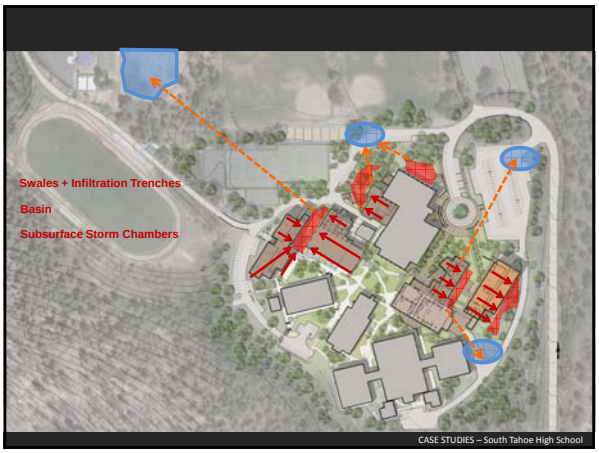
CASE STUDIES – South Tahoe High School

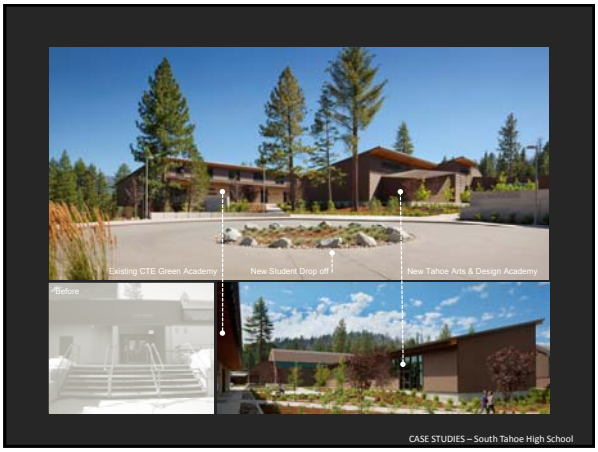
CASE STUDIES – South Tahoe High School

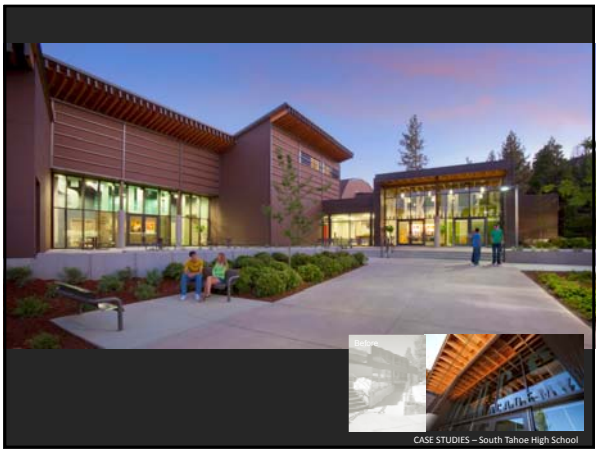


SNOW MELT COLLECTION

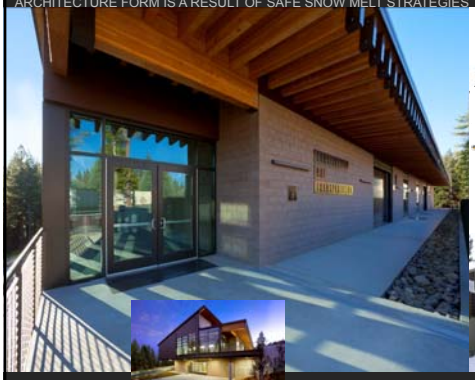
CASE STUDIES – South Tahoe High School


Swales + Infiltration Trenches
Basin
Subsurface Storm Chambers
CASE STUDIES – South Tahoe High School


Existing CTE Green Academy
New Student Drop off
New Tahoe Arts & Design Academy
Before
CASE STUDIES – South Tahoe High School


Before
CASE STUDIES – South Tahoe High School

ARCHITECTURE FORM IS A RESULT OF SAFE SNOW MELT STRATEGIES



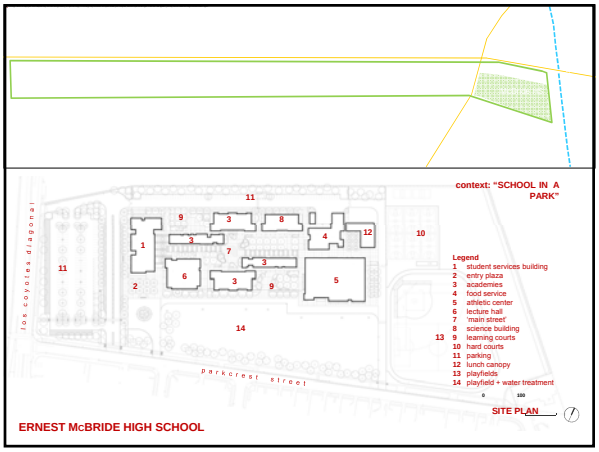
CASE STUDIES – South Tahoe High School

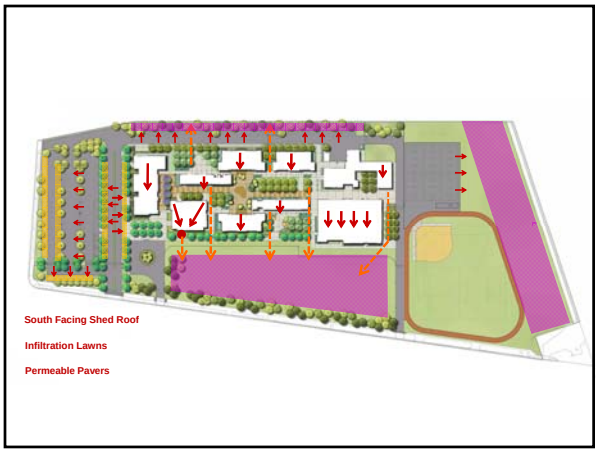
EDUCATIONAL SIGNAGE CREATE A SUSTAINABLE TEACHING LAB

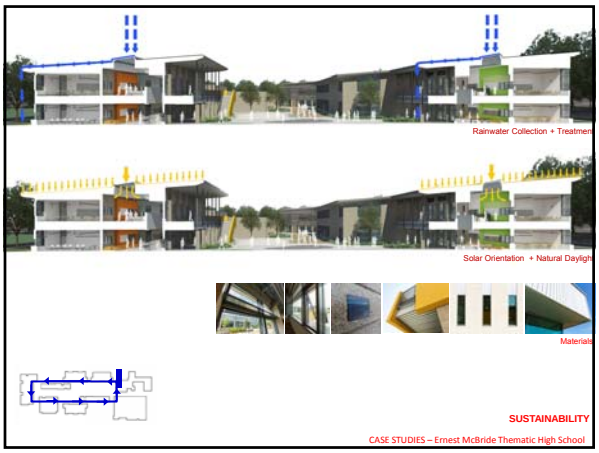
CASE STUDIES – South Tahoe High School

CASE STUDIES – South Tahoe High School

Case Study: ERNEST McBRIDE HIGH SCHOOL

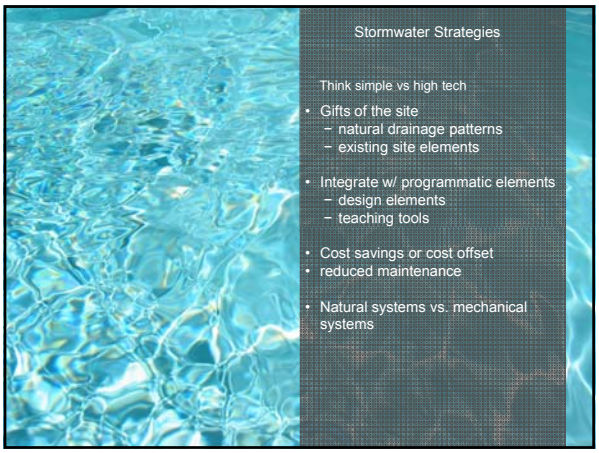


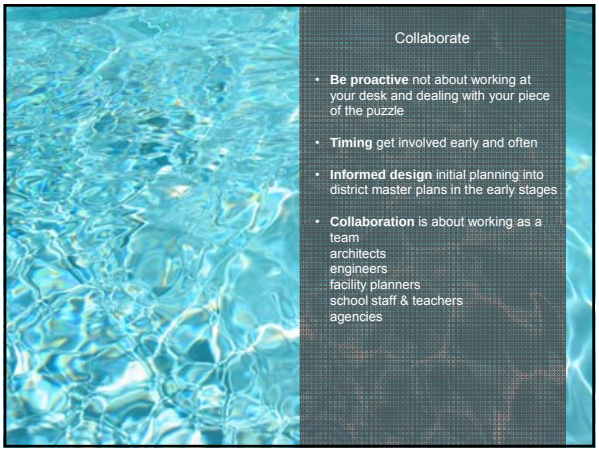


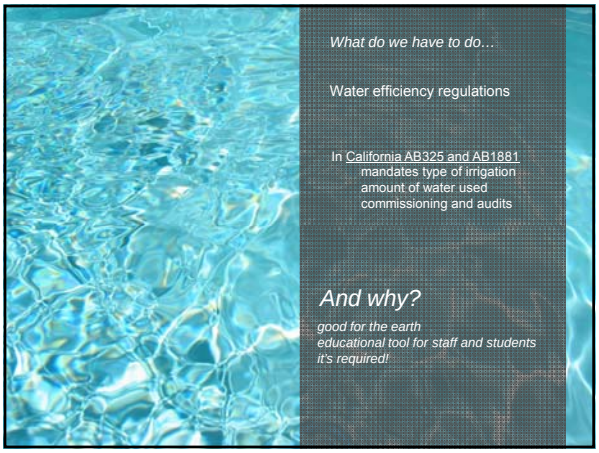

Rainwater Collection + Treatment
Solar Orientation + Natural Daylight
Materials
SUSTAINABILITY
CASE STUDIES – Ernest McBride Thematic High School


School within a Park
Overt Scupper Highlights Water Strategies for Student
Designed to qualify for The Collaborative for High Performance Schools (CHPS) Verified program the campus:
• exceeds California Title-24 2008 standards by approximately 40%
• meets 57% of the estimated site energy use with a 277-KW rooftop grid-tied photovoltaic system
• exceeds its relevant 2030 Challenge benchmark by 75%, well ahead of the current 2030 Commitment levels
• Reduces overall irrigation water use by 30% with a District wide central control system
CASE STUDIES – Ernest McBride Thematic High School


lessons learned
natural systems - no increase in cost
some problems with retention being too moist for play – but no vector problems to date
may be a class 2 project today – which would increase the cost of the project
SMARTS system: good experience and easy
[increased response times from the agency]


Stormwater Strategies
Think simple vs high tech
• Gifts of the site
– natural drainage patterns
– existing site elements
• Integrate w/ programmatic elements
– design elements
– teaching tools
• Cost savings or cost offset
• reduced maintenance
• Natural systems vs. mechanical systems


Collaborate
• **Be proactive** not about working at your desk and dealing with your piece of the puzzle
• **Timing** get involved early and often
• **Informed design** initial planning into district master plans in the early stages
• **Collaboration** is about working as a team
architects
engineers
facility planners
school staff & teachers
agencies


What do we have to do…
Water efficiency regulations
In California AB325 and AB1881
mandates type of irrigation
amount of water used
commissioning and audits
And why?
good for the earth
educational tool for staff and students
it's required!


Questions ?
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