PRO Green EXPO

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Impacts of Irrigation in Building Rating Programs

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Market Trends

- Moving toward sustainability
  - Includes building structure, but also the site
- "Green" Building Codes / Ordinances

- Voluntary Programs

- Rating Systems

Codes & Standards

- Above minimum code
- Use mandatory language
- Typically are prescriptive rather than performance based
  - Verifiable by inspection
- Models that can be adapted locally
- Reduce or eliminate use of potable water for irrigation

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ANSI/ASHRAE/ICC/USGBC/IES Standard 189.1-2017
(Supersedes ANSI/ASHRAE/USGBC/IES Standard 189.1-2014)
Includes ANSI/ASHRAE Addenda listed in Appendix J

Standard for the Design of High-Performance Green Buildings

Except Low-Rise Residential Buildings

IgCC
SAFE & SUSTAINABLE BY THE BOOK

The Complete Technical Content of the International Green Construction Code™

See Appendix J for approval dates by the ASHRAE Standards Committee, the ASHRAE Board of Directors, the International Code Council, the U.S. Green Building Council, the Illuminating Engineering Society, and the American National Standards Institute.

This standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE website (www.ashrae.org), or in paper form from the ASHRAE Manager of Standards.

Provisions in ASHRAE 189.1:

- 33% of improved landscape area can use potable water
- If using on-site alternate water sources = 100% of site can be irrigated
- 40% of improved landscape area any type of plant
- 60% of site = native, adapted or rainfall-ETc compatible plants
  - potable or reclaimed for establishment, no permanent irrigation system
  - only reclaimed for establishment within 200 feet of site
- Conflicting sections on use of reclaimed water

Ordinances

- Different than codes or standards in the development process
- Locally created
- Mandatory
- Enforceable

Voluntary Programs*

Voluntary Programs

- Prerequisites or requirements (prescriptive)
- Options to earn credits or points (performance)
- Levels of accomplishment

- **Green**
- **Greener**
- **Greenest**
- **Greenisimo**

LEED v4 New Construction

- Prerequisite
- Reduce 30% using WaterSense Water Budget Tool

- 50% reduction 1 point
- 100% reduction 2 points
- Combination of:
  - Efficiency
  - Alternate Water Sources
  - Smart Technologies

Green Building Initiative (Green Globes)

- Doesn't have requirements or prerequisites

- Goals for water use reductions

- More reduction – more points

- Reduce demand by using native plants

- Develop the use of alternate water sources

- Some points for use of technology

- Points using irrigation professionals

Rating Systems

- Geared toward residential
- Compare expected or potential water use to a "reference home"
- Considers both indoor and outdoor water use
- Home builders can use the score to differentiate their product
- Irrigation design/build contractor impacted

WERS   **NGBS-WRI**   **HERS$_{H2O}$**

Water Efficiency Rating Score

- Developed by Green Builder Coalition
- 3rd party verification tool.
- Predict water use for new or existing properties.
- Flexible—builder can decide where & how to conserve water.
- Goal to reduce the use of potable water.
- Incentives to use on-site water sources
  - Graywater
  - Rain water harvesting

WERS

Outdoor methodology of WERS

- Step 1 – Create an outdoor water budget (based on EPA WaterSense, but modified)
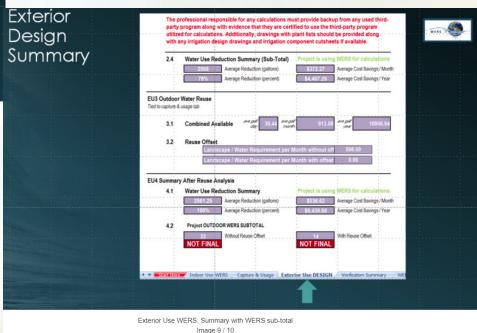- Step 2 – Determine the outdoor water demand projection via subtractive method

    (Lot – Impervious Surfaces – Undisturbed Areas – Encroachments)

- Step 3 – Offset outdoor water demand with reuse techniques (if applicable)

WERS

Exterior ETo and Rainfall data

Exterior Use WERS: Gathers information regarding outdoor water use
Image 7 / 10

Exterior Design Summary

Exterior Use WERS: Summary with WERS sub-total
Image 9 / 10

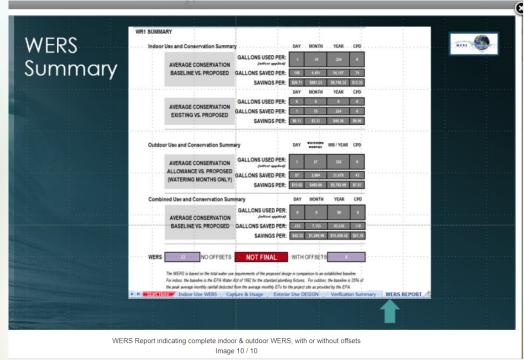Uses a traditional water budget approach based on monthly ETo and Rainfall

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Reducing Potable Outdoor Water Use

- Plant selection
- Use of technology—smart controllers, sensors etc.
- Use nonpotable water—gray water, rain water harvesting, etc.

- Compared rated home to a baseline. The lower the score the better.

WERS Report indicating complete indoor & outdoor WERS, with or without offsets
Image 10 / 10

WERS Compliance Options

EU2 Preliminary / Assessment Design Analysis

(Please note - if using another third-party program for analysis, skip section 2.1 and leave questions as No and values as zero)

2.1 OPTION ONE: Landscape / Water Requirement Using WERS

Use of the following pull-downs affects the "Average Peak ALLOWABLE Rainfall" percentage.

| N | Rain Sensor present? (10%) | | Y | Smart Controller present? (10%) |

(EPA label must be on the controller)

| 5 | *Select the number of lines needed and complete the table below with the information that best describes the outdoor water use.* |

Line	Area Name or Notes *(optional)*	Irrigated or Non-Irrigated Soft-scape Area (sf)	Plant / Feature Type & Water Requirement	K_L	Irrigation Type	IE	LWR$_H$ (G/M) *average only - for watering months*
1	Apple tree	200.00	Trees - Medium	0.5	Drip-Standard	0.7	544.41
2	Vegetable Garden	200.00	Food Gardens	0.7	Drip/Micro	0.8	706.76
3	Sagebrush	1000.00	Groundcover - Low	0.2	No Irrigation	0.7	747.26
4		0.00	<select item type>	0	<select irrigation>	0	0.00
5		0.00	<select item type>	0	<select irrigation>	0	0.00
Total Area		1400.00	Landscape / Water Requirement for Site (G/M)				1998.43

2.2 OPTION TWO: Landscape / Water Requirement Via Third-Party Program

OUTDOOR WATER USE CALCULATION PROGRAM

Are non-WERS calculations being done for this home? | Yes |

2.3 NON-PERMANENT IRRIGATION AFFIRMATION

Use this section only if there is landscaping but no irrigation for the project.

Xeriscaping? | No | ▼ | Percent of softscape?

I CERTIFY AS THE DESIGN PROFESSIONAL OF RECORD THAT THE LANDSCAPE AS DESIGNED SHOULD NOT REQUIRE WATER BEYOND THAT WHICH IS NEEDED FOR INITIAL ESTABLISHMENT OF PLANTINGS.

SIGNED:_____ DATE: _____

The professional responsible for any calculations must provide backup from any used third-party program along with evidence that they are certified to use the third-party program utilized for calculations. Additionally, drawings with plant lists should be provided along with any irrigation design drawings and irrigation component cutsheets if available.

Water Efficiency Rating Score (WERS)®

- ## Applicability
  - New or Existing Properties
  - Single Family or Multifamily
  - Design or Audit Tool

- ## Outputs
  - Score: 0-100 (lower is better)
  - Projected usage in gallons: Daily, monthly and yearly
  - Projected water costs: Daily, monthly and yearly

- ## Adopted/Implemented
  - State of New Mexico: Tax credit since Jan. 1, 2017
  - City of Santa Fe: Single-family code since March 2017
  - City of Santa Barbara, CA: Multifamily code since Sept. 2018
  - Built Green Canada: Pilots in 2019; implement in 2020

- ## Future
  - 3 green building programs incorporating into water efficiency chapter
  - WaterSense for Homes 2.0: Under consideration for dual certification

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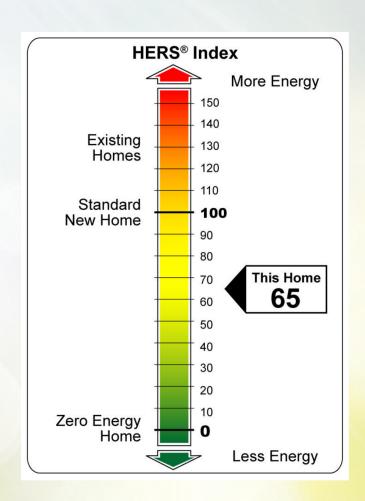
National Green Building Standard

- Points-based system
- Points for doing irrigation efficiently
- Points for not doing irrigation
- Points for not using potable water
- Alternate method is WRI Water Rating Index (Appendix F)
- Based on WERS

Bronze, Silver, Gold, Emerald
More points is better

- Development by Residential Energy Services Network (RESNET)
  - Home Energy Rating Systems— estimate the amount of energy a home uses based on types of equipment that are installed.
  - HERS H2O doing the same for water usage—Water Efficiency Rating Index
    - Indoor and Outdoor
  - Currently developing an ANSI standard

HERS Reference Home

- Attributes of a standard home built about 2006

- Outdoor water use based on data from REUWS 2

- Complicated equations create the modeling worksheet

Reference home outdoor water use:

- Rated home has Net ET <12 inches/year or has automatic irrigation system

$$\left[\frac{\exp(A)}{1+\exp(A)}\right] \times 1.18086 \times (2.0341 \times netET^{0.7154} \times Ref\_Irr\_Area^{0.6227} + 0.5756 \times ind\_Pool \times netET)$$

- Rated home has NetET >12 inches/year AND does not have automatic irrigation

$$\left[\left[\frac{\exp B}{1+\exp B}\right] \times 1.22257 \times [1.4233 + 0.6311 \times netET + 0.9376 \times Ref\_Irr\_Area]\right] + ref\_Pool$$

Where:

- Exp(A)= exponent of [1.4416 + 0.5069 * (IrrArea/1,000)]
- Exp(B)= exponent of [0.6911 + 0.00301 * netET * (IrrArea/1,000)]
- Ref_Irr_Area= The size of the irrigated area in the reference home, calculated in accordance with section 4.4.1
- Rat_Irr_Area= The size of the irrigated area in the rated home
- netET= The annual historic sum of mean reference evapotranspiration minus the mean precipitation for all months that evapotranspiration exceeds precipitation

Irrigated Area

- Lot size of Rated Home <7,000 s.f. the Reference Home shall be calculated as:

- $Ref\_Irr\_Area=$ Lot_Area x (0.002479 x Lot_Area$^{0.6157}$)

- Lot size of Rated Home >7,000 s. f., the Reference Home shall be calculated as:

- $Ref\_Irr\_Area=$ Lot_Area x 0.577

Rated home outdoor water use

- Rated home has automatic irrigation system

$$\left[\frac{\exp(A)}{1+\exp(A)}\right] \times 1.18086 \times (2.0341 \times netET^{0.7154} \times Rat\_Irr\_Area^{0.6227} + 0.5756 \times ind\_Pool \times netET)$$

- Rated home does not have automatic irrigation

$$\left[\left[\frac{\exp B}{1+\exp B}\right] \times 1.22257 \times [1.4233 + 0.6311 \times netET + 0.9376 \times Rat\_Irr\_Area]\right] + Pool\_use$$

Where:

- Exp(A)= exponent of [1.4416 + 0.5069 * (Rat_Irr_Area/1,000)]
- Exp(B)= exponent of [0.6911 + 0.00301 * netET * (Rat_Irr_Area/1,000)]
- Rat_Irr_Area= The size of the landscape that might receive supplemental water in the rated home
- netET= The annual historic sum of mean reference evapotranspiration minus the mean precipitation for all months that evapotranspiration exceeds precipitation
- ind_Pool= Indicator representing the presence or absence of a swimming pool
- Pool_use= equation 1 (using ind_Pool = 1) – equation 1 (using ind_Pool = 0)

Example Water Use Calculations

Water Use	Cold Wtr	Hot Wtr	Total Wtr		Home characteristics:			Drain Water Heat Recovery:	
Shower_gpd	7.2	16.9	24.1		CFA	2400		Showers connected	all
KitchF_gpd	4.2	9.9	14.2		Nbr	3		Equal flow?	yes
LavF_gpd	1.9	4.5	6.4		Nfl	2		CSA 55.1 DWHR$_{eff}$	54.0%
Waste_gpd	4.7	11.0	15.7		Bsmt	0		*Tmains =58.0*	
CW_gpd	20.6	3.9	24.5		Appliances:			*WHinTadj =0.00*	
DW_gpd		4.3	4.3		Dishwasher	std		*WHinT =58.0*	
Toilets_gpd	21.9		21.9		Clothes washer	std			
Soft_gpd	0.0		0.0		WF	9.5			
Other_gpd	15.7	2.1	17.8		Toilets:				
EP_gpd	0.0	0.0	0.0		gpf	1.6			
Indoor_gpd	76.2	52.6	128.9		Water Softener:				
Outdoor_gpd	86.7	0.0	86.7		Softener	no			
Total_gpd	162.9	52.6	215.5		gal/removed	5.0	gallons/1,000 grains removed		
Ref_In =	76.2	52.6	128.9		Outdoors:				
Ref_Out =	86.2	0.0	86.2		Inground Pool?	no			
Ref_Tot =	162.5	52.6	215.1		Automatic Irrigation?	no			
Save_Tot =	-0.5	0.0	-0.5		Smart controller?	no			
H2O_in =	100	100	100		Use RICI?	no			
H2O_Out =	101	100	101		Zone flow rates	27.0	Sum of irrigation zone flow rates		
H2O_Tot =	100	100	100		Prof Audit?	yes			
HERS$_{H2O}$ =	100	SaveH2O*=	-167		Static Pressure	75			

User input fields are yellow

Location (pull down)	Denver, CO
Distribution system	std
HW pipe Insulation	none
Shower (gpm)	2.5
Kitch Faucet (gpm)	2.2
Lav Faucet efficiency	std
Std sys pipe length	89
Recirc sys loop length	159
Recirc sys branch length	10
Recirc pumpWatts	50
DW heat recovery?	no
Lot Area (ft2)	8,500
Landscaped Area (ft2)	5,000

% Outdoor H2O = 40%

Ref Irr_Area = 4,905

Tot_Ref Irr_ratio = 57.7%

Net_Lscape_ratio = 68.5%

Lot size (acres) = 0.195

Ref std sys pipe length = 89.3

Ref recirc sys loop length = 158.6

* Gallons per year

Indoor_gpd	76.2	52.6	128.9
Outdoor_gpd	86.7	0.0	86.7
Total_gpd	162.9	52.6	215.5
Ref_In =	76.2	52.6	128.9
Ref_Out =	86.2	0.0	86.2
Ref_Tot =	162.5	52.6	215.1
Save_Tot =	-0.5	0.0	-0.5
$H2O\_in$ =	100	100	100
$H2O\_Out$ =	101	100	101
$H2O\_Tot$ =	100	100	100
$HERS_{H2O}$ =	100	SaveH2O*=	-167

Water Softener:

Softener	no
gal/removed	5.0

Outdoors:

Inground Pool?	no
Automatic Irrigation?	no
Smart controller	no
Use RICP	no
Zone flow rates	27.0
Prof Audit?	no
Static Pressure	75

				Water Softener:	
Indoor_gpd	76.2	52.6	128.9		
Outdoor_gpd	256.0	0.0	256.0	Softener	no
Total_gpd	332.3	52.6	384.9	gal/removed	5.0
Ref_In =	76.2	52.6	128.9	Outdoors:	
Ref_Out =	252.8	0.0	252.8	Inground Pool?	no
Ref_Tot =	329.0	52.6	381.6	Automatic Irrigation	yes
Save_Tot =	-3.3	0.0	-3.3	Smart controller?	no
H2O_in =	100	100	100	Use RICI?	no
H2O_Out =	101	100	101	Zone flow rates	27.0
H2O_Tot =	101	100	101	Prof Audit?	no
HERS$_{H2O}$ =	101	SaveH2O*=	-1,200	Static Pressure	75

Indoor_gpd	76.2	52.6	128.9
Outdoor_gpd	217.6	0.0	217.6
Total_gpd	293.9	52.6	346.5
Ref_In =	76.2	52.6	128.9
Ref_Out =	252.8	0.0	252.8
Ref_Tot =	330.0	52.6	381.6
Save_Tot =	35.1	0.0	35.1
H2O_in =	100	100	100
H2O_Out =	86	100	86
H2O_Tot =	89	100	91
HERS$_{H2O}$ =	91	SaveH2O*=	12,819

Water Softener:

Softener	no
gal/removed	5.0

Outdoors:

Inground Pool?	no
Automatic Irrigation?	yes
Smart controller?	yes
Use RICI?	no
Zone flow rates	27.0
Prof Audit?	no
Static Pressure	75

Indoor_gpd	76.2	52.6	128.9
Outdoor_gpd	206.8	0.0	206.8
Total_gpd	283.0	52.6	335.6
Ref_In =	76.2	52.6	128.9
Ref_Out =	252.8	0.0	252.8
Ref_Tot =	329.0	52.6	381.6
Save_Tot =	46.0	0.0	46.0
H2O_in =	100	100	100
H2O_Out =	82	100	82
H2O_Tot =	86	100	88
HERS$_{H2O}$ =	88	**SaveH2O*=**	16,791

Water Softener:

Softener	**no**
gal/removed	**5.0**

Outdoors:

Inground Pool?	**no**
Automatic Irrigation?	**yes**
Smart controller?	**yes**
Use RICI?	**no**
Zone flow rates	**27.0**
Prof Audit?	**yes**
Static Pressure	**75**

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Summary

- Market trends toward sustainability affect the irrigation industry.
- Trends in landscapes is to use native/native-type plants.
- Reducing potable water use in the landscape.
- Standards, codes & ordinances are being adopted.
- Volunteer programs for commercial landscapes
  - Prerequisites and credits or points
- Rating systems for residential properties
  - Third-party verification
  - EPA WaterSense has NOI to use rating systems for new homes
- Opportunity to understand and help clients who embrace sustainability.

Thank you!

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