This presentation premiered at WaterSmart Innovations

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RESNET®
RESIDENTIAL ENERGY SERVICES NETWORK

Water Efficiency: What Gets Measured Gets Improved

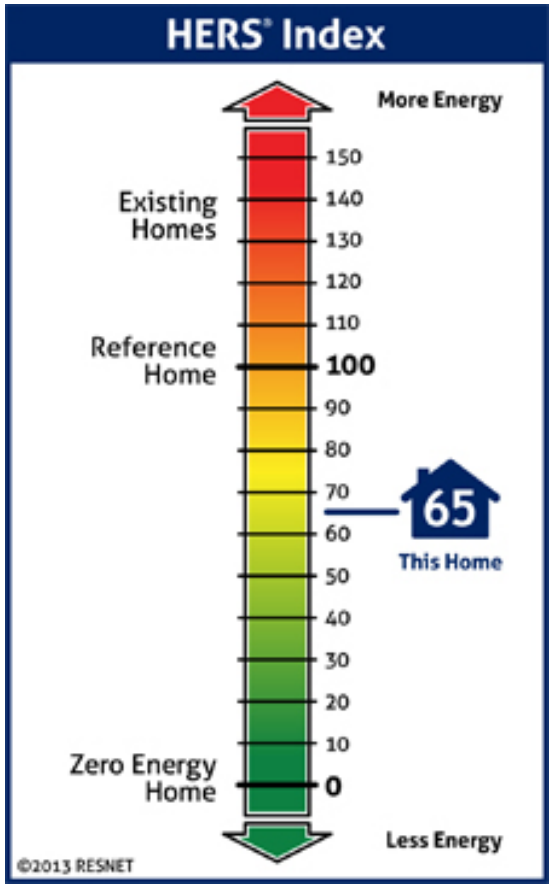
Introducing

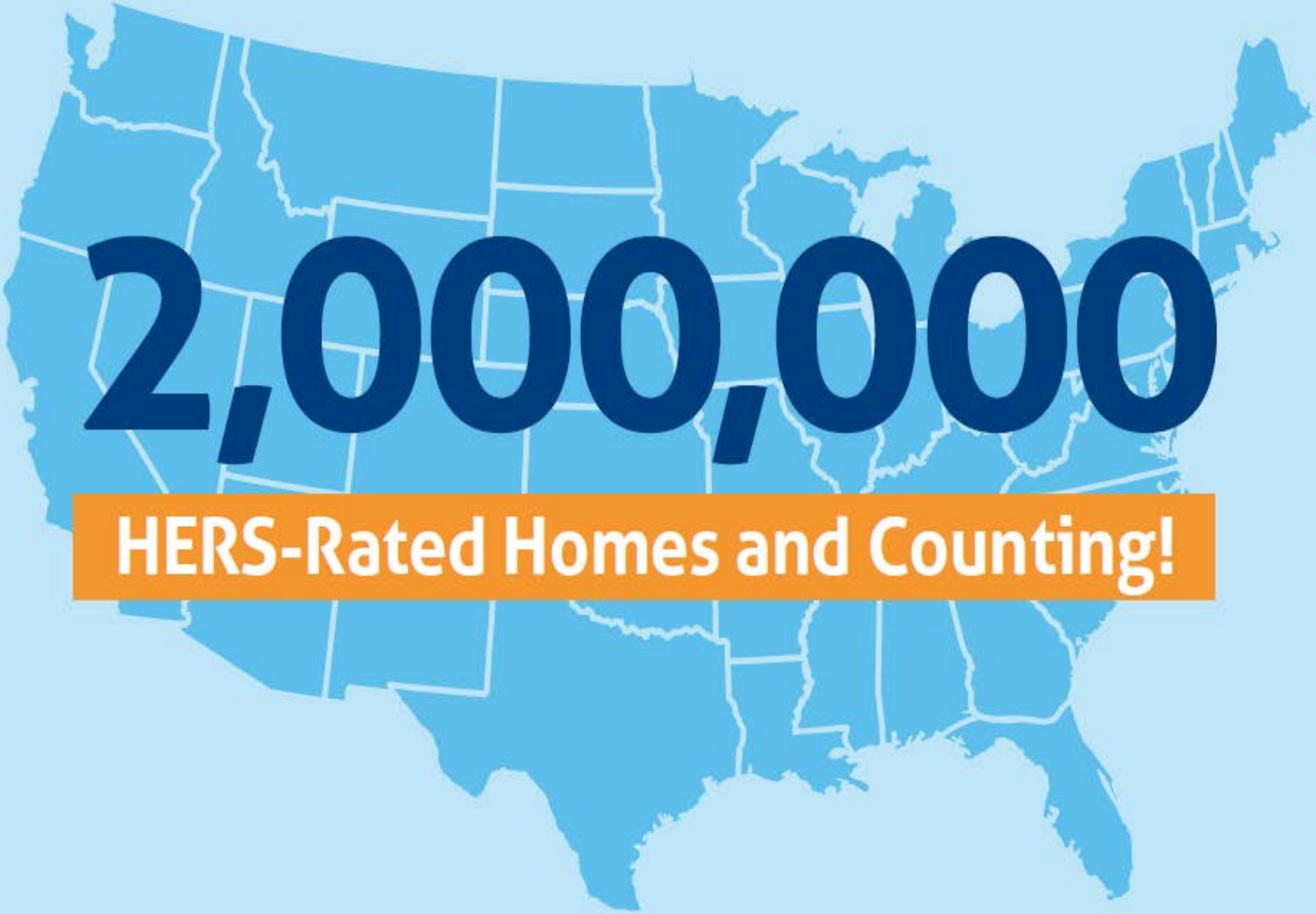
RESNET WER® INDEX

RESNET®
RESIDENTIAL ENERGY SERVICES NETWORK

- An industry-based, not for profit organization
- A national standards making body for building energy efficiency rating and certification systems in the USA (ANSI Accredited Standards Development Organization)
- A home energy rating is a whole house analysis of a home's energy efficiency by a trained and certified RESNET Home Energy Rater. The house data is entered into a RESNET accredited rating software tool which produces the rating

RESNET HERS Index




2,000,000
HERS-Rated Homes and Counting!

Water Rating Systems

Energy ratings are common in the market place:

- More than 200,000 homes a year receive a HERS rating
- Title 24 performance modelling

The building industry shows a strong preference for performance modelling over prescriptive requirements

- Title 24 compliance
- ENERGY STAR Certified Homes performance vs. prescriptive paths

Homes have not been rated for water due to:

- Lack of available data, tools, and resources
- WaterSense labeled homes were launched in 2009 using a combination of prescriptive, performance, and professional requirements

Water Rating Systems

Water Efficiency Rating System (WERS)

- Developed originally by the Sante Fe Home Builders Associations
- Being implemented by the Green Building Coalition

RESNET's Water Efficiency Rating Index (WERI)

- Developed by RESNET
- Designed to leverage the existing HERS infrastructure
- Currently being proposed as an American National Standard (ANSI standard)

Objectives | Timeline | Details | Case Study

Key Objectives for the WER Index

- **Nationwide applicability**
- **Suitable for both new and existing homes**
- **Encompasses both indoor and outdoor water efficiency**
- **Practical and affordable to administer**
- **Scores usable for quantitative comparison**

RESNET WER® INDEX

2015

- RESNET Board Approves Program
- WER Index Advisory Council Formed

2016

- WER Index Working Group Formed
- WER Index Working Group Technical Subcommittees formed

2017

- WRI Technical Guidelines Drafted and Underwent Public Review and Comment Process
- RESNET/ICC ANSI SDC Formed
- Field Testing of Technical Guidelines

Plans for 2018: Adoption of ANSI RESNETY/ICC Standard, Pilot Projects

RESNET/ICC Water Rating Index Standard Development Committee (SDC)

The members of the SDC 1100 – Water Rating Index are:

- Jacob Atalla, Vice President of Sustainability, KB Home
- Brett Cook, Building Code Official, City of Boardman, Oregon
- Mary Ann Dickinson, President and CEO, Alliance for Water Efficiency
- Andrew Espinoza, Building Code Official, City of San Antonio, Texas
- Philip Fairey, Deputy Director, Florida Solar Energy Center
- Ed Osann, Team Leader – Water Use Efficiency, Natural Resources Defense Council
- David Sauter, Building Code Official, Hatfield Township, Pennsylvania
- Jonah Schein, WaterSense Program Manager, U.S. Environmental Protection Agency
- Kelly Stephens, Director of Operations, SunRiver Development

Plans are underway to submit the draft Water Rating Index standard for RESNET ANSI standards public review and comment in the final quarter of 2017.

WER Index Core Model

- Indoor (primarily from HERS) includes:
  - Size & location of home
  - Average flow rate of fixtures/Average flush volume of toilets
  - Appliance information (energy and water factors)

- Outdoor (developed based on REUWS II report) includes:
  - Size & location of landscape
    - Sets reference landscape based on lot size
  - Automatic irrigation system
  - Presence of pool

Outdoor Water Use Model

- REUWS II includes predictive methods for estimating outdoor water use that includes terms for:
  - Ln(irrigated area +1)
  - Ln(Net ET)
  - Cost of water
  - Indicator for automatic irrigation systems
  - Indicator for presence/absence of swimming pools

Outdoor Water Use Model

When we remove undesired terms, we see residual problems in the model that need to be addressed so the model becomes:

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

$$\left[\frac{\exp(\mathrm{B})}{1 + \exp(\mathrm{B})}\right] * 1.22257$$
$$* [1.4233 + 0.6311 * \mathrm{netET} + 0.9376$$

Outdoor Water Use Model

What the equation is really saying is:

$$\left[\frac{exp(A)}{1 + exp(A)}\right] * 1.18086 * [2.0341 * netET^{0.7154} * Irr\_Area^{0.6227}$$

Water use in landscapes with irrigation system are a function of:

- Size
- ET
- Presence or absence of a pool

$$\left[\frac{\exp(B)}{1 + \exp(B)}\right] * 1.22257 * [1.4233 + 0.6311 * netET + 0.9376$$

Water use in landscapes without irrigation are a function of:

- Size
- ET
- Presence or absence of a pool*

Outdoor Water Use Model

What the equation is really saying is:

Water use in landscapes with irrigation system are a function of:

- Size
- ET
- Presence or absence of a pool

Water use in landscapes without irrigation are a function of:

- Size
- ET
- Presence or absence of a pool*

Outdoor Water Use Model

We then add various constraints and correction factors to:

- Account for properties in REUWS that have no outdoor water use (alternative to using LN+1 technique from REUWS II)
- Avoid predicting unrealistically low numbers or artificially raising scores

And adjustments based on technology and techniques that have been shown to have statistically predictive impacts on outdoor water use:

- Use of smart controllers
- Use of more efficient emitters devices as expressed by the Residential Irrigation Capacity Index (RICI)
- Proper commissioning by a qualified irrigation professional

RICI Adjustment

Rated outdoor water use can be adjusted using the Residential Irrigation Capacity Index (RICI):

$$\frac{sum\ of\ flow\ (gpm)\ of\ all\ irrigation\ valves}{ft^2\ irrigated\ area}\ X\ 1{,}000$$

- Can be tested by running each irrigation zone separately and recording the water usage and run time
- Every one-point reduction in RICI (from a baseline of 5) results in 10% water savings

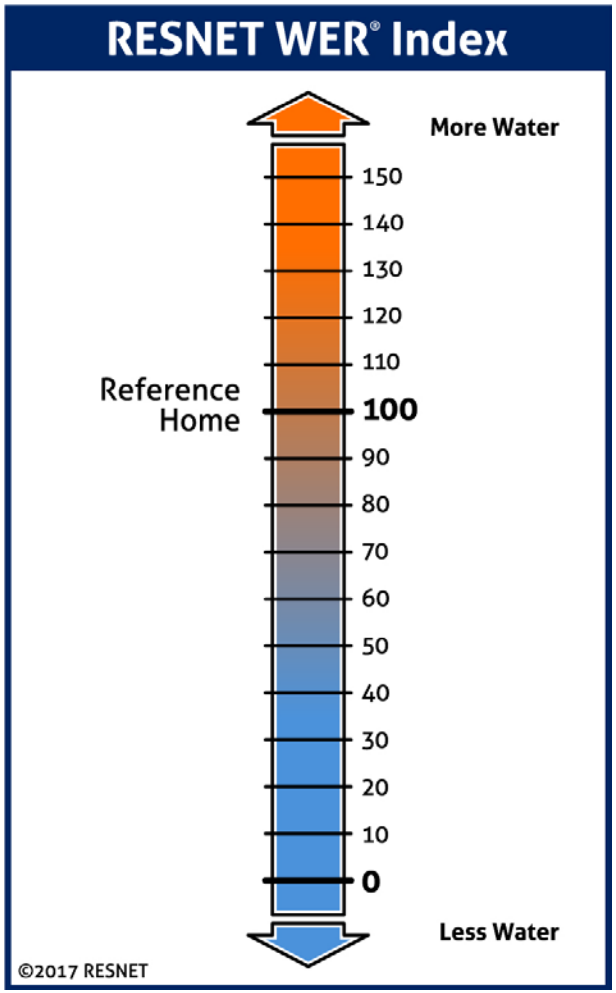
RICI Adjustment

In a well designed landscape, total flow rate will be lowered by:

- Replacing intense water use features with drought tolerant plants
  - Allows designers to replace high flow technologies (such as fixed spray) with lower flow technologies (such as drip)
- Using technologies with more efficient emission
  - Drip irrigation
  - Pressure compensating sprinkler bodies

How You Get a WER Index Score

$$rating\ index = \frac{rated\ home}{reference\ home}\ x\ 100$$



Indoor Rated Water Use

Will respond to:

- More efficient plumbing products
- Efficient Appliances
- More efficient plumbing distribution
- Unnecessarily high pressure

Normalized for:

- Climate
- Size of house & predicted occupancy

Outdoor Rated Water Use

Will respond to:

- Smaller landscapes (the reference landscape is fixed based on lot size)
- Presence of absence of an automatic irrigation system (the reference home includes an irrigation system)
- More efficient irrigation technology
  - Smart controllers
  - More efficient emitters, as expressed by the Residential Irrigation Capacity Index (RICI)
  - Proper commissioning

Normalized for:

- Climate

Cadanera Case Study

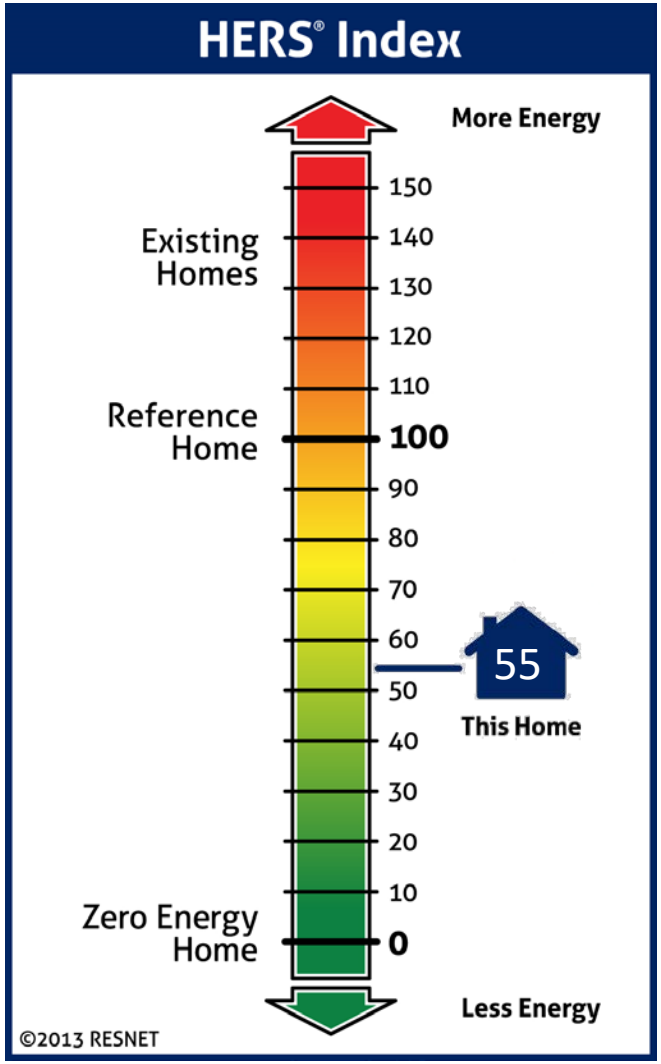
We estimate that the 45 WaterSense labeled homes at Cadanera will save annually

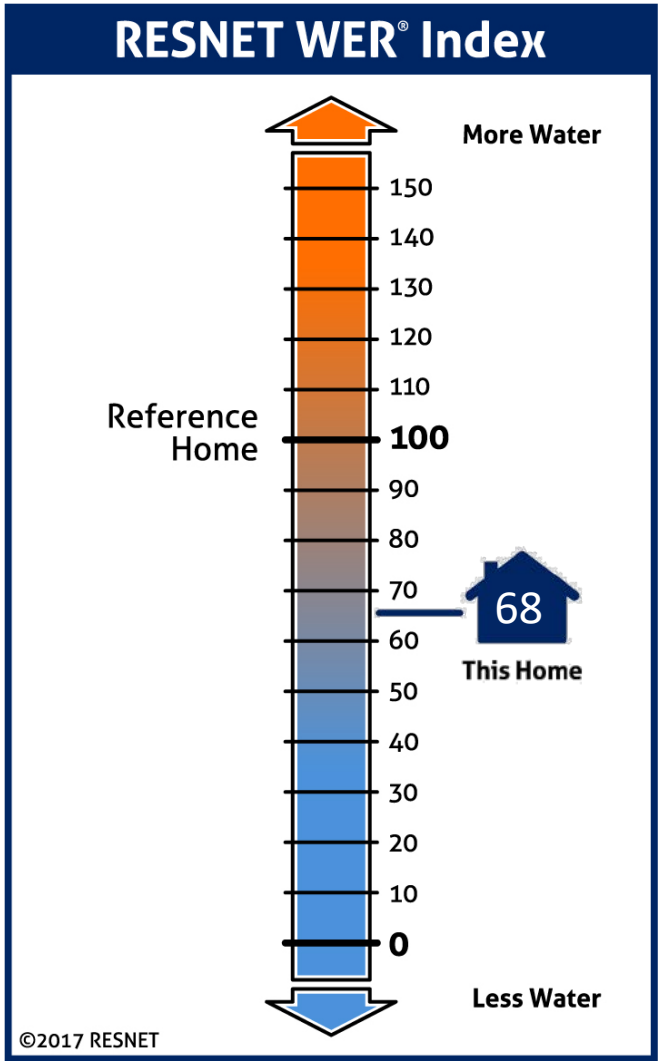
- 1.4 million gallons of water a year
- 74,000 kWh of energy to move, treat, and heat water

Cadanera Community

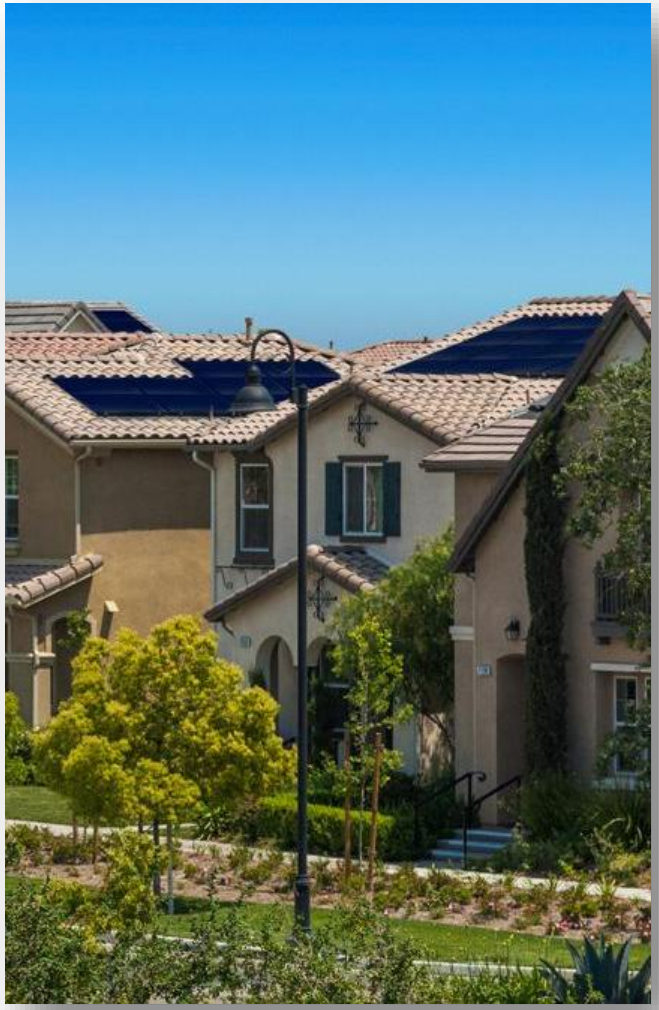
- Built in 2016
- Typical home includes
  - 3 to 4 bedrooms
  - 2,000 to 2,500 ft^2
  - 2 floors
  - WaterSense labeled products
  - High efficiency appliances
  - Average 4,500 ft^2 lots with efficient irrigation and drought tolerant landscaping
- Instantaneous gas water heater (.67 EF)
- Using draft WER Index would have an average score of 68

Companion Index Results for Cadanera





WER Index Field Trials, Fall 2017



Field tests in FL, TX, CO, NV, and CA:

- Availability of data
- Checklist's usability
- Sampling protocol
- Readiness of home and landscape for inspection and verification
- Time it takes to do field inspection
- WER Index scores of rated homes

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