**BSR/RESNET/ICC Standard 850**

Standard for the Calculation and Labeling of the Water Use Performance of Dwelling and Sleeping Units~~One- and Two-Family Dwellings~~ Using a~~the~~ Water Rating Index

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**FORWARD** (Informative)

This Standard provides a consistent, uniform methodology for evaluating, quantifying, and labeling the water use performance of one- and two-family dwellings. The methodology compares the water use performance of an actual home (rated home) with the water use performance of a reference home of the same geometry, resulting in a relative Water Use Rating called the Water Rating Index (WRI). Where the water use performance of the actual home and the reference home are equal, the Water Rating Index is 100.

The Reference Home used for this comparative analysis has the attributes of a standard home built circa 2006. The underpinnings of the indoor Reference Home model are based on ANSI/RESNET/ICC Standard 301. The outdoor Reference Home model is adapted using data from the Water Research Foundation’s Residential End Uses of Water Study II. Both the indoor and outdoor calculation models are grounded in actual field water use data. It is the opinion of the Standard Development Committee that alternatives not included in the calculation of the Water Rating Index did not have sufficient data to develop an equation (on par with the existing indoor and outdoor model) to confidently and accurately predict their water consumption.

This first public comment draft for the next version of Standard 850 includes additions for multi-family dwelling and sleeping units, gray water reuse for toilet flushing, revisions to outdoor water use and additional requirements for sampled ratings.

This second public comment draft for the next version of Standard 850 includes revisions based on the first round of public comments.

A WRI rating includes water use for: toilets, kitchen faucets, lavatory faucets, showerheads, clothes washers, dishwashers, water softeners, outdoor/landscape irrigation systems and pools/spas. There are additional factors that also influence the rating, including: excess water pressure, house size, geographic location, number of bedrooms, lot and landscape size and hot water distribution layout. The following components are not included in the standard, due to a lack of data: whole house humidifiers, water filtration systems and ~~alternative w~~rainwater harvesting systems.~~sources.~~.

This Standard contains both normative and informative material. The body of the Standard is normative and must be complied with to conform to the Standard. Informative materials are not mandatory and are limited to this forward, footnotes, references and annexes, all of which are clearly marked as informative.

**CHAPTER 1. PURPOSE**

# Purpose. The provisions of this document establish a uniform methodology for evaluating, rating and labeling the water use performance of Dwelling Units and Sleeping Units in attached and detached housing types.~~single family and duplex dwelling units.~~

# CHAPTER 2. SCOPE

# 

# 2.1 Scope. This standard is applicable to Dwelling Units and Sleeping Units in Residential or Commercial Buildings, excepting hotels and motels.[[1]](#footnote-2) Water Ratings determined in accordance with this standard are for individual Dwelling Units or Sleeping Units only. This standard does not provide procedures for determining Water Ratings for whole buildings containing more than one unit. ~~This Standard will provide a uniform methodology for evaluating, rating and labeling the indoor and outdoor water use performance of one- and two-family dwellings.~~

# CHAPTER 3. DEFINITIONS

# ~~Definitions.~~ The following terms and acronyms have specific meanings as used in this Standard. In the event that definitions given here differ from definitions given elsewhere, the definitions given here shall govern.

3.1 General**.** Unless stated otherwise, the terms and words in Section 3.2 shall have the meanings indicated therein. Words used in the present tense include the future, words in the masculine gender include the feminine and neuter, and singular and plural are interchangeable. Terms not defined in Section 3.2 shall have ordinary accepted meanings the context implies.

# 3.2 Definitions.

***Approved*** – shall mean acceptable to the adopting entity.

***Approved Rating Provider*** – An approved entity responsible for the certification of home water efficiency raters working under its auspices and who is responsible for the quality assurance of such Certified Raters and for the quality assurance of water efficiency ratings produced by such home water efficiency raters.

***Approved Software Rating Tool*** – A computerized procedure that is approved for the purpose of conducting home water efficiency ratings and calculating the annual water consumption, annual water costs and a Water Rating Index for a home.

***Attached Dwelling Unit—****A Dwelling Unit sharing demising walls, floors, ceilings or common corridors with another Dwelling Unit or Occupiable Space.*

***Bedroom*** – A room or space 70 square feet of floor area or greater that can be used for sleeping, with emergency escape and rescue openings or two means of egress from the dwelling unit or sleeping unit, and privacy provisions capable of isolating it from the main body of the Dwelling Unit.  A room that includes equipment or appliances intended to be used for cooking, mechanical systems, sanitation, or laundry, or a room intended for use as an access or egress area to the main body of the Dwelling Unit shall not be considered a bedroom. ~~A room or space 70 square feet of floor area or greater, with egress window and closet, used or intended to be used for sleeping. A "den," "library," "home office" with a closet, egress window, and 70 square feet of floor area or greater or other similar rooms shall count as a Bedroom, but living rooms and foyers shall not.~~

***Automatic Irrigation System***— An irrigation system that is initiated by a clock timer, irrigation controller, or other method that does not require human intervention to initiate an irrigation event.

***Commercial Building—****All buildings that are not included in the definition of Residential Building.*

***Detached Dwelling Unit*** *– A Dwelling Unit that does not meet the definition of Attached*

*Dwelling Unit.*

***Dwelling—***Any building that contains one or two Dwelling Units used, intended, or designed to be built, used, or rented, leased, let or hired out to be occupied, or that are occupied for living purposes.

***Dwelling Unit –*** A single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking, and sanitation.

***Gray Water—****Waste discharged from* lavatories, bathtubs, showers, clothes washers and laundry ~~trays~~ sinks.

***Irrigated Area***—the portion of a lot that can be landscaped and that might receive~~s~~ supplemental water for irrigation.

***Lot Size***—the area of a single parcel of land upon which the Rated Home is located.

***Other Water Use***— Water use associated with leaks, minor draws, and other end uses not specified in the Reference Home or Rated Home.

***Outdoor Water Use***— Water use that occurs outside of the exterior walls of a dwelling unit.

***Rated Home*** – The specific real property that is evaluated using the water use performance rating procedures specified by this Standard.

***Residential Building—****Includes detached one-family Dwellings and two-family Dwellings and multiple single-family Dwellings (Townhouses) and Group R-2, R-3 and R-4 buildings three stories or less in height above grade plane.*

**Residential Irrigation Capacity Index (RICI)**— The intensity with which an automatic irrigation system applies water calculated in accordance with section 4.6.3

***Shall -*** means that the action specified is mandatory.

***Sleeping Unit –*** A room or space in which people sleep, which includes permanent provisions for living, eating, and either sanitation or kitchen facilities but not both. Such rooms and spaces that are also part of a Dwelling Unit are not Sleeping Units*.*

***Townhouse****—*A single-family Dwelling Unit constructed in a group of three or more attached units in which each unit extends from the foundation to roof and with open space on at least two sides.

***Water Rating Index*** – An integer representing the relative water use of a Rated Home as compared with the water use of the Reference Home and where an Index value of 100 represents the water use of the Reference Home and each integer reduction represents a one percent improvement in water use efficiency.

***Reference Home*** – A hypothetical home configured in accordance with the specifications set forth in Section 4.3 of this Standard and the basis of comparison for the purpose of calculating the Water Rating Index of a Rated Home.

# CHAPTER 4. ~~Home Water Rating Calculation Procedures~~ WATER RATING CALCULATION PROCEDURES.

4.1. Determining the Water Rating Index. The Water Rating Index shall be determined in accordance with Sections 4.2 through 4.6. The Reference Home shall be configured in accordance with Sections 4.3 and 4.4; and the Rated Home shall be configured in accordance with Section 4.5 and 4.6. The number of bedrooms in the Rated Home shall not be less than one.

4.2 Calculating the Water Rating Index.A Water Rating Index shall be calculated as follows:

* 1. Determining the Daily Indoor Water Use for the Reference Home.The indoor daily water use for the Reference Home shall be calculated as follows:

**(Eq 4.3-1)**

Where:

refFgpd = daily fixture water use for the Reference Home

refWgpd = daily wasted water use ~~wasted from hot water outlets~~by hot water distribution systems for the Reference Home

refDWgpd = daily dishwasher water use for the Reference Home

refCWgpd = daily clothes washer water use for the Reference Home

refTgpd = daily toilet water use for the Reference Home

refSofgpd = daily water softener water use for the Reference Home

refOther = daily total other/unidentified water use for the Reference Home

* + 1. Determining Daily Reference Home Fixture Water Use.Reference Home daily fixture water use shall be calculated as follows:

**(Eq 4.3-2)**

Where:

Nbr= number of bedrooms in the Rated Home

* + 1. Determining Daily Reference Home Hot Water Waste.Reference Home daily hot water waste shall be calculated as follows:

**(Eq 4.3-3)**

Where:

Nbr= number of bedrooms

* + 1. Determining Daily Reference Home Dish Washer Water Use.Reference Home dish washer water use shall be calculated as follows:

**(Eq 4.3-4)**

Which simplifies to:

*refDWgpd = 1.97 + 0.7802 \* Nbr*

Where:

Nbr= number of bedrooms

(88.4+34.9\*Nbr) = best fit regression equation for dishwasher cycles per year using data from the 2005 Residential Energy Consumption Survey.

8.16 = gallons per cycle from the DOE Technical Support Document from the NAECA standard in effect in 2006

This value is determined in accordance with ANSI/RESNET/ICC 301 ~~Addendum A~~.

* + 1. Determining Daily Reference Home Clothes Washer Water Use.Reference Home daily clothes washer water use shall be calculated as follows:   
        **(Eq 4.3-5)**

where

3.0 = reference washer capacity (CAPw) in ft3

11.4 = reference integrated water factor (IWF) in (gal/cyc) per ft3

ACY = Adjusted Cycles per Year = (164 + 46.5 \* Nbr)

Nbr = number of bedrooms

* + 1. Determining Daily Reference Home Toilet Water Use.Reference Home daily toilet water use shall be calculated as follows:

**(Eq 4.3-6)**

Where:

refFPO= the Reference Home flushes per person per day = 5.05

refGPF= the Reference Home gallons per flush for toilets = 1.6

Occ=

Single Family: 1.09+0.54\*Nbr

Multifamily: 1.49+0.45\*Nbr ~~the number of occupants = 1.09 + 0.54 \* Nbr~~

Nbr= number of bedrooms

Nbr= number of bedrooms

* + 1. Determining Daily Reference Home Water Softener Use. Where the Rated Home has a water softener and the water hardness at the Rated Home location is greater than or equal to 180 milligrams/liter, the Reference Home water softener daily water use shall be calculated as follows:

**(Eq 4.3-7)**

Where Rated Home does not meet these conditions the refSofgpd = 0.

* + 1. Determining Daily Reference Home Other Water Use.Reference Home daily other water use shall be determined as follows:

**(Eq 4.3-8)**

Where:

Nbr= the number of bedrooms in the Rated Home

* 1. Determining the Reference Home Outdoor Water Use. The reference home outdoor annual water use (in thousands of gallons per year) shall be calculated using the following two equations:

*If the rated home has a netET of less than 12 inches/year OR the rated home has an automatic irrigation system, use Equation 1.*

**Equation 1:**  
 **(Eq 4.4-1a)**

*If the rated home has a netET of greater than 12 inches/year AND the rated home does NOT have an automatic irrigation system, use Equation 2.*

**Equation 2:**

**(Eq 4.4-1b)**

*Either equation shall be constrained as follows:*

***IF***

*Rat\_Irr\_Area < Ref\_Irr\_Area*

***THEN***

**AND**

*Outdoor Reference Home Annual Water Use shall never be lower than equation 2.*

The outdoor water use for the *Reference Home* shall never be greater than the result of the following calculation:

**Equation 4.4-1c**

**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

ind\_Pool= Indicator representing the presence or absence of a swimming pool in the rated home

Pool\_use = calculated in accordance with Section 4.6 as Equation 4.6-1 (using ind\_Pool=1) - Equation 4.6-1 (using ind\_Pool = 0)

~~ref\_Pool= equation 1 (using ind\_Pool = 1) – equation 1 (using ind\_Pool = 0)~~

* + 1. **Determining Outdoor Daily Water Use for the Reference Home.**  Reference Home daily outdoor water use shall be determined by multiplying the result of either Eq 4.4-1a or Eq 4.4-1b, as appropriate, by 1,000 and dividing the product by 365. Where the Rated Home is not a dwelling or townhouse, the outdoor daily water use shall be allocated equally to each dwelling unit.
    2. Determining Irrigated Area for the Reference Home.Reference Home Irrigated Area shall be calculated as follows:

Where the Rated Home is a ~~one- or two-family~~ dwelling or townhouse and the lot size of the Rated Home is less than 7,000 ft2, the Irrigated Area of the Reference Home shall be calculated as follows:

**(Eq 4.4-2a)**

Where the Rated Home is a ~~detached or duplex~~ dwelling or townhouse and the Lot Size of the Rated home is greater than or equal to 7,000 ft2, the Irrigated Area of the Reference Home shall be calculated as follows:

**(Eq 4.4-2b)**

Where:

Ref\_Irr\_Area= The size of the landscape that receives supplemental water in the Reference Home

Lot\_Area= The size of the lot on which the Rated Home is being constructed

~~For multi-family building properties, the irrigated area for the Reference Home shall be the same as the Rated Home irrigated area.~~ Where the Rated Home is not a dwelling or townhouse, the irrigated area for the Reference Home shall be the same as the Rated Home irrigated area.

* 1. Determining Daily Indoor Water Use of the Rated Home.The daily Indoor Water Use of the Rated Home shall be calculated as follows:

**(Eq 4.5-1)**

Where:

Showergpd = daily shower water use for the Rated Home

KitchFgpd = daily kitchen faucet water use for the Rated Home

LavFgpd = daily lavatory water use for the Rated Home

Wastegpd = daily water use wasted for the Rated Home

CWgpd = daily clothes washer water use for the Rated Home

DWgpd = daily dishwasher water use for the Rated Home

Toiletsgpd = daily toilet water use for the Rated Home

Softgpd = daily water softener water use for the Rated Home

Othergpd = daily other/ unidentified water use for the Rated Home

EPgpd = daily excess pressure adjustment

* + 1. Determining Daily Shower Water Use for the Rated Home.Rated Home daily shower water use shall be calculated as follows:

**(Eq 4.5-2)**

Where:

FixtureTot= Determined in accordance with ANSI/RESNET/ICC 301 =

Shower\_pc= Percent of fixture water use consumed by showers = 54%

SHeff= the ratio of the average rated flow rate of showerheads to the reference home flow rate

* + 1. Determining Daily Kitchen Faucet Water Use for the Rated Home.Rated Home daily kitchen faucet water use shall be calculated as follows:

**(Eq 4.5-3)**

Where:

FixtureTot= Determined in accordance with ANSI/RESNET/ICC 301 ~~Addendum A~~ =

faucetpc= Percent of fixture water use consumed by faucets = 46%

KitchFeff= the ratio of the average rated flow rate of kitchen faucets to the reference home flow rate =

Kitch= the percentage of faucet use that is attributed to kitchen faucets= 69%

* + 1. Determining Daily Lavatory Faucet Water Use for the Rated Home.Rated Home daily lavatory faucet use shall be calculated as follows:

**(Eq 4.5-4)**

Where:

Lav = the percentage of faucet use that is attributed to lavatory faucets= 31% FixtureTot= Determined in accordance with ANSI/RESNET/ICC 301

~~Addendum A~~ =

faucet\_pc = Percent of fixture water use consumed by faucets = 46%

LavFeff = the ratio of the average rated flow rate of lavatory faucets to the Water Rating Reference Home flow rate = 1 for standard faucets and 0.95 for high efficiency faucets

* + 1. Determining Daily Hot Water Waste for the Rated Home.Rated Home daily hot water waste shall be calculated as follows:

**(Eq 4.5-5)**

Where:

Feff = Fixture efficiency of showerheads, kitchen faucets, and lavatory faucets weighted by contribution to total fixture use (by volume)

oWgpd = daily standard operating condition hot water wasted quantity as determined by ANSI/RESNET/ICC 301 ~~Addendum A~~

sWgpd = daily structural hot water wasted quantity as determined by ANSI/RESNET/ICC 301 ~~Addendum A~~

WDeff = distribution system water use effectiveness from Table 4.2.2.5.2.11(3) of ANSI/RESNET/ICC 301 ~~Addendum A~~

This value is determined in accordance with ANSI/RESNET/ICC 301 ~~Addendum A~~.

* + 1. Determining Daily Clothes Washer Water Use for the Rated Home.Rated Home daily clothes washer water use shall be calculated as follows:

**(Eq 4.5-6)**

Where:

CAPw = washer capacity in cubic feet = the manufacturer’s data or the CEC database or the EPA Energy Star website

IWF = Integrated Water Factor from manufacturer’s data [gal/cyc)/ft3]

ACY= Adjusted cycles per year

Determining ACY:

ACY = (164 + 46.5 \* Nbr) \* ((3.0 \* 2.08 + 1.59) / (CAPw \* 2.08 + 1.59))

Where

CAPw = the capacity of the clothes washer in ft3

(164 + 46.5 \* Nbr) = Standard Cycles per Year based on 2005 Residential Energy Consumption Survey data

((3.0 \* 2.08 + 1.59) / (CAPw \* 2.08 + 1.59)) = best fit regression equation to adjust the standard cycles per year to account for occupancy and size of clothes washer. Based on 2005 Residential Energy Consumption Survey data.

* + 1. Determining Daily Dishwasher Water Use for the Rated Home.Rated Home daily dish washer water use shall be calculated as follows:

*DWgpd = [(88.4+34.9\*Nbr) \* (12/dWcap) \* gal/cycle / 365* **(Eq 4.5-7)**

Where:

Nbr= number of bedrooms in the Rated Home

dWcap= capacity of the dishwasher in the Rated Home (in place settings) as included in the manufacturer’s data

(88.4+34.9\*Nbr) = best fit regression equation for dishwasher cycles per year using data from the 2005 Residential Energy Consumption Survey.

gal/cycle can be entered either directly or as listed on:

1. The ENERGY STAR product finder database
2. The California Energy Commission (CEC) Modernized Appliance Efficiency Database
3. The Department of Energy (DOE) Compliance Certification Management System (CCMS)

OR gal/cycle can be calculated from the Energy Guide label as follows (developed using the equations from 10 CFR 430, Subpart B, Appendix C and values on the Energy Guide label) to isolate the energy used by the appliance from the energy used in water heating):

gal/cycle= h2o\_kWh\*elec\_h2o

h2o\_kWh= LER-Appl\_kWh

LER= Labeled Energy Rating in kWh per year per the dishwasher Energy Guide label

Appl\_kWh= dishwasher appliance annual electric energy use = (GHWC\*gas\_h2o/$\_therm-LER\*$\_kWh\*elec\_h2o/per\_kWh) / ($\_kWh\*gas\_h2o/$\_therm-elec\_h2o)

where

$\_kWh= the cost of one kWh per the dishwasher Energy Guide label

$\_therm= the cost of one therm per the dishwasher Energy Guide label

GHWC= Gas Hot Water Cost per the dishwasher Energy Guide label

elec\_h2o= gallons of hot water use per cycle per unit of annual electricity use in gal∙y/kWh∙cyc = 1/(80\*0.0024\*208) = 0.02504

gas\_h2o = gallons of hot water use per cycle per unit of annual gas use in gal∙y/therm∙cyc = 1/(80\*8.2/0.75\*208/100,000) = 0.5497

80= the average hot water heater temperature rise per 10 CFR 430, Subpart B, Appendix C

0.0024 = specific heat of water in kWh/gal∙F per 10 CFR 430, Subpart B, Appendix C

8.2 = specific heat of water in Btu/gal∙F per 10 CFR 430, Subpart B, Appendix C

0.75 = recovery efficiency of gas hot water heater per 10 CFR 430, Subpart B, Appendix C

215= cycles per year per 10 CFR 430, Subpart B, Appendix C

This value is determined in accordance with ANSI/RESNET/ICC 301 ~~Addendum A~~.

* + 1. Determining Daily Toilet Water Use for the Rated Home.Rated Home daily toilet water use shall be calculated as follows:

𝑇𝑜𝑖𝑙𝑒𝑡𝑔pd = 𝑟𝑒𝑓𝐹𝑃𝑂 ∗ 𝑔𝑝𝑓 ∗ 𝑂𝑐c

Where:

refFPO= the reference flushes per person per day = 5.05

gpf= the average gallons per flush of all toilets installed in the Rated Home. For tank-type dual-flush toilets, use the effective flush volume per flush based on EPA Water Sense specification for Tank Type Toilets.

Occ= the number of predicted occupants in the Rated Home=

Single Family: 1.09+0.54\*Nbr

Multifamily: 1.49+0.45\*Nbr~~1.09 + 0.54\*Nbr~~

Nbr= the number of bedrooms in the Rated Home

**4.5.7.1 Using Gray Water for Toilet Flushing**. Where a Rated Home has a gray water system to flush toilets, daily toilet water use for the Rated Home shall be reduced by 80 percent of the gray water collected or the water use associated with the toilets connected to the Gray Water System, whichever is less.

* + 1. Determining Daily Water Softener Water Use for the Rated Home. Rated Home daily water softener water use shall be calculated as follows:

**(Eq 4.5-8)**

Where:

Softened water = water conditioned by a water softener

* + 1. Determining Daily Other Water Use for the Rated Home.Rated Home daily other water use shall be calculated as follows:

**(Eq 4.5-9)**

Where:

Nbr= the number of bedrooms in the rated home

* + 1. Determining Daily Excess Pressure Adjustment Water Use for the Rated Home. Where a Rated Home does not have a pressure-reducing valve or pressure tank, additional water use attributed to excess water pressure shall be calculated as follows:

**(Eq 4.5-10)**

Where:

*PR* = Static water pressure (in psi) measured at the indoor fixture outlet on the lowest floor and (if more than one) closest to the water service entry to the house

Note: Shower and lavatory faucets controlled by integral or accessory pressure-compensating devices may be excluded from this equation.

* 1. Determining Outdoor Water Use for the Rated Home.The Rated Home Outdoor Water Use shall be calculated as follows:

Where the Rated Home ~~is a detached or duplex dwelling and~~ has an Automatic Irrigation System, Outdoor Water Use shall be calculated as follows:

Equation 1:

***(Eq 4.6-1)***

Where the Rated Home ~~is a detached or duplex dwelling and~~ does not have an Automatic Irrigation System, Outdoor Water Use shall be calculated as follows:

Equation 2:

**(Eq 4.6-2)**

The Outdoor Water Use for the Rated Home shall never be ~~less~~ greater than the result of the following calculation:

**(Eq 4.6-3)**

**(Eq 4.6-3)**

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)

~~For multi-family building properties, the irrigated area for the Rated Home and Reference Home shall be equal.~~ Where the Rated Home is not a dwelling or townhouse, the irrigated area for the Reference Home shall be the same as the Rated Home irrigated area.

* + 1. Determining Outdoor Daily Water Use for the Rated Home.  Rated Home daily outdoor water use shall be determined by multiplying the result of either Eq 4.6-1 or Eq 4.6-2, as appropriate, as such result may be further modified pursuant to Sections 4.6.1 through 4.6.4, by 1,000 and dividing the product by 365. Where the Rated Home is not a dwelling or townhouse, the outdoor daily water use shall be allocated equally to each dwelling unit.

4.6.2 Weather-based Controllers.Sensor and ~~weather based~~weather-based irrigation controllers that are certified by the U.S. EPA WaterSense program shall decrease the portion of predicted rated home outdoor water use associated with irrigation (less the water use associated with pools) by 15% in homes that have automatic irrigation system.

4.6.3. Commissioning of an Automatic Irrigation System.In rated homes, with an automatic irrigation system, where documentation is provided the water use associated with irrigation shall be decreased by 5% where a certified professional, as identified by a WaterSense labeled certification, and the irrigation system has been inspected according to the protocols identified in ASABE 626 and verified as follows:

• Average distribution uniformity of at least 65% on turf areas

• Sprinklers are operating at the manufacturer’s recommended water pressure +/- 10%

• The system operates without leaks

• The system prevents runoff and overspray from leaving the property (checked during the audit)

• Two seasonal water schedules (initial grow-in period and established landscape) are posted at the controller

4.6.4 Residential Irrigation Capacity Index (RICI).In a Rated Home, with an automatic irrigation system, where documentation is provided, a RICI shall be calculated as follows:

**(Eq 4.6-4)**

4.6.4.1 Applying RICI.A Rated Home where documentation for a RICI is provided may adjust the volume of water use associated with irrigation (less the water use associated with pools) in the Outdoor Water Use of the Rated Home by 10% for every point from a baseline RICI (RICI\_ref) of 5.

4.6.5 Applying Adjustments to the Outdoor Water Use of Rated Homes.Because the Water Rating Index model includes a number of percent adjustments for the outdoor water use of the rated home, the order of application becomes important. The correct order in which to apply these adjustments is as follows:

**Table 4.6.5. Applying Adjustments to Outdoor Water Use of the Rated Home**

|  |  |  |
| --- | --- | --- |
| 1 | 4.6.1- Smart Controllers | Shall be determined by the presence or absence of a smart controller in the installed portion of the landscape. |
| 2 | 4.6.2- Commissioning of an Automatic Irrigation System | Shall be determined by the presence or absence of commissioning in the installed portion of the landscape. |
| 3 | 4.6.3- Residential Irrigation Capacity Index (RICI) | Shall be calculated in accordance with section 4.6.4 and adjusted in partially finished landscapes to be calculated as:  (Predicted Back\_irr is defined in Section 5.3.) |

# CHAPTER 5. ~~Minimum Rated Features~~MINIMUM RATED FEATURES.

# 

# The estimated annual indoor and outdoor water use shall be determined using the minimum rated features set forth in Table 5.0.

**Table 5.0. Minimum Rated Features**

|  |  |
| --- | --- |
| **Building Element** | **Minimum Rated Feature** |
| 1. Toilet | Flush volume for each toilet as measured on-site or from manufacturer’s data. |
| 1. Shower/Bath | As imprinted on the product, stated by manufacturer in product documentation, or tested via flow rate test in the field. |
| 1. Bathroom Faucet | As imprinted on the product, stated by manufacturer in product documentation, or tested via flow rate test in the field. |
| 1. Kitchen Faucet | As imprinted on the product, stated by manufacturer in product documentation, or tested via flow rate test in the field. |
| 1. Clothes Washer | Washer capacity (cubic feet) from manufacturer’s data or the CEC Appliance Efficiency Database or the EPA ENERGY STAR website for all clothes washers located within the Rated Home. |
| 1. Dishwasher | Capacity of the dishwasher (in place settings) as included in the manufacturer’s data, labeled energy factor (cycles/kWh) for all dishwashers located within the Rated Home. |
| 1. Water Softener | Gallons of water used per 1,000 grains of hardness removed. |
| 1. Hot Water Distribution | Insulation R-value of pipe insulation, type of recirculation system, length of pipe |
| 1. Outdoor Water Use | Irrigation system type (automatic or manual), lot size, irrigated area (square feet) |
| 1. Pool/Spa | Indicate presence or absence of a pool or spa. |
| 1. Service Water Pressure | Service pressure of water being supplied to the home, as established by the setting of an installed pressure-reducing valve OR the setting of an installed pressure tank OR written documentation from the water supplier that service pressure to the site is ≤ 90 psi OR an on-site static pressure test. |

* 1. Data Sources.Data required for the calculation of indoor and outdoor daily water use in the Rated and Reference Homes shall be determined by the location of the Rated Home and using data as set forth in 5.1.1 and 5.1.2.

5.1.1. Net Evapotranspiration.Data for net evapotranspiration shall be determined for the location of the rated home using the World Water and Climate Atlas.

5.1.2. Hardness of Water.Data for the hardness of water shall be determined by the location of the Rated Home and one of the following:

**a)** U.S. Geological Survey *Concentrations of Hardness as Calcium Carbonate* Map

**b)** Data provided by the local water supplier

**c)** A hardness test of water collected in the home using an EPA approved method for determination of hardness

5.2 Default Values.Values that are not available in accordance with Table 5.0 or are absent from the home at time of the rating shall use default values in accordance with Table 5.2. Values for building elements that are not specified in table 5.2 are required for a rating to be issued.

**Table 5.2 Default Values**

|  |  |
| --- | --- |
| **Building Element** | **Default** |
| 1. Water Softeners | Can be entered as 0 if they are absent from a Rated Home. If they are present and no documentation is available they may be assumed to use 5 gallons/1,000 grains removed for cation water softeners if information is unavailable. |
| 1. Clothes Washer | Same as Reference Home |
| 1. Dishwasher | Determined by ANSI/RESNET/ICC 301. A rated home without either a dishwasher or an undercounter cavity for placement of a dishwasher shall be assigned a Daily Dishwasher Water Use of 0 |
| 1. Hot Water Distribution | Determined by ANSI/RESNET/ICC 301 ~~Addendum A~~ |
| 1. Outdoor Water Use | Must be done in accordance with Section ~~4.2.3~~ 4.6 and 5.3. |

5.3. Incomplete Outdoor Area. To receive a rating, a home shall~~must~~ (at a minimum) have the front yard landscape completed. Homes that do not have landscaping completed in the back yard shall be determined in accordance with Section 4.6 with the portion of landscaping that is done determining the presence or absence of an automatic irrigation system. The following steps shall be followed in determining irrigated area in this instance.

*Rater must determine a line between the front and back area (front\_area + back\_area must = total available area)*

*Lot\_Area – Pad Footprint= total available area*

*(Back\_area/total available area) \* Ref\_Irr\_Area= Predicted Back\_irr*

*Irr\_Area= Predicted Back\_irr + Front\_irr*

*Where:*

*Pad Footprint= the portion of the lot area covered by the dwelling unit and any attached or detached garage.*

*Total\_available\_area= The portion of the lot excluding the pad of the house that is available for landscaping or other design features (hardscape, softscape, etc.)*

*Front\_area= the area (in sq. ft.) of the total available area that is located primarily in front of the house*

*Back\_area= the area (in sq. ft.) of the total available area that is located primarily behind the house*

*Front\_irr= The area located primarily in front of the house that receives supplemental water for irrigation at the time of the rating*

*Predicted Back\_irr= the portion of the area located primarily behind the house that can be predicted to receive supplemental water for irrigation in the future*

# CHAPTER 6. ~~Certification and Labeling~~CERTIFICATION AND LABELING.

# This section establishes minimum uniform standards for certifying and labeling home water use performance using the Water Rating Index. These include minimum requirements of the home water use rating process, standard methods for estimating water use, minimum reporting requirements, and specification of the types of ratings that are performed in accordance with this Standard.

## 6.1. Rating Requirements.

6.1.1. General. The rating for a home shall be determined in accordance with sections 6.1.1.1 through 6.1.1.2.

**6.1.1.1.** For an existing home, required data shall be collected on site.

**6.1.1.1.1.** For a new, to-be-built home, the procedures of Section 5.0 shall be used to collect required data.

**6.1.1.2.** The collected data shall be used to estimate the annual water consumption for indoor and outdoor water use for both the Rated Home and the Reference Home as specified by Section 4.0.

6.1.2. Cost Savings Estimates. Where determined, cost savings estimates for water and wastewater (sanitary sewer) service for the Rated Home shall be calculated in accordance with Sections 6.1.2.1 through 6.1.2.3.

### 6.1.2.1. **Water Cost Savings.**

6.1.2.1.1. Water Prices. Water cost savings for homes receiving potable water service from a water supplier shall be based on the schedule of rates and charges adopted by the water supplier serving the Rated Home.

6.1.2.1.2. Relevant Rates and Charges. Water cost savings shall be calculated from the volumetric portion of the schedule of rates and charges, sometimes referred to as the commodity charge. Fixed or flat charges that do not vary with the volume of water delivered to the home, sometimes referred to as the meter charge or service charge, shall not contribute to the cost savings estimate.

### 6.1.2.1.3. **Water Cost Savings Calculations.**

6.1.2.1.3.1. Average Billed Indoor Volume of the Reference Home.Convert the total annual volume of indoor water use by the Reference Home to an increment of indoor use during a water billing period by dividing the annual indoor volume by the number of bills per year generated by the water supplier, e.g., for monthly billing divide by 12 and for quarterly billing divide by 4. Convert the units of consumption of the Reference Home as necessary to match the units of the rate schedule (e.g., 1.000 gallons, 100 cubic feet) to yield the average billed indoor volume of the Reference Home.

6.1.2.1.3.2. Determine Outdoor Water Use for a Billing Period.Convert the total annual volume of outdoor water use in the Reference Home to an increment of outdoor use during a water billing period using one of two methods, based on prevailing practice at the location of the Rated Home.

6.1.2.1.3.2.1. Peak Season Irrigation. Divide the annual outdoor volume by the number of bills generated by the water supplier during the irrigation season, e.g. for a 6-month irrigation season with monthly billing, divide by 6; for a 6-month irrigation season with quarterly billing, divide by 2. Convert the units of consumption of the Reference Home as necessary to match the units of the rate schedule (e.g., 1.000 gallons, 100 cubic feet) to yield the average billed outdoor volume of the Reference Home.

6.1.2.1.3.2.2. Year-Round Irrigation. Divide the annual outdoor volume by the number of bills generated by the water supplier during a full year, e.g., for monthly billing divide by 12 and for quarterly billing divide by 4. Convert the units of consumption of the Reference Home as necessary to match the units of the rate schedule (e.g., 1.000 gallons, 100 cubic feet) to yield the average billed outdoor volume of the Reference Home.

6.1.2.1.3.3. Combine Indoor and Outdoor Water Use Charges.For each billing period in a year, calculate the billed water volume by combining the average billed indoor volume with any average billed outdoor volume applicable to such billing period. Note that where peak season irrigation has been calculated, the billed water volume for billing period outside of the irrigation season will consist entirely of the average billed indoor volume. Apply the volumetric portion of the rate schedule to the billed volume for each billing period, accounting for any rate blocks or seasonal variations in the rate schedule, to produce the billed volume charge (in dollars) for each billing period. Combine the billed volume charge for each billing period to yield the annual water volume charge of the Reference Home.

6.1.2.1.3.4. Determine Water Use Cost for the Rated Home.Repeat the process described in Section 6.1.2.1.3 through 6.1.2.1.3.3 for the Rated Home to calculate the annual water volume charge of the Rated Home.

6.1.2.1.3.5. Total Estimated Water Cost Savings.Estimated water cost savings shall be the difference between the estimated annual water volume charge of the Reference Home and the estimated annual water volume charge of the Rated Home.

### 6.1.2.2. **Sanitary Sewer Service Cost Savings.**

6.1.2.2.1. Sewer Service Prices. Sanitary sewer service cost savings for homes with a permanent connection to sanitary collection and treatment works shall be based on the schedule of rates and charges adopted by the sanitary sewer service provider serving the Rated Home. Note that collection and treatment of sanitary discharges may be performed by separate entities, and that billing to the Rated Home by such entities may be combined or separate.

6.1.2.2.2. Relevant Rates and Charges. Sanitary sewer service cost savings shall be calculated from the volumetric portion of the schedule of rates and charges. Fixed or flat charges that do not vary with the volume of water delivered to the home shall not contribute to the cost savings estimate.

### 6.1.2.2.3. Sewer Cost Savings Calculations.

6.1.2.2.3.1. Average Billed Indoor Volume of the Reference Home.Convert the total annual volume of indoor water use by the Reference Home to an increment of indoor use during a sewer billing period by dividing the annual indoor volume by the number of bills per year generated by the sewer service provider, e.g., for monthly billing divide by 12 and for semi-annual billing divide by 2. Convert the units of consumption of the Reference Home as necessary to match the units of the rate schedule (e.g., 1.000 gallons, 100 cubic feet) to yield the average billed indoor volume of the Reference Home.

6.1.2.2.3.2. Annual Sewer Volume Charge for the Reference Home.Apply the volumetric portion of the sewer rate schedule to the average billed indoor volume for each billing period, accounting for any rate blocks or seasonal variations in the rate schedule, to produce the billed volume charge (in dollars) for each billing period. Combine the billed volume charge for each billing period to yield the annual sewer volume charge of the Reference Home.

6.1.2.2.4. Determine Annual Sewer charge for the Rated Home.Repeat the process described in Section 6.1.2.2.3 for the Rated Home to calculate the annual sewer volume charge of the Rated Home.

6.1.2.2.5. Estimated Sewer Cost Savings.Estimated sewer cost savings shall be the difference between the estimated annual sewer volume charge of the Reference Home and the estimated annual sewer volume charge of the Rated Home.

6.1.2.2.6 Combined Presentation of Cost Savings. Estimated water cost savings and estimated sewer cost savings may be presented as a total estimated cost savings when designated as “water and sewer” savings.

6.1.2.4. Other Cost Savings. Performance attributes of the Rated Home may influence other types of charges, depending on the fee structure in the jurisdiction of the Rated Home. While less common, these savings may be significant. Any determinations for cost savings associated with the following charges shall be submitted for individual review and approval by the body providing quality assurance for the rating service provider of the Rated Home.

(a) water service connection charges, also known as tap fees;

(b) sanitary sewer service connection charges, also known as capacity charges;

(c) stormwater fees.

6.1.3 Reports.All reports generated by an Approved Software Rating Tool shall, at a minimum, contain the information specified by Sections 6.1.3.1 through 6.1.3.6.

6.1.3.1. The property location, including city, state, zip code and either the street address or the Community Name and Plan Name for the Rating.

6.1.3.2. The name of the certified rater conducting the Rating.

6.1.3.3. The name of the Approved Rating Provider under whose auspices the rater is certified.

6.1.3.4. The date the Rating was conducted.

6.1.3.5. The name and version number of the Approved Software Rating Tool used to determine the Rating.

6.1.3.6. The following statement in no less than 10-point font: “The Home Water Rating Standard Disclosure for this home is available from the Rating Provider.” At a minimum, this statement shall also include the Rating Provider’s mailing address and phone number.

6.1.4 Rating Types.There shall be three Rating Types in accordance with Sections 6.1.4.1 through 6.1.4.3.

6.1.4.1 Confirmed Rating.A Rating Type that encompasses one individual dwelling and is conducted in accordance with Sections 6.1.4.1.1 through 6.1.4.1.3.

6.1.4.1.1. All Minimum Rated Features of the Rated Home shall be field-verified through inspection and testing in accordance with Section 5.

6.1.4.1.2.All field-verified Minimum Rated Features of the Rated Home shall be entered into the Approved Software Rating Tool that generates the home water rating. The home water rating shall report the Water Rating Index that comports with these inputs.

6.1.4.1.3.Confirmed Ratings shall be subjected to Quality Assurance requirements established by an Approved Rating Provider. ~~quivalent to Section 900 of the~~ *~~Mortgage Industry National Home Energy Rating Systems Standard.~~*

6.1.4.2. Sampled Ratings.A Rating Type that encompasses a set of dwellings and is conducted in accordance with Sections 6.1.4.2.1 through 6.1.4.2.3.

6.1.4.2.1. For the set of Rated Homes, all Minimum Rated Features shall be field verified through inspection and testing of a single home in the set, or distributed across multiple homes in the set, in accordance with the requirements established by an Approved Rating Provider. ~~equivalent to Section 600 of the~~ *~~Mortgage Industry National Home Energy Rating Systems Standard~~*~~.~~  ~~In addition to Section 600 of the~~ *~~Mortgage Industry National Home Energy Rating Systems Standard, t~~*~~he~~ ~~following requirements shall be followed for completing sampled ratings:~~

1. ~~Homes shall be grouped with up to seven in each sample set.~~
2. ~~The seven homes shall have their irrigation systems installed within a 30-day period.~~
3. ~~The seven homes shall have the same irrigation controller and emitter technology (spray vs. drip)~~
4. ~~The maximum irrigated area shall be within 10 percent of the minimum irrigated area.~~
5. ~~The home with the largest irrigated area shall be used in the model.~~
6. ~~The seven homes shall be within the same or adjacent zip code~~
7. ~~When using RICI as outlined in Section 4.6.4, one home in each sample set shall have the irrigation flow rate tested to determine the gallons per minute flow rate of all emitters.~~
   1. ~~Where the tested home cannot achieve a Residential Irrigation Capacity Index (RICI) Score of five (5) or less, two additional homes from the sample set shall be tested.~~
   2. ~~If one or more of the additionally tested homes in the sample cannot achieve a RICI Score of five (5) or less, the four remaining homes in the sample shall be tested.~~
8. ~~When using RICI, all homes in the sample shall be assumed to have the same flow rate as the tested home.~~
9. ~~At least one home in the sample shall have the indoor and outdoor minimum rated features verified.~~
10. ~~Where it is not possible to test one in every seven homes, due to seasonal conditions, the following assumptions, in Table 6.1.4.2.1(h) shall be used to determine flow rates of the irrigation system:~~

|  |  |
| --- | --- |
| ~~Emitter Type~~ | ~~GPM/emitter~~ |
| ~~Drip emitters~~ | ~~0.1~~ |
| ~~Microspray~~ | ~~0.5~~ |
| ~~Spray~~ | ~~1.5~~ |

**6.1.4.2.2.** The threshold specifications from the Worst-Case Analysis for the Minimum Rated Features of the set of Rated Homes shall be entered into the Approved Software Rating Tool that generates the home water use rating. The home water use rating shall report the Water Rating Index that comports with these inputs.

**6.1.4.2.3.** Sampled Ratings shall be subjected to Quality Assurance requirements established ~~quivalent to Section 900 of the~~ *~~Mortgage Industry National Home Energy Rating Systems Standard~~by an Approved Rating Provider.*

6.1.4.3. Projected Ratings.A Rating Type that encompasses one individual dwelling and is conducted in accordance with Sections 6.1.4.3.1 through 6.1.4.3.5.

**6.1.4.3.1.** All Minimum Rated Features of the Rated Home shall be determined from architectural drawings, threshold specifications, and the planned location for a new home or from a site audit and threshold specifications for an existing home that is to be improved.

**6.1.4.3.2.** Unknown values shall be determined in accordance with Section 5.2.

**6.1.4.3.3.** The Projected Rating Report shall contain the following text in no less than 14-point font at the top of the first page of the report: “Projected Rating Based on Plans—Field Confirmation Required.”

6.2 Innovative Design Requests.

6.2.1. Petition. Water Rating providers can petition for adjustment to the Water Rating Index for a Rated Home with features or technologies not addressed by Approved Software Rating Tools or this Standard. Innovative Design Requests (IDRs) shall be submitted to an Approved IDR authority and shall include, at a minimum, the following:

* + - 1. A Rating generated from Approved Software Rating Tool for the Rated Home without feature(s) that cannot be modeled in the software tool.
      2. Written description of feature(s) not included in Rating generated from software.
      3. Manufacturer’s technical and/or performance specifications for feature(s) not included in the Rating generated from the Approved Software Rating Tool.
      4. Estimated water use impact. Calculations or simulation results estimating the water use impact of feature(s) not included in the Rating generated from an Approved Software Rating Tool and documentation to support the calculation methodology and/or describe the modeling approach used.
      5. Estimated adjustment to the Water Rating Index. Calculations shall follow procedures of Sections 4.1 and 4.2.

6.2.2. Approval. IDRs shall be approved on a case by case basis. The Approved IDR review authority shall accept or reject the IDR as submitted, or request additional information. The Approved IDR review authority shall assign a unique identifier to each IDR and maintain a database of IDRs. If the IDR is approved, the Water Rating provider is authorized to issue a supplemental report that adjusts the Water Rating Index, as approved.

# Normative References

ANSI/RESNET/ICC 301-2022~~14~~, *~~Addendum A-2015 Domestic Hot Water Systems~~*, Residential Energy Services Network, Oceanside, CA

World Water and Climate Atlas, International Water Management Institute, Colombo, Sri Lanka. (http://www.iwmi.cgiar.org/resources/world-water-and-climate-atlas/)

*Concentrations of Hardness as Calcium Carbonate* Map, U.S. Geological Survey, Washington, DC. (https://water.usgs.gov/owq/hardness-alkalinity.html)

**Informative Appendix A**

**Background on Outdoor Water Calculations**

Base Outdoor Water Use Calculations:

Base equations for outdoor water use in both the reference and rated home (4.4 and 4.6) are established as a best fit regression equation using data from the Residential End Uses of Water, Version 2 (REUWS II)[[2]](#footnote-3).

The equation is based on the findings of the REUWS II report summarized in “Outdoor use model 1” with some modifications applied. REUWS II finds outdoor water use to be a non-linear trend best described as a factor of:

* The natural log of (irrigated area + 1)
* The natural log of net evapotranspiration
* The natural log of the average cost of water at 25,000 gallons of consumption
* An indicator for in ground sprinkler irrigation
* An indicator for swimming pools

The modifications applied to this equation are:

* Removal of the average cost of water term as an operational descriptor not appropriate for an asset-based rating system
* Replacing the natural log +1 technique with one that removes homes that reported values of “0” and using an adjustment factor[[3]](#footnote-4)
* Improving fit by separating into predictions for homes with and without in ground sprinkler irrigation into two equations with a switch between them in lieu of an indicator
* Forcing the indicator for swimming pools into the equation for homes without in ground sprinkler systems[[4]](#footnote-5)

Residential Irrigation Capacity Index:

The Residential Irrigation Capacity Index (RICI) is developed based on research conducted on submetered portions of landscapes by the Southern Nevada Water Authority (SNWA) as part of it’s Xeriscape Conversion Study[[5]](#footnote-6). The original research completed in the SNWA territory was used to establish the calculation and application method for RICI. The data from the REUWS II dataset was then used to validate the relationship between flow rate and outdoor water use of an automatic irrigation system on a national level and to establish the standard reference RICI of 5.0.

~~The Residential Irrigation Capacity Index (RICI) is developed based on research conducted on the “xeriscape conversion” of landscapes by the Southern Nevada Water Authority (SNWA)~~~~[[6]](#footnote-7)~~~~. The original research completed in the SNWA territory was used to establish the calculation and application method for RICI. The data from the REUWS II dataset was then used to validate the relationship between flow rate and outdoor water use of an automatic irrigation system on a national level and to establish the standard reference RICI of 5.0.~~

~~To calculated RICI scores for homes included in the REUWS II dataset, the following processing was completed:~~

1. (Normative Note) The terms dwelling unit and sleeping unit are interchangeable with the term home throughout this Standard, except where specifically noted. [↑](#footnote-ref-2)
2. http://www.waterrf.org/Pages/Projects.aspx?PID=4309 [↑](#footnote-ref-3)
3. Both “natural log +1” and adjustment factors are techniques for non-linear best fit regressions when values of “0” are present, as one cannot take the natural log of “0”. [↑](#footnote-ref-4)
4. While this term was not statistically significant, the subcommittee felt this to be the result of a lack of data for homes with swimming pools but without in ground sprinkler systems. [↑](#footnote-ref-5)
5. https://www.snwa.com/assets/pdf/reports-xeriscape.pdf [↑](#footnote-ref-6)
6. ~~https://www.snwa.com/assets/pdf/reports-xeriscape.pdf~~ [↑](#footnote-ref-7)