

# Water Policy We Should Have

The premise of this paper is that the United States needs to separate water policy from energy policy, and create a Department of Water that parallels the Department of Energy. The US needs water security and has the opportunity to become a leader demonstrating to the developing world how to conserve and increase water supplies for food growing, provide healthy drinking water, maintain sanitation, optimize watershed health, protect wetlands' ability to cleanse and purify watershed drainage, recharge aquifers, reduce global warming, stimulate the economy, and create green jobs.

This paper is grouped in categories of facts, principals, problems, policies, solutions A, B, C, D, and appendix A and B.

## WATER FACTS

- 97% of all water is salt water—too salty to drink or grow crops with. The other 3% is locked up out of practical human reach in the icecaps of Greenland and Antarctica and in deep groundwater aquifers.
- Globally, commercial energy for delivering water is more than 26 Quads, 7% of total world consumption.
- 99.7% of all the water on earth is not available for human and animal consumption. Of the remaining 0.3%, much is inaccessible due to unreachable locations and depths, less than 1% of the total supply, is stored in ground water.
- Typical rainfall destination: 40% infiltrates, 15% goes to the water way, 45% evapo-transpires (the engine of Earth's water cycles) the challenge of the urban environment is to maintain the evapo-transpiration.

## GUIDING PRINCIPALS

Water supply is directly related to the health of the atmosphere and the water shed.

Population places the greatest stress on the world's fresh water supply; pollution has become the second major adversary to our water.

A World Bank study found if countries wish their economies to do well they should take five major steps. *What if we applied these five major steps toward water?*

1. Simplify and de-regulate markets
2. Enhance property rights
3. Expand use of technology
4. Reduce court involvement

## 5. Make reform a continuous process

Water and energy are critical elements of sustainable development. Without access to both, economic growth and job creation cannot take place and poverty cannot be averted.

Water promises to be to the 21<sup>st</sup> century as oil was to the 20<sup>th</sup> century. It will determine the wealth of nations.

Maintaining watershed health is the future for all civilization to meet demands of human basic needs. We need fully integrated water policy.

In the past five years water cost has increased 27%. Thirty-six states expect to have water shortages in the next 10 years under normal conditions.

Water supply is directly related to the health of the atmosphere and the watershed.

- The environment can survive the water demand of cities and increasing populations if we have water policies that legislate basic rights, have catchments management, demand management, mimic nature's ecosystems, renewable energy and no waste, monitor and maintain our rivers in excellent health, implement bio retention pre-filtering, monitor macro invertebrate health, aquatic plants health and biodiversity, atmospheric management, light and noise pollution, to result in lovely elegant modernization strategies.
- All water on earth is recycled. Evapo-transpiration is the engine that does it.
- Integrated Water Management for urban and rural, consisting of rain water harvesting, potable disinfection, gray water reuse, black water reclamation, constructed wetlands for bio-remediation, and storm water retention and re-use, flood control, food growing irrigation, maintaining watershed health is the future for all civilization to meet demands of human basic needs. We all need water and we all need to manage it.

## PROBLEMS

### International Crisis

- Currently two billion (1/3 of earth's 6 billion population) people do not have access to clean sanitary water
- By 2015, at least 40 % of the world's population will lack an adequate water supply, *(estimated by both the United Nations and the United States government)*.
- Experts predict that water shortages will affect the livelihood of one-third of the world's population by 2025.
- The UN states that 2/3 of the world population will have water scarcity by 2025.

### USA Crisis

- Conventional hydrology is 18<sup>th</sup> century public health engineering level. Some regions have grown 65% in 20 years. Water infrastructure has not kept up with population increase.
- 2371 USA dams and watershed structures are in danger, needing repair and replacement.
- MTBE and other chemical contamination <http://www.epa.gov/mtbe/water.htm>
- A chronic lack of funding- Despite the obvious risks, these sewage problems are largely ignored. Federal, state, and local wastewater treatment facilities are dangerously underfunded, often lacking the resources needed to fully perform normal operations and maintenance, let alone infrastructure improvements that will allow them to deal with increased sewage burdens. According to the EPA's "2002 Clean Water and Drinking Water Gap Analysis," current spending rates will create an *annual* shortfall of \$1 to 6 *billion* over the next 20 years.
- Aquifers are being over used by civilization, going dry, getting polluted with arsenic and fluoride, salt ocean water siphons in laterally at aquifers adjacent to the coast. California and Arizona aquifers are being depleted three ft/yr.
- In the past five years water cost has increased 27%. 36 states expect to have water shortages in the next 10 years under normal conditions. We need to either force conservation or develop alternative sources.
- Pollution has so diminished the world's fresh water resources that less than one percent of it can be used for drinking or agriculture.
- We need to phase out dinosaur water strategies: Dams with macro hydro, desalinization, chlorine treated waste water, etc.

## **POLICY, CODES, and GUIDELINES**

### **USA POLICY**

- California's Greywater Standards, are now part of the State Plumbing Code, making it legal to use gray water everywhere in California, (Assembly Bill 3518, and Greywater Systems for Single Family Residences Act of 1992. There are seven steps that will help people plan, design, install, and maintain their gray water system)
- State Plumbing Code <http://www.iapmo.org/pages/californiaplumbingcode.aspx>
- UPC
- Texas Guide to Rain Water Harvesting  
[http://www.ecy.wa.gov/programs/wr/hq/pdf/texas\\_rw\\_harvestmanual\\_3rdedition.pdf](http://www.ecy.wa.gov/programs/wr/hq/pdf/texas_rw_harvestmanual_3rdedition.pdf)
- University Of CA sustainable Water Policies  
<http://sustainability.universityofcalifornia.edu/water-action-plan.html>
- States have historically addressed water issues.
- Santa Fe mandates systems on new buildings 2500 square feet or larger.
- Tucson requires R.W.H. systems for irrigation and flood control.
- 12 states in USA currently use rainwater harvesting.
- The Texas Manual on Rainwater Harvesting is "the Bible".

- ARCSA is currently working on refining their guideline to get ready to submit them to the International Conference of Building Officials (ICBO) as suggested guidelines for code adoption in plumbing and building, and fire codes.
- EPA Water Sense <http://www.epa.gov/owm/water-efficiency/>
- Berkeley, CA commercial solar landlord-tenant solar energy sharing program
- Tucson, AZ requires rainwater harvesting systems for irrigation and flood control.
- Texas, rain water harvesting equipment and systems are exempt from sales tax and property tax.

INTERNATIONAL POLICIES: there are English speaking approved policies that we can share and adopt

- Australian Guidelines for Water Recycling  
<http://www.environment.gov.au/resource/national-water-quality-management-strategy-australian-guidelines-water-recycling-managing-0Australia> Storm water Harvesting and Reuse and Managed Aquifer Recharge  
<http://www.recycledwater.com.au/index.php?id=16>
- UNEP The objectives of the UNEP water policy and strategy, distilled from its mandates, are: (a) Improved assessment and awareness of water issues; (b) Improved environmental management of basins, coastal and marine waters, including the identification of linkages with ongoing international processes;
- (c) Improved cooperation in the water sector.  
[http://www.unep.org/Themes/freshwater/Documents/Water\\_and\\_Cities\\_Final.pdf](http://www.unep.org/Themes/freshwater/Documents/Water_and_Cities_Final.pdf)
- Australia eWater <http://www.ewatercrc.com.au/>
- Korea has 500 years of successful water management governing the nation with three masters: rain, cloud, and wind. Korea's vision of the ultimate urban system integrates three tanks under each high-rise for: flood control, water saving, and emergency reserve. Water monitoring of all tanks in urban area to water office to Internet weather and emergency offices would empty all cisterns in advance of a major storm so that the cisterns are empty at time of flood, so that the cisterns can be filled by the flood to offset that amount of water in the storm drain overflow to watershed.
- Australia: It will cost \$3/4 billion to do rainwater harvesting on all homes in all major cities in Australia vs. \$ 3.1 billion to build desalination facilities. A bill is currently being reviewed proposing \$1 billion/yr rebates per year for 20 years to upgrade all homes to rainwater harvesting and greening of homes. The goal to upgrade all homes within one generation.
- Australia: In 2005/2006 three councils spent \$4.8 million maintaining 20 water bodies, assumed to be under maintained. Cost per hectare of surface and \$6500 to \$17,000. There is a need for local guidance on design, maintenance, remediation, consistent methods for collecting data, sustainable water management regime for all new water bodies, storm water harvesting strategies, eco system protection, regional water supply strategy, rainwater conveyance, attenuation, recharge pits, network with other water shed water, treat the water before it goes into the piped water system, the top 20 cm has the best filtration with bio beneficial critters in it, decentralized natural systems, occupant must use storm water or else infiltrate it. Development must come up with a maintenance

free system. ESC ecological storm drainage. Water related zoning: recreational/natural/working. The restoration economy of environmentalism need to go from boutique to mainstream. The future of ecology engineering is closed loop design.

- Australia: Has an organization called [www.greenplumbers.com](http://www.greenplumbers.com) that is training plumbers on how to install integrated water management systems. California is currently adopting a similar green plumber program.
- Australian national agenda: cut greenhouse pollution, restore rivers, secure water supplies, build smarter cities, and strengthen the environment.
- Australia currently recycles four percent of water. Goals are to recycle 40% by 2020.
- Australia's water shortages have stimulated industry businesses that make products
- Australia: Five years ago tanks were not allowed, today homes with a 530 gallon tank connected to toilets and laundry save 40% of prior water use.
- Australia: Dual system gages that use rain water first if it is in the tank and municipal water only as a backup, back flow preventer.
- Australia: Waste water- The OzziKleen is the only domestic sewerage system utilizing the Aerobic Activated Sludge technology, therefore the only one which offers the convenience associated with town sewerage.
- Australia: Fire protection is being approved with rain water by some jurisdictions by having the domestic tap above the fire protection reserve
- Canada has 25% of the world's fresh water. Patrick Lucy and Carrie Barroclay are designing development on Victoria Island where its population will double in 30 years. Currently there is no sewage system and all is dumped into the ocean. The premiere and cabinet are looking for bio models to challenge and implement green thinking on a large enough scale to enable whole city change to implementing integrated design to accommodate capacity. Canadians are developing projects with a bio refinery. Integrated resource management boards are implementing the urban version of the intention of permaculture (even though they don't use that word), or industrial ecology, in that everything becomes a revenue stream. Nothing is waste. They envision a water ministry/bio refinery/district heating/biodiesel factory/fertilizer plant/organic waste processing/bio gas plant. Currently all parts exist fragmented on earth. We need to pull together peer review teams from around the world.
- Global conferences coming up are writing legal instrument for managing aquifers shared by two or more countries.
- Three key components of UNEP freshwater work are identified as assessment, management and cooperation and are tied together within a framework of integrated water resources management (IWRM).
- Portland and Australia have ordinances allowing dual supply systems (rainwater and municipal with back flow and air gap devices to protect the municipal source from cross contamination.
- Australian guidelines for rainwater and waste water have 600 pages of text. 66% of south Australians drink rainwater, based on a risk management approach.
- The UN and World Health Organization are drafting an aquifer treaty
- AU- Recycled sewage water being used for power station cooling water (western corridor water recycling scheme). Desalination is too energy intensive. Grey water has

gone from illegal to encouraged. New homes are now required to have rainwater technologies (RWT) plumbed into them. The home of the future will integrate RWT, greywater re-use and storm water reuse.

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- Australia - Bill is currently being reviewed proposing \$1 billion/yr rebates per year for 20 years to upgrade all homes to rainwater harvesting and greening of homes. Goal to upgrade all homes within one generation

**SOLUTIONS A: We can adopt the following integrated sustainable water strategies to conserve and increase water sources for US water security and to drive innovation for the economy and green jobs:**

- Rainwater harvesting
- Storm water reclamation
- Grey water reclamation
- Backwater reclamation
- Industrial reclamation
- Bioremediation
- Wetlands
- Solar distillers
- Carbon filters and UV lights
- Living roofs
- Sponge landscaping
- Permaculture
- Integrated fire protection h20 cisterns
- Micro-hydro
- Mycology remediation
- River restoration
- Permeable pavement is for re-using water stored under pavement
- soiling drinking water for sanitation
- reduce and reclaim sewage water
- tidal power
- river power
- stored water as stored energy
- micro hydro
- global warming rising sea level
- SOLAR VOLTAIC PUMPED HYDRO ELECTRIC SYSTEM: The power is generated at the bottom and pushed by the pressure of the vertical descent. The pump is at the bottom, powered by the electricity generated there, to send the water back up to the top cistern where it will be perched at potential energy, ready to make electricity once again. Then this power is available for instant electricity: the perched water in the top cistern is

the potential energy or “battery”. Renewable energy is used to pump the water back up hill during sun or wind. In the event of an emergency (solar or wind power failure) a single generator could run this pump to send water back up to the upper cistern, as the only backup to keep the whole system working. If falls apart only need one generator

## **SOLUTIONS B-GENERAL**

We need to either force conservation or develop alternative sources:

- We need to decentralize water supplies to minimize security fears.
- Why not a New Smart Water Grid with localized Integrated Water Management?
- Partner with USA Green Tech Computer industry and UN to create an open to the public database of international water inventory, measurement, reporting and goal monitoring.
- No water strategy will work unless it is consistent with developing countries' continued growth. So curbing water waste requires cheaper clean water than is currently available. And that requires innovation.
- Create a free trade green tech maquiladora in the USA as a matchmaker to attract international water tech business investment in new green Made IN USA innovation products and services.
- Host International Water Tech Conference
- Submit an aggressive global leadership commitment white paper to Poznan than this: [http://unfccc.int/files/kyoto\\_protocol/application/pdf/unitedstatesadaptationbap011008.pdf](http://unfccc.int/files/kyoto_protocol/application/pdf/unitedstatesadaptationbap011008.pdf)
- We need to decentralize water supplies to minimize security fears.
- Aquifers: Optimize health
- Wetlands: Preserve existing and build new constructed wetlands for natural water filters
- Pollute less: Adopt a pollution mitigation program
- Pollution cap and trade program
- Conservation cap and trade program- to offset aquifer use as well as recharge aquifer
- Innovation
- Conserve , recycle, reuse, reclaim, remediate all water sources so that the aquifers do not need to be depleted
- Establish mandatory water use reporting
- Implementation Phase Ins- year one or two mandatory water check list and water reporting for public education, outreach, awareness, and fluency , followed by mandatory reductions
- Use NGO stakeholders for posting water use reporting. Corporations and Institutions do not like to be shown as vulgar abusers of the common good so this tactic will serve to changing their practices
- Safety: The basic rules- all water needs to be treated with respect, safe water is the most important element in providing healthy societies, separation of humans and drinking water supplies from wastewater has had the biggest impact on public health in terms of preventing disease and extending life.
- US needs to post ads in innovative unvisited and educational programs like this add: At Griffith University we recognize that we don't just have a water shortage, we have a water expertise shortage to match. In Government and the private sector there is a

growing demand for professionals in water resource management. That's why Griffith has developed a [Bachelor of Science \(Water Resources\)](http://www.griffith.edu.au/science/water-resources)<sup>1</sup> degree to address this fundamental issue. <http://www.griffith.edu.au/science/water-resources>

- We need a dept. of Water Resource Optimization Initiative for the United States <http://www.is4ie.org/Default.aspx?pagelid=227861>

### **SOLUTIONS C- PURSUE STAKE HOLDER ENDORSEMENT FOR WATER PROGRAMS, CREDENTIALS, MONITORING, INVENTORY, and PUBLIC INFORMATION OF REPORTING**

- Get several NGO groups to unite to maintain and post to public: all water reporting monitoring for inputs, outputs, pollution, conservation improvement efforts, aquifer levels (increase vs. decrease)
- <http://usmayors.org/climateprotection/agreement.htm> Evaluate opportunities to increase pump efficiency in water and wastewater systems; recover wastewater treatment methane for energy production; <http://usmayors.org/climateprotection/documents/mcpAgreement.pdf>
- Grey Water Gorillas <http://www.greywaterquerrillas.com/>
- <http://www.water-ed.org/>
- Mairesse, 2005
- The Water Education Foundation
- Green plumbers union
- Arcsa
- Irca
- Oasis Design
- Department of Water Resources

### **SOLUTIONS D- ADOPT NATION WIDE GREEN BUILDING WATER MEASURES and CODES:**

- Buildings are the primary cause of greenhouse gas emissions in the U.S. and must be made carbon-neutral as quickly as possible.
- In the United States alone, roughly six billion square feet of buildings are constructed each year.
- Technologies, products, and intellectual capital exists now for five star sophisticated existing off grid/grid optional , zero carbon buildings that provide their own water catchments, waste water reclamation, and food growing. These conservation and self-reliant strategies need to be made mainstream.
- Change Building Codes to implement a GHG foot print cap for water supply, irrigation, drainage and waste water system operation and embodied which will have the effect to stimulate innovation to implement or:
- Require water catchment and reclamation on individual buildings to save 6%-7% USA pump energy.
- Use solar pumps where passive gravity not possible
- Legalize gray and black water reclamation
- Require passive strategies for drainage



- Require edible landscaping at campuses, institutions, homes (to minimize embodied food miles)
- Nationalize New Mexico's Sustainable Testing Site Bill in all States to drive innovation in the building industry.
- Smart Building Sensors for water Resource Monitoring
- Declare carbon neutral water use in the US to set an example for the developing world. Measure and monitor!
- Water supply and energy reserves are linked and policy can also be expressed in similar terms. The first priority of energy policy should be the wise, efficient use of whatever energy supplies are available. The same is true of water – priority should be given to the wise, efficient use of whatever water supplies exist. It is after focusing on efficient use of existing resources that attention must be focused on new energy and water supplies that meet sustainability and environmental requirements. It is important to understand that water security is a growing threat in the 21st century, and to understand the implications for energy supply. “The Carbon Disclosure Project is vital, and we’ve got to get everybody to participate in it.”
- Inventory all natural capital
- Inventory all water volumes and their energy uses for pumping distribution, aquifers, watershed, wetlands
- Inventory all embodied CO2 miles in our food supply
- Inventory all electrical generation from utilities and private renewable installations for grid tie and off grid
- Establish criteria , standards, and training for GHG foot print boundaries
- Establish waste data base of all sector out puts and unwanted goods to match with parties who want them as inputs, offer GHG offset incentives to parties who successfully find a home for their refuse outputs. Inventory database of embodied CO2 / energy in outputs from mining, industrial, commercial and agricultural waste outputs.
- States- shall report on their footprint
- Corporate accounting and annual reports shall report their footprint on public database
- Inventory and database embodied CO2 in packaging
- Recommend ICA and ICI database be collected for every industry sector in US, make goals on this parallel with GHG cap.
- Cities shall report on their foot print: ICLEI’s Cities for Climate Protection Campaign is an international movement of more than 800 local governments, including over 300 in the United States, have joined. The CCP campaign provides a framework for local communities to identify and reduce greenhouse gas emissions, organized along five milestones: (1) Conduct an inventory of local water inputs and outputs (2) Establish a water reduction target (3) Develop an action plan for achieving the water reduction target (4) Implement the action plan and (5) Monitor and report on progress.
- New Smart Water Grid to repair and replace 2371 dams and watershed structures in danger with localized Integrated Water Management of rain and storm water harvesting, gray and black water reclamation.
- Globally, commercial energy consumed for delivering water is more than 26 Quads, seven percent of total world consumption. The fast growing demand for clean water,

coupled with the need to protect and enhance the environment, has already created shortages in some parts of the U.S. and will make other areas of the U.S. vulnerable to water shortages in the future. US City report shows six percent of GHG is spent delivering water with pumps.

- Inventory total water inputs of: Rain, greywater -greywater is alkaline ph., fog, snow.
- Inventory water outputs: Evapotranspiration, agriculture, industrial, residential, laundry, domestic landscaping, toilets, kitchen, bathing, sinks
- Energy storage hydro battery--renewable or solar voltaic pumped hydroelectric system. Receive maximum inputs: eliminate current barriers to grid tie contribution by redesigning our grids to store power so if more is being generated than used, we can store it. Invest in energy security by storing potential energy.
- Establish database of embodied CO2 for all water use by fed/state/local governments, utility districts, industry, institutions
- Start a database of international innovative water policy in English (vs. in other languages to be translated)
- Start a base of monitoring

## **APPENDIX A--H2O BASICS and DEFINITIONS**

- Rainwater harvesting as a new source, reduces power and greenhouse gas emissions.
- Integrated Water Management for urban /rural, rainwater harvesting, potable disinfection, greywater reuse, black water reclamation, constructed wetlands bioremediation, storm water retention and reuse, flood control, and food growing irrigation are effective, pilot project proven strategies available now.
- Rainwater collection basics: determine quantity of water needed determine annual rain fall, size roof surface to collect required quantity, divert through gutters to storage cistern (Cistern size large enough to accommodate occupant usage volume during the longest expected interval without rain).
- Tanks are the most expensive component of a rainwater harvesting system so start with what you can afford and add more tanks in the future.
- Pipe to user taps with either gravity or pumps for 40 to 60 psi pressure, determine percentage of potable and drinking water. Install disinfection system to potable and drinking water.
- Technically, rain water and waste water reclamation can provide all water needs, provided there is enough collection surface and rain fall. NM Earthship strategies reuse the water four times which is like quadrupling the rainfall.
- Rainwater harvesting provides a new source, reduces power and greenhouse gas emissions.
- Waste water and storm water bioretention systems either retain to reuse or infiltrate.
- Goal: don't create storm water runoff. Initiate and improve waste water re use at the allotment scale. "Wet" bioremediation includes pond remediation and biocell installation. Pond remediation use snails, algae, and lotus flowers to naturally draw the chemicals out. Biocells use effective reservoirs in the sand and gravel rock layers underneath a planter.

- The roots of the plants perceive gray and black water as a source of food, drinking the nutrients and putting oxygen back to the water.
- When the water comes out of the biocell, it is bacteria-free and reusable. It can be filtered even further with micron, carbon, or UV filters.
- Storm drain systems collect rainwater and excess water (runoff) from irrigation, car washing and other activities and routes that water, without treatment, to storm drain channels, rivers, creeks, and ultimately to watershed.
- Invite water to move as slowly as possible on property, to soak into plant roots as a sponge, recharge the aquifer, or collected, in low spot on property, to be pumped back up
- Treatment techniques: Screening, settling, activated charcoal, roof washer, cartridges, slow sand, distilling, chlorine, UV lights, nano-filtration (just a big word that means super tiny), ozone, reverse osmosis. No treatment necessary for irrigation.
- Catchment systems typically disinfect 10% of water for potable using five, one, and .5 micron cylinders, UV lights, distillers, charcoal if they use chlorine (discouraged) and occasionally ozone.
- Chlorine degrades into trichloroethane which is carcinogenic when combined with decaying carbon (like leaves). Choosing alternates to chlorine is an advantage of private rainwater harvesting systems.
- Maintenance: clean UV light meter and lens , change filter cylinders, clean out first flush and roof washers, brine membrane changing, repair leaks, clean gutters, change filters, maintain and clean disinfection equip, quarterly water quality testing at labs for potable water, check roof integrity, check openings, inlets, and screens, de-sludge every two to three years
- Tanks: are now available in all materials, shapes and sizes from 50 gal to 40,000 gal and larger. Polyethylene, fiberglass, wood, metal, concrete, masonry, above ground, below ground, bladders, and food grade liners.
- Underground tanks should be 50 ft min from septic systems to minimize contamination
- Rainwater harvesting systems need to be maintained. They are perhaps not suitable for rental vacation homes, rather better suited at homes where the occupants take responsibility for the mint.
- Carbon filters remove pesticides. Carbon is the food that bacteria like, hence carbon filters help reduce the bacteria in the cistern or potable water.
- ABS pipe is toxic. Make sure your tank is made from new virgin food grade material. Reclaimed plastic might have chemicals in it.
- Still stored water improves its quality, Bacteria needs mixing, microbiologists say that tanks have good bacteria, like yogurt. Do not try to clean the walls of your tank.
- Ph: Rainwater preserves ground water, it is mineral free, is close to the user, and can reduce flooding. Rain falls at neutral 7.0 ph. When it comes in contact with naturally occurring carbon dioxide it gets slightly acid to 5.7 ph.
- Acid ph rain is corrosive. Concrete tanks or copper roofing make it even more acid. Rain that lands on copper roofs and gutters becomes acid ph, and corrosive for the rest of the rainwater catchment system parts (pipes, pumps, filters, tanks, etc.) Water can be buffered by baking soda to alkalize it.

- Water gardens take out the calcium oxalate that water may have absorbed from concrete cisterns or tanks in rainwater is ph 7. Ponds are ph 8. Below ph 7 copper pipe starts to etch and corrode. Greywater is alkaline ph.
- Grow food ratio: The water catchment area must be 2.5 times larger than the cultivated area. Different plants have different coefficients of evaporation.
- To estimate the daily greywater flow: First calculate the number of occupants of your home (First bedroom with 2 occupants, each addition bedroom at 1 occupant. Then estimate the daily gray water flow for each occupant. Showers, bathtubs and wash basins (total) at about 25 gallons per day per occupant. Then clothes washer at 15 gallons per day per occupant. Then multiply the number of occupants by the estimated gray water flow
- Local off the grid application power miser- pump will not work when batteries are drained; have an extra tank above the house so you get any gravity pressure. Use your pump in sunny good PV days, so that the water is perched above with free gravity on no PV gray sky storm days.
- 58% of residential “waste” water is comprised of dish, shower, and sink and laundry water. This “waste” water can be reused for other purposes such as landscape irrigation.
- Average American water use: about 100 to 150 gallons of water per day for showers, toilet flushing, clothes washing, cooking, and lawn watering
- Individuals generate 90 liters of greywater per person per day.
- Individuals generate an average of laundry greywater of 15 gal/day/occupant

## APPENDIX B- H2O LINKS

- Accreditation [www.Arcsa.org](http://www.Arcsa.org)
- Accreditation training for green plumbers  
<http://www.greenplumberstraining.org/Pages/default.aspx>
- River health <http://www.americanrivers.org/?docID=5682>
- The Connection: Water Supply and Energy Reserves  
<http://waterindustry.org/Water-Facts/world-water-6.htm>
- Facility for Advanced Bio-filtration (FAWB) <http://www.monash.edu.au/fawb/>
- Australian eWater <http://www.ewater.com.au/>
- International Society for Industrial Ecology <http://www.is4ie.org/>
- Water Technology Online <http://www.watertechonline.com/>
- Water supply and irrigation  
<http://www.ibisworld.com/industry/retail.aspx?indid=161andchid=1>
- The Pacific Institute <http://www.pacinst.org/>
- International Water Centre <http://www.watercentre.org/>
- IRC (global water sanitation and hygiene services) <http://www.irc.nl>
- Global Water <http://www.globalwater.org/>
- Global Water System Project <http://www.gwsp.org/>
- Interesting article on the water situation in California (2008)  
[http://www.huffingtonpost.com/jeffrey-feldman/can-we-stop-pretending-ca\\_b\\_144155.html](http://www.huffingtonpost.com/jeffrey-feldman/can-we-stop-pretending-ca_b_144155.html)

## TEXAS TECH WATER ENTITIES

- Texas Water Resources Institute <http://twri.tamu.edu/>
- Center for Water Law and Policy <http://www.law.ttu.edu/acp/centers/water/>
- [International Center for Arid and Semiarid Land Studies](http://www.ttu.edu/departments/icasals.php)  
<http://www.ttu.edu/departments/icasals.php>
- [Institute of Environmental and Human Health](http://www.tiehh.ttu.edu/Pages/default.aspx)  
<http://www.tiehh.ttu.edu/Pages/default.aspx>

## TEXAS LOCAL AND REGION AGENCIES

- [Brazos River Authority](#)
- [City of Lubbock](#) Water Department
- [High Plains Underground Water Conservation District](#)
- Lower Colorado River Authority <http://www.lcra.org/Pages/default.aspx>
- [Mesa Underground Water Conservation District](#)
- [Ogallala Aquifer Initiative](#)
- Panhandle Groundwater Conservation District <http://pgcd.us/>
- [Region 6 Water Programs](#)

## TEXAS AGENCIES

- [Cooperative State Research, Education, and Extension Service \(CSREES\)](#)
- Texas Alliance for Water Conservation <http://www.depts.ttu.edu/tawc/>
- [Texas Commission on Environmental Quality](#)
- [Texas Department of Agriculture](#)
- [Texas Parks and Wildlife Department](#)
- [Texas State Soil and Water Conservation Board](#)
- [Texas Water Development Board](#)
- [Texas Water Resources Institute](#)

## FEDERAL AGENCIES

- [International Boundary and Water Commission](#)
- [National Ground Water Association](#)
- USGS [National Water-Quality Assessment Program](#)
- National Park Service - Nationwide Rivers Inventory (NRI)  
<http://www.nps.gov/ncrc/programs/rtca/nri/index.html>
- [U.S. Army Corps of Engineers](#)
- U.S. Department of Agriculture - Natural Resources Conservation Service  
<http://www.nrcs.usda.gov/wps/portal/nrcs/site/national/home/>
- U.S. Environmental Protection Agency Surf Your Watershed  
<http://cfpub.epa.gov/surf/locate/index.cfm>
- Universities Council on Water Resources <http://www.ucowr.org/>

## INTERNATIONAL AGENCIES

- [UN Water for Life](#)
- [International Water Law](#) Project
- World Health Organization [http://www.who.int/water\\_sanitation\\_health/en/](http://www.who.int/water_sanitation_health/en/)

## ASSOCIATIONS AND ORGANIZATIONS

- [American Water Resources Association](#)
- [American Water Works Association](#)
- [North Central Texas Council of Governments Storm Water Management](#)
- [Sierra Club](#)
- [Texas Alliance of Groundwater Districts](#)
- [Texas Environmental Profiles](#)
- [Texas Rural Water Association](#)
- [Texas Water Conservation Association](#)
- Texas Living Water Project <http://texaslivingwaters.org/>
- [Water Environment Association of Texas](#)
- [Waterwise Council of Texas](#)

## WATER AND ETHICS

- [Institute for Global Ethics](#)
- [The Earth Charter Initiative](#)

## WATER FACTS AND GLOSSARIES

- [Aqua Lingua](#)

## WATER ORGANIZATIONS and CONFERENCES

- [www.ircsa.org](http://www.ircsa.org) International Rain Catchment systems Assoc., 2008 conference
- [www.iwahq.org](http://www.iwahq.org) International Water Association
- ARCSA Conference <http://www.arcsa.org/?page=2014conference>.arcsa-usa.org
- WaterSmart Innocations [www.watersmartinnovations.com](http://www.watersmartinnovations.com)
- International Water Technologies Conference <http://www.iwtc.info/>

## H2O SCHOLARS

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- Dr. A.C. Correa, Director of the International Center for Arid and Semiarid Land Studies; Adjunct Professor of Geology (ac.correa@ttu.edu)
- Professor Gabriel Eckstein, Director of the Center for Water Law and Policy; George W. McCleskey Professor of Water Law (gabriel.eckstein@ttu.edu)

- Dr. Don Ethridge, Associate Director of the CASNR Water Center; Director of the Cotton Economics Research Institute; Professor of Agricultural and Applied Economics (don.ethridge@ttu.edu)
- Dr. Ken Rainwater, Director of the Water Resources