



# Getting the Details Right on the ENERGY STAR Water Management System Builder Checklist


RESNET Building Performance Conference, Orlando FL  
March 1, 2013

# Agenda

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- Purpose and Value of the Water Management System Builder Checklist.
- Discussion of critical details from the checklist.
- Which items do you need to meet?

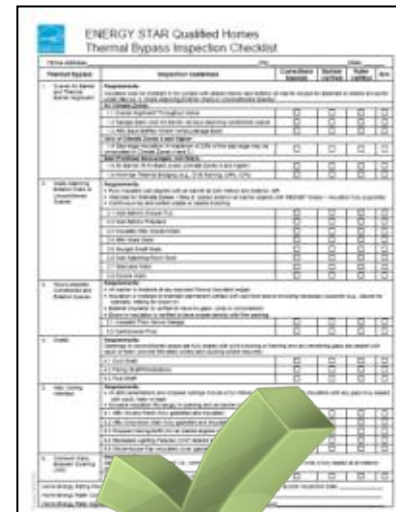
A small inset image in the top left corner shows a person in a blue shirt looking up and using a flashlight to inspect the ceiling of a room.

# **Purpose and Value of the Water Management System Builder Checklist**

# Key Points about the Water Management System Checklist



- Helps prevent durability problems from moisture.
- Based on code requirements, plus best practices.
- Especially important in high performance homes, regardless of whether the home is ENERGY STAR certified.



# Complete water management system



## Water Management System Checklist

Checklist  
system

- One page of checklist items to ensure that every home has a complete water management system.
- Verified by the builder
- Benefits
  - Reduced risk of moisture damage to the home before and after construction
  - Ensures that details that are difficult to go back and fix are properly installed the first time

# Real World Examples



# Real World Examples

## Improperly Flashed Window Water Damage



# Real World Examples

## Weep screed for stucco veneer





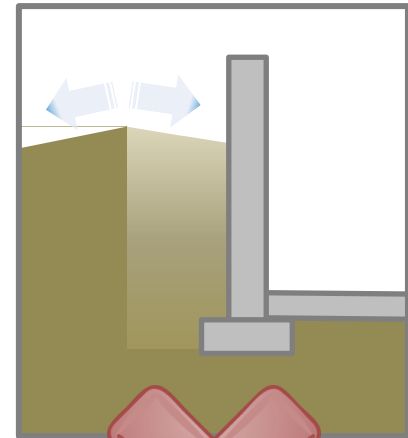
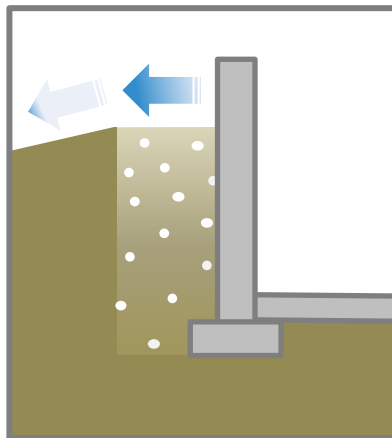
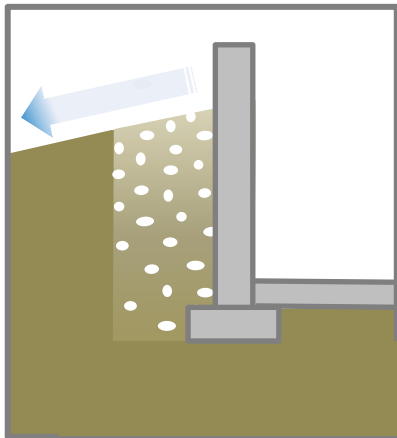


# Critical Details of the Checklist

# Item 1.2: Tamp backfill & slope

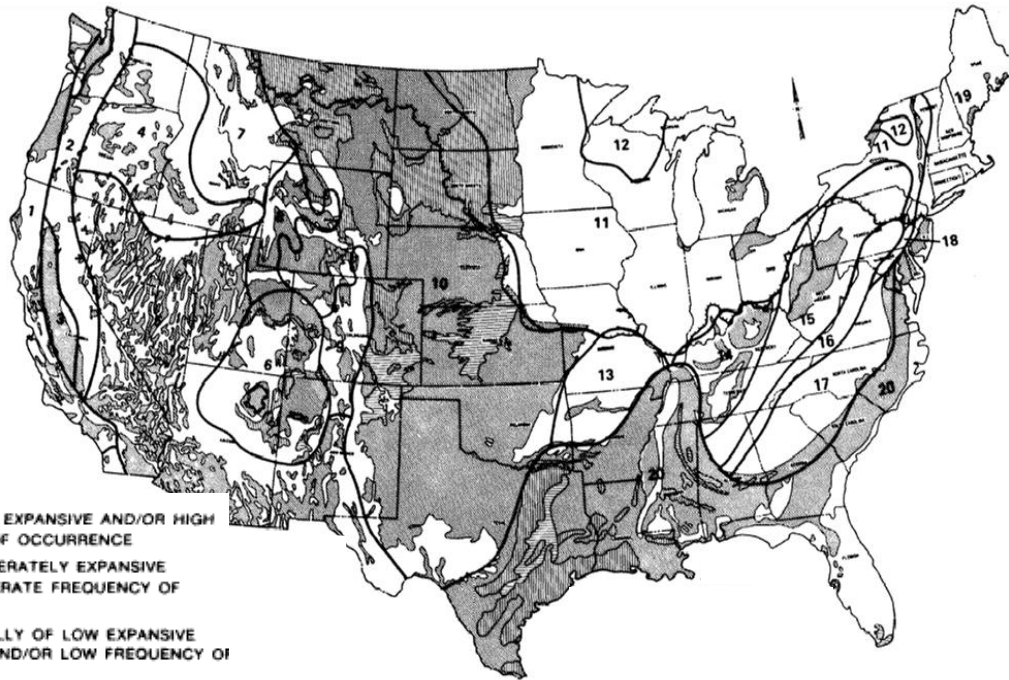
- Tamp backfill, and,
- Slope final grade  $\geq 0.5$  in per ft. away for  $\geq 10$  ft.





Untamped backfill may settle over time...



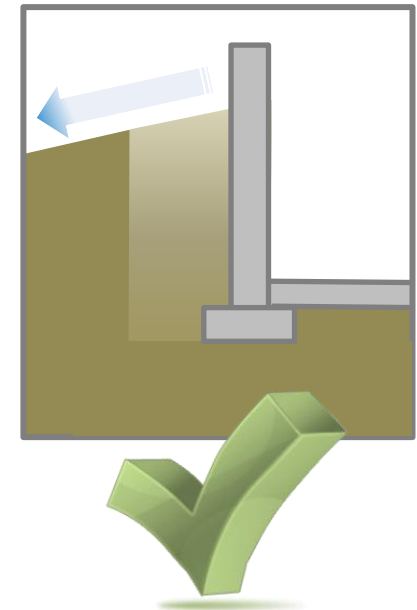
# Item 1.2: Tamp backfill & slope

- Tamping exemption for non-settling compact soils, as determined by a certified hydrologist, soil scientist, or engineer.



 HIGH: HIGHLY EXPANSIVE AND/OR HIGH FREQUENCY OF OCCURRENCE  
 MEDIUM: MODERATELY EXPANSIVE AND/OR MODERATE FREQUENCY OF OCCURRENCE  
 LOW: GENERALLY OF LOW EXPANSIVE CHARACTER AND/OR LOW FREQUENCY OF OCCURRENCE  
 NONEXPANSIVE: THE OCCURRENCE OF EXPANSIVE MATERIALS EXTREMELY LIMITED

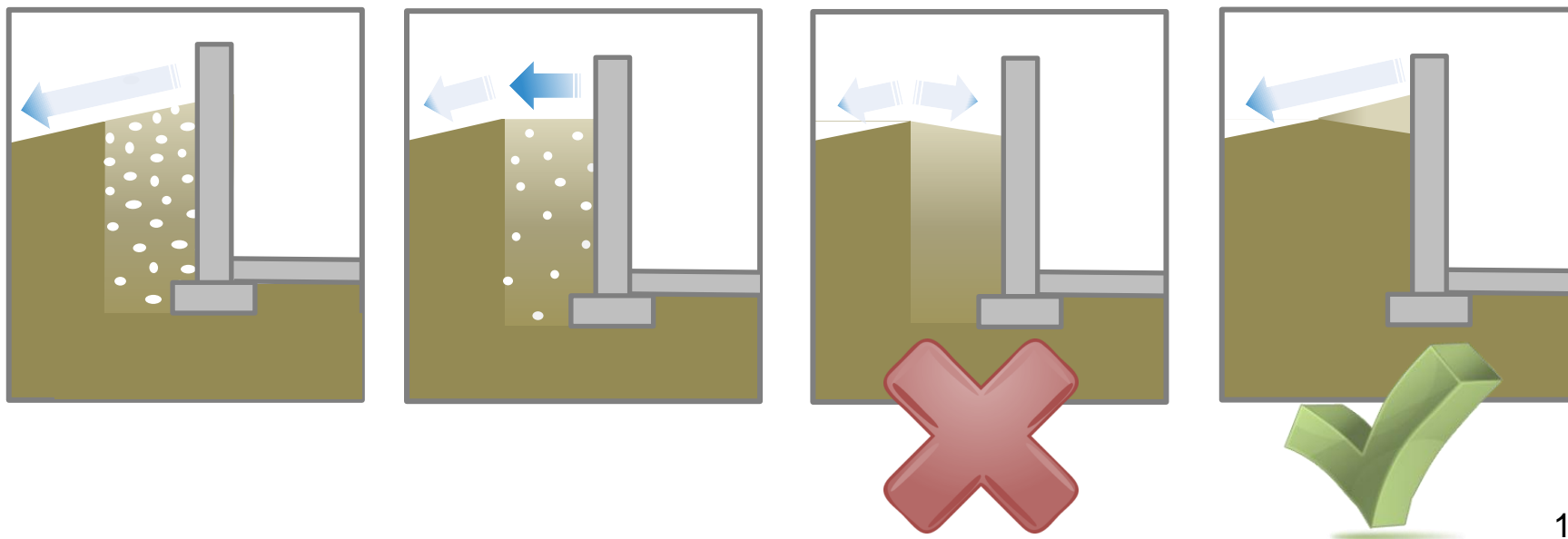
US Army Corps of Engineers Figure 2-1



## Item 1.2: Tamp backfill & slope

- Tamping exemption if site visit is scheduled to provide in-fill and final grading after first rainy season.

Untamped backfill may settle over time...  
... but can be in-filled and graded after settling occurs.

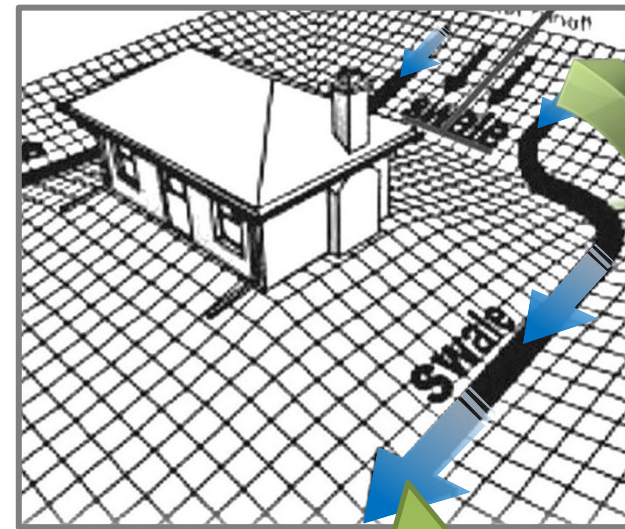


# Item 1.2: Tamp backfill & slope

- Slope exemption for drains or swales that are installed where grade cannot be sloped for  $\geq 10$  ft.



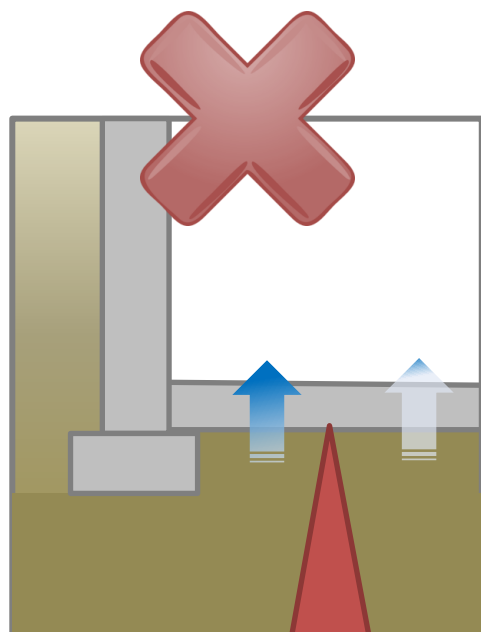
Setback limited  
<10 ft. away



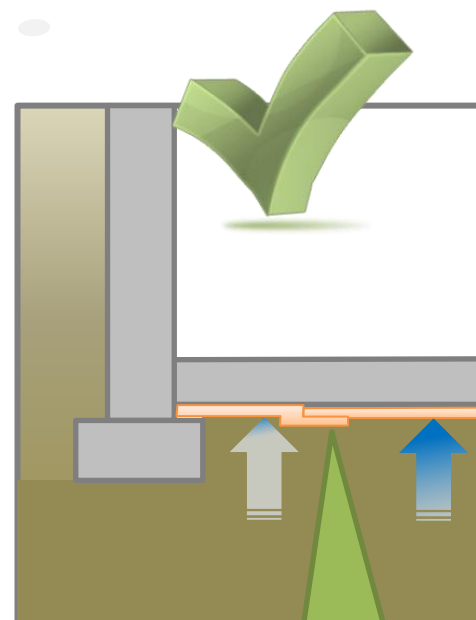
Swales installed

# Item 1.3 & 1.4: Capillary break

- Capillary break provided beneath all slabs to prevent moisture from migrating from the soil through the concrete.



No capillary  
break

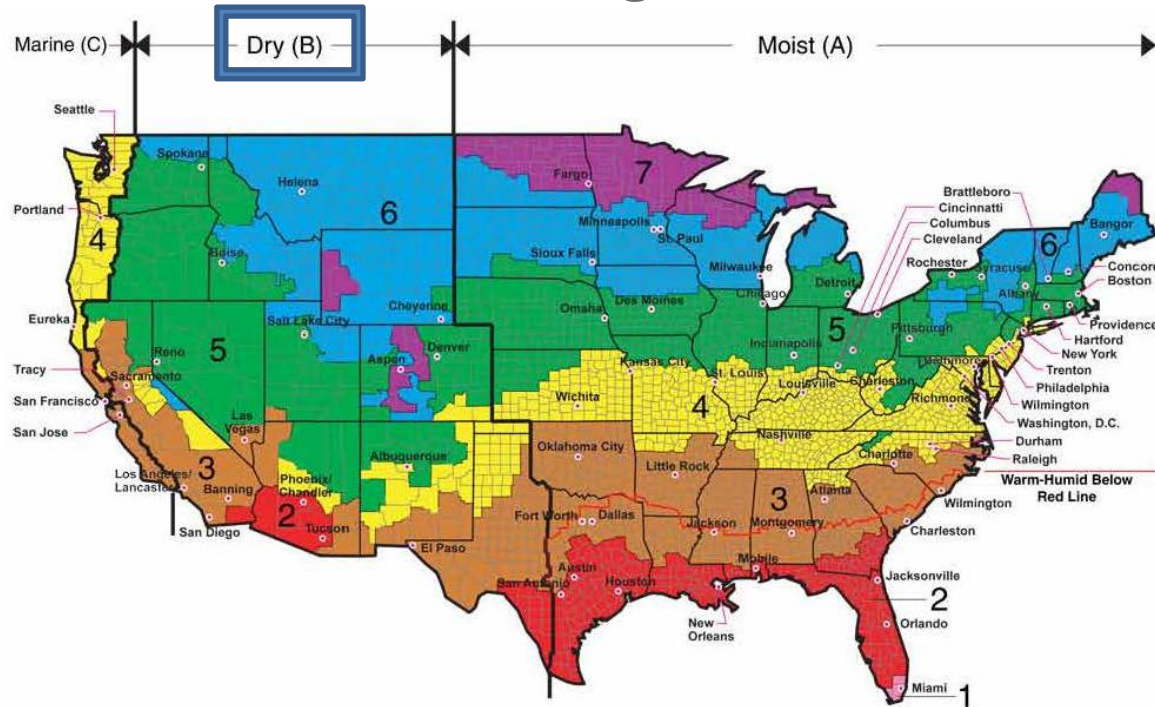


Capillary break  
installed

# Item 1.3 & 1.4: Capillary break

- Exemption for capillary break in 2009 IECC Dry climates.

2009 IECC Figure 301.1

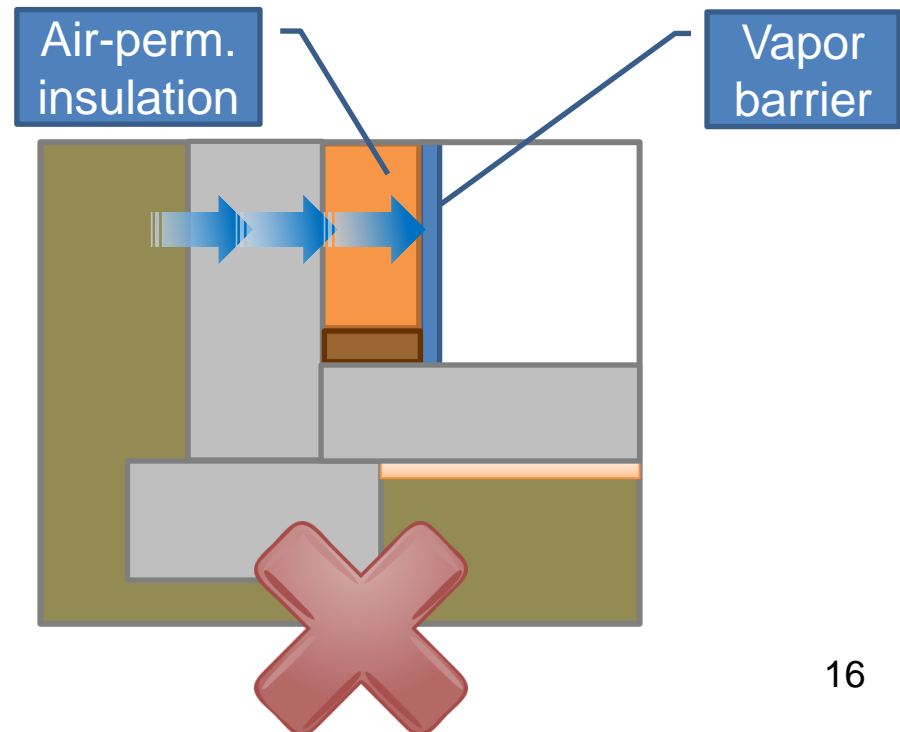


All of Alaska in Zone 7 except for the following Boroughs in Zone 8: Bethel, Dellingham, Fairbanks, N. Star, Nome North Slope, Northwest Arctic, Southeast Fairbanks, Wade Hampton, and Yukon-Koyukuk

Zone 1 includes: Hawaii, Guam, Puerto Rico, and the Virgin Islands

# Item 1.6: Prohibition on Class I vapor retarders

- Class 1 vapor retarders are not to be installed on interior side of air permeable insulation, in exterior below-grade walls.
- A Class 1 vapor retarder is a material or assembly with a rating of  $\leq 0.1$  perm; that is to say, highly resistant to vapor transport.



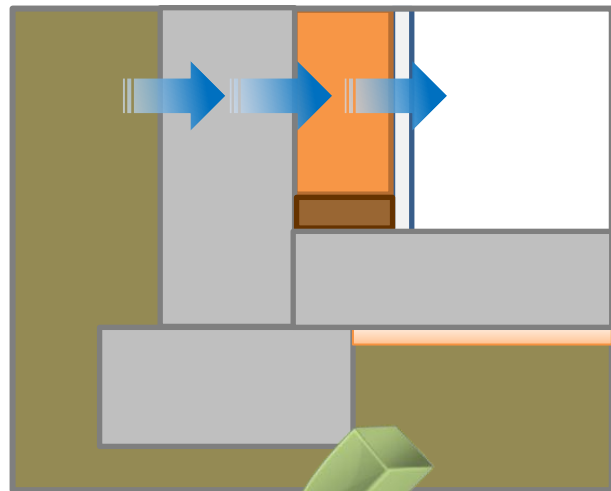


# Item 1.6: Prohibition on Class I vapor retarders

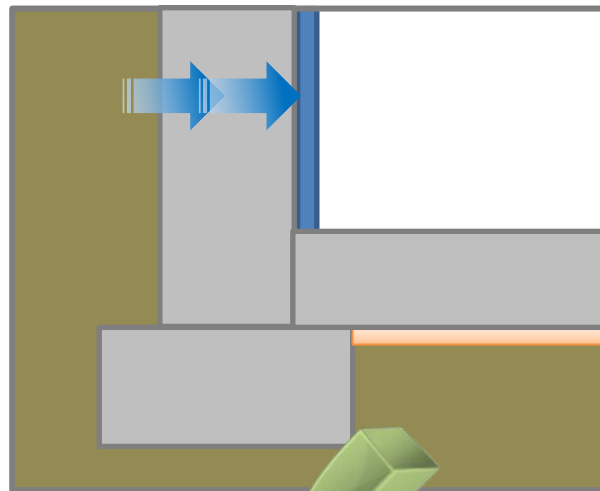


- Class 1 vapor retarders are not to be installed on interior side of air permeable insulation, in exterior below-grade walls.

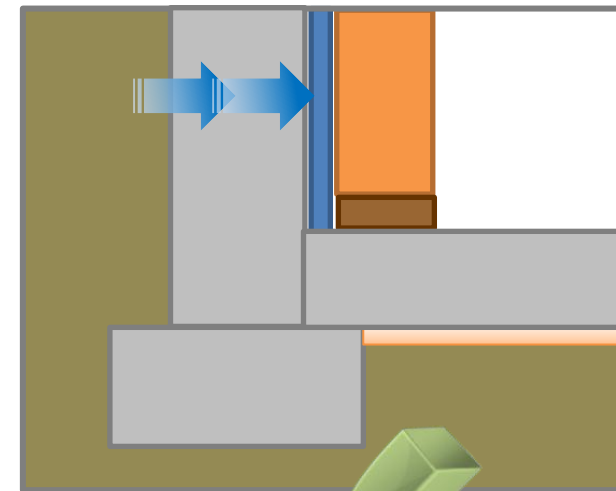
No vapor barrier



Vapor barrier at foundation wall

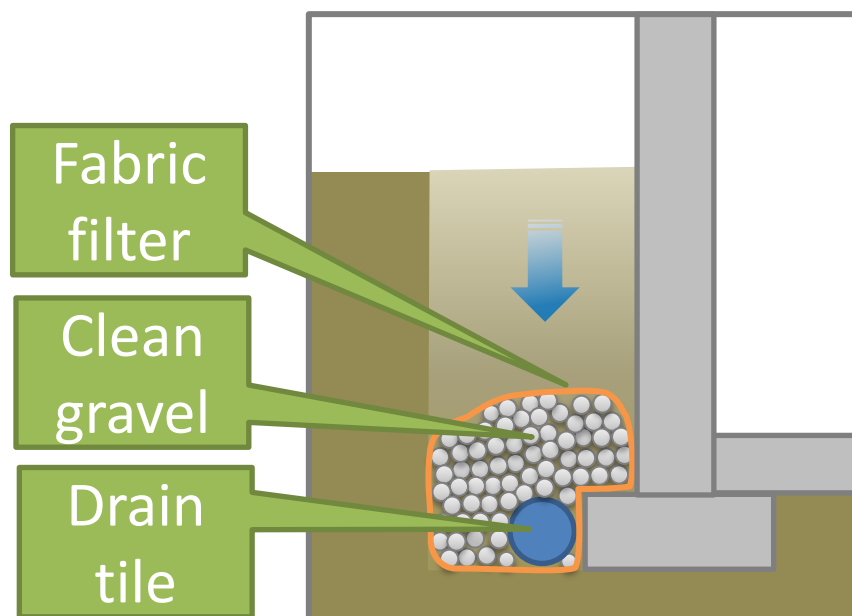


Vapor barrier on exterior side of air-permeable insulation



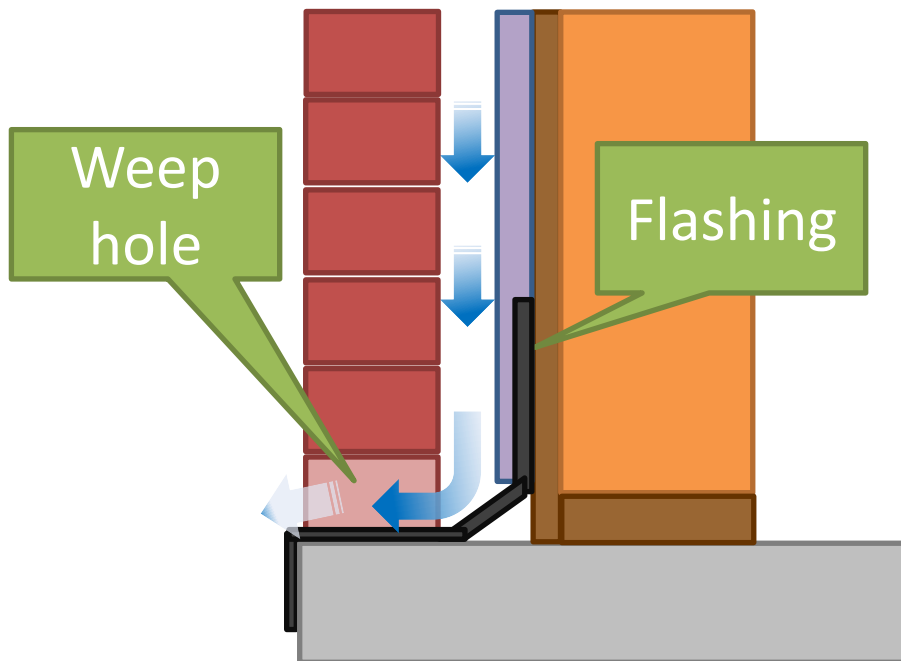
# Item 1.8: Drain tile

- Drain tile surrounded with clean gravel and fabric filter.
- Alternatives include:
  - A drain tile pre-wrapped with a fabric filter.
  - A Composite Foundation Drainage System (CFDS) evaluated for use by ICC-ES per AC 243.



## Item 2.1: Flashing at bottom of walls

- Flashing at bottom of exterior walls.
- Also include weep holes for masonry veneer.
- Also include weep screed for stucco cladding systems.



## Item 2.3:

# Windows & doors fully flashed



- Windows & doors fully flashed:
  1. Apply pan flashing over sill framing, inclusive of corners.
  2. Apply side flashing over pan flashing.
  3. Apply top flashing over side flashing.
- ASTM E2112 provides additional helpful guidance.



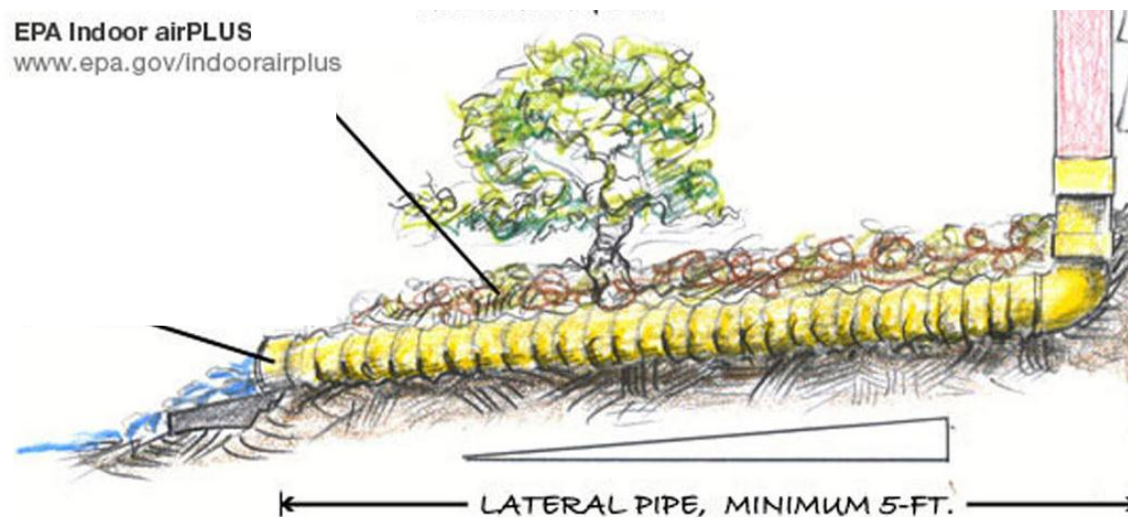
# Item 3.1: Step & kick-out flashing

- Step and kick-out flashing at all roof-wall intersections, extending  $\geq 4$ " on wall surface about roof deck and integrated with drainage plane above.
- Step flashing goes behind the water barrier on wall and under shingles on the roof.



## Item 3.2: Gutters & downspouts

- Gutters & downspouts provided that empty to lateral piping that deposits water on sloping final grade  $\geq 5$ ft. from foundation, or to underground catchment system  $\geq 10$  ft. from foundation.
- Only required for homes that don't have a slab-on-grade foundation and do have expansive or collapsible soils.



# Item 3.2: Gutters & downspouts

EPA Indoor airPLUS  
[www.epa.gov/indoorairplus](http://www.epa.gov/indoorairplus)

AT-GRADE DRAINAGE SYSTEM EXTENDS JUST BELOW SURFACE GRADE

TO AVOID SPLASH ONTO SIDING OR OTHER CLADDING, MAINTAIN A MIN. 16-IN. TO FIRST COURSE OF SIDING

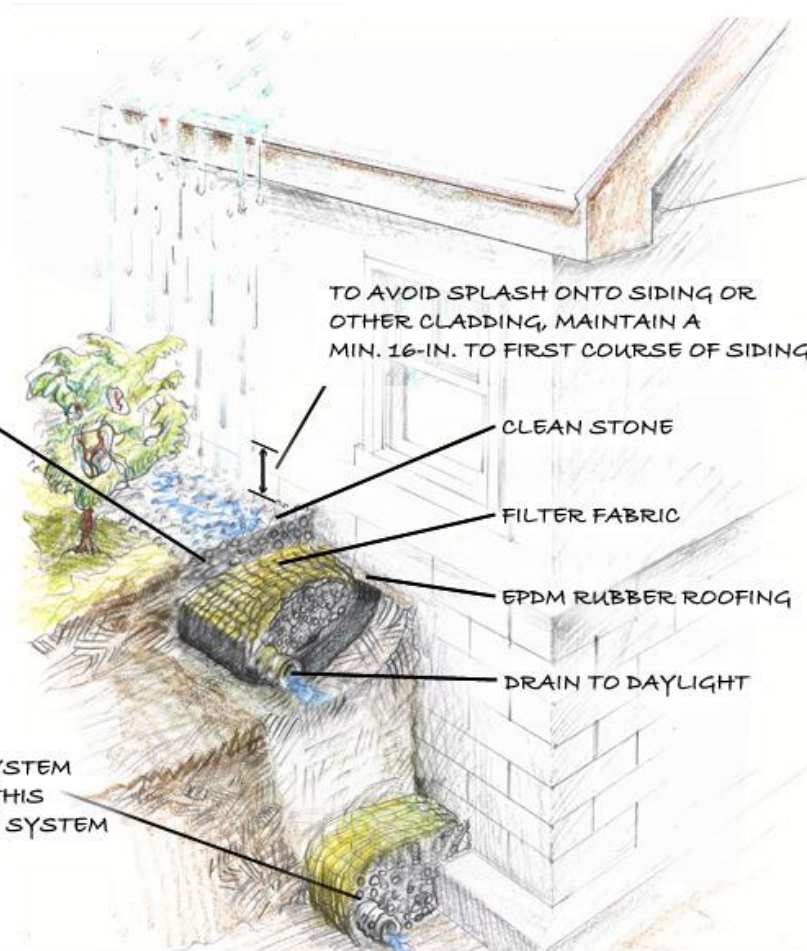
CLEAN STONE

FILTER FABRIC

EPDM RUBBER ROOFING

DRAIN TO DAYLIGHT

THE ROOF DRAINAGE SYSTEM IS NOT CONNECTED TO THIS FOUNDATION DRAINAGE SYSTEM



AT-GRADE ROOF DRAINAGE SYSTEM - ALTERNATIVE TO GUTTERS

## Item 3.3: Self-sealing bituminous membrane



- Self-sealing bituminous membrane or equivalent at all valleys & roof deck penetrations.
- Provides layer of protection at areas prone to failure.
- Alternatively, metal flashing that utilizes a cement backer is permitted.



Bituminous  
membrane  
installed



## Item 4.2:

# Cement board at tub & shower walls



- Cement board or equivalent moisture-resistant backing material installed on all walls behind tub and shower enclosures composed of tile or panel assemblies with caulked joints.
- Paper-faced backer-board shall not be used.

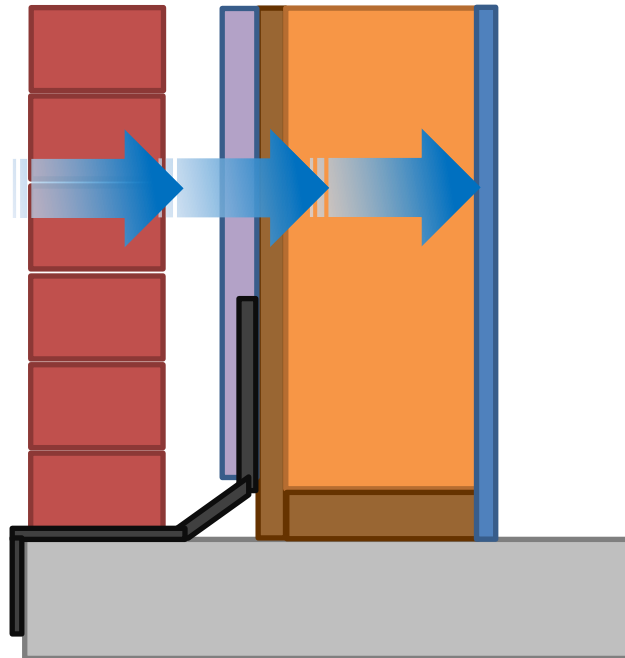


Moisture resistant  
backer board  
installed

## Item 4.3: Prohibition on Class I vapor retarders



- Class 1 vapor retarders are not to be installed on interior side of air permeable insulation, in above-grade walls in Warm-Humid climates.
- An exception is provided for shower & tub walls.



A photograph in the top left corner shows a man in a white t-shirt and blue jeans kneeling on the floor next to a white front-loading washing machine. He is looking at a smartphone in his hands. The washing machine door is open, and some items are visible inside.

# Illustration of How the Checklist Applies to a Typical Home

# Example Home 1


- Slab-on-grade foundation.
- Orlando, FL:
  - Climate Zone 2.
  - Warm-Humid climate.
- Stucco siding.
- No sump pumps.



- A total of 20 Checklist Items, but how many apply?

# Items that don't apply to this home



 **ENERGY STAR**  
Water Management System Builder Checklist

**Water-Managed Site and Foundation**

1.1

1.2

1.3

1.4

1.5

1.6

1.4 Capillary break at all crawlspace floors using  $\geq 6$  mil polyethylene sheeting, lapped 6-12 in., and installed using one of the following three options: <sup>5</sup>

1.4.1 Placed beneath a concrete slab; OR,

1.4.2 Lapped up each wall or pier and fastened with furring strips or equivalent; OR,

1.4.3 Secured in the ground at the perimeter using stakes.

3.3

3.4

**Water-Managed Building Materials**

4.1

4.2


4.3

4.4

4.5

# Items that don't apply to this home



 **ENERGY STAR**  
Water Management System Builder Checklist

**Water-Managed Site and Foundation**

1.1

1.2

1.3

1.5 Exterior surface of below-grade walls finished as follows:

- For poured concrete, concrete masonry, and insulated concrete forms, finish with damp-proofing coating.
- For wood framed walls, finish with polyethylene and adhesive or other equivalent waterproofing.

2.3

**Water-Managed Roof Assembly**

3.1

3.2

3.3

3.4

**Water-Managed Building Materials**

4.1

4.2


4.3

4.4

4.5

# Items that don't apply to this home



 **ENERGY STAR**  
Water Management System Builder Checklist

**Water-Managed Site and Foundation**

1.1

1.2

1.3

~~1.4~~

~~1.5~~

~~1.6~~

1.6 Class 1 vapor retarders not installed on the interior side of air permeable insulation in exterior below-grade walls. <sup>6</sup>

2.2

2.3

**Water-Managed Roof Assembly**

3.1

3.2

3.3

3.4

**Water-Managed Building Materials**

4.1

4.2


4.3

4.4

4.5

# Items that don't apply to this home



 **ENERGY STAR**  
Water Management System Builder Checklist

**Water-Managed Site and Foundation**

1.1

1.2

1.3

~~1.4~~

~~1.5~~

~~1.6~~

~~1.7~~

1.8

1.7 Sump pump covers mechanically attached with full gasket seal or equivalent.

2.3

**Water-Managed Roof Assembly**

3.1

3.2

3.3

3.4

**Water-Managed Building Materials**

4.1

4.2

4.3


4.4

4.5





# Items that don't apply to this home





 **ENERGY STAR**  
Water Management System Builder Checklist


**Water-Managed Site and Foundation**


1.1 


1.2 

1.3 


~~1.4 ~~


~~1.5 ~~


~~1.6 ~~

~~1.7 ~~


1.8 Drain tile installed at the footings of basement and crawlspace walls, with the top of the drain tile pipe below the bottom of the concrete slab or crawlspace floor. Drain tile surrounded with  $\geq 6$  in. of  $\frac{1}{2}$  to  $\frac{3}{4}$  in. washed or clean gravel and with gravel layer fully wrapped with fabric cloth. Drain tile level or sloped to discharge to outside grade (daylight) or to a sump pump.<sup>7</sup>


3.2 


3.3 


3.4 


**Water-Managed Building Materials**

4.1 

4.2 


4.3 

4.4 

4.5 

# Items that don't apply to this home



 **ENERGY STAR**  
Water Management System Builder Checklist

**Water-Managed Site and Foundation**

1.1

1.2

1.3

~~1.4~~

~~1.5~~

3.2 For homes that don't have a slab-on-grade foundation and do have expansive or collapsible soils, gutters & downspouts provided that empty to lateral piping that deposits water on sloping final grade  $\geq 5$  ft. from foundation or to underground catchment system  $\geq 10$  ft. from foundation.<sup>11</sup>

**Water-Managed Roof Assembly**

3.1

~~3.2~~

3.3

3.4

**Water-Managed Building Materials**

4.1

4.2


4.3

4.4

4.5

# Items that don't apply to this home



 **ENERGY STAR**  
Water Management System Builder Checklist

**Water-Managed Site and Foundation**

1.1

1.2

1.3

~~1.4~~

~~1.5~~

~~1.6~~

~~1.7~~

3.4 In 2009 IECC Climate Zones 5 and higher, self-sealing bituminous membrane or equivalent over sheathing at eaves from the edge of the roof line to > 2 ft. up roof deck from the interior plane of the exterior wall. <sup>12</sup>

**Water-Managed Roof Assembly**

3.1

~~3.2~~

3.3

~~3.4~~

**Water-Managed Building Materials**

4.1

4.2


4.3

4.4


4.5


# Items that require no action





 **ENERGY STAR**  
Water Management System Builder Checklist


**Water-Managed Site and Foundation**


1.1 


1.2 


1.3 

~~1.4 ~~


~~1.5 ~~

~~1.6 ~~


~~1.7 ~~


~~1.8 ~~


4.1 Wall-to-wall carpet not installed within 2.5 ft. of toilets, tubs, and showers.


2.3 

**Water-Managed Roof Assembly**



3.1 


~~3.2 ~~


3.3 


~~3.4 ~~


**Water-Managed Building Materials**


4.2 

4.3 


4.4 


4.5 


# Items that require no action



 **ENERGY STAR**  
Water Management System Builder Checklist



**Water-Managed Site and Foundation**



1.1 



1.2 



1.3 


 



 


 



4.3 In Warm-Humid climates, Class 1 vapor retarders not installed on the interior side of air permeable insulation in above-grade walls, except at shower and tub walls. <sup>6</sup>

**Water-Managed Roof Assembly**



3.1 


 



3.3 


 


**Water-Managed Building Materials**

4.2 


 

4.4 


4.5 


# Items that require no action





 **ENERGY STAR**  
Water Management System Builder Checklist


**Water-Managed Site and Foundation**


1.1 


1.2 


1.3 

~~1.4 ~~


~~1.5 ~~

~~1.6 ~~


~~1.7 ~~


~~1.8 ~~


4.4 Building materials with visible signs of water damage or mold not installed. <sup>14</sup>


2.3 

**Water-Managed Roof Assembly**



3.1 


~~3.2 ~~



3.3 



~~3.4 ~~


**Water-Managed Building Materials**

4.2 


 

4.5 

# Items that require no action



 **ENERGY STAR**  
Water Management System Builder Checklist

**Water-Managed Site and Foundation**

1.1

1.2

1.3

~~1.4~~

~~1.5~~

~~1.6~~

~~1.7~~

~~1.8~~

4.5 Interior walls not enclosed (e.g., with drywall) if either the framing members or insulation products have high moisture content. <sup>15</sup>

2.3

**Water-Managed Roof Assembly**

3.1

~~3.2~~

3.3

~~3.4~~

**Water-Managed Building Materials**

4.1

4.2


4.3

4.4

4.5

# Remaining action items



 **ENERGY STAR**  
Water Management System Builder Checklist

**Water-Managed Site and Foundation**

- ✓
- ✓
- ✓
- ✗

4.2 Cement board or equivalent moisture-resistant backing material installed on all walls behind tub and shower enclosures composed of tile or panel assemblies with caulked joints. Paper-faced backerboard shall not be used. <sup>13</sup>

- ✓
- ✓
- ✓

**Water-Managed Roof Assembly**

- ✓
- ✗
- ✓
- ✗

**Water-Managed Building Materials**

- ✓
- 4.2
- ✓
- ✓
- ✓



# Example Home 2




- Boston, MA:
  - Climate Zone 5.
- Unconditioned basement.
- Vinyl siding.
- Has a sump pump.
- Soil is not expansive or collapsible.



- A total of 20 Checklist Items, but how many apply?

# Items that don't apply to this home



 **ENERGY STAR**  
Water Management System Builder Checklist

**Water-Managed Site and Foundation**

1.1

1.2

1.3

~~1.4~~

1.5

1.6

1.4 Capillary break at all crawlspace floors using  $\geq 6$  mil polyethylene sheeting, lapped 6-12 in., and installed using one of the following three options: <sup>5</sup>

1.4.1 Placed beneath a concrete slab; OR,

1.4.2 Lapped up each wall or pier and fastened with furring strips or equivalent; OR,

1.4.3 Secured in the ground at the perimeter using stakes.

3.3

3.4

**Water-Managed Building Materials**

4.1

4.2

4.3

4.4

4.5

# Items that don't apply to this home



## ENERGY STAR Water Management System Builder Checklist

### Water-Managed Site and Foundation

3.2 For homes that don't have a slab-on-grade foundation and do have expansive or collapsible soils, gutters & downspouts provided that empty to lateral piping that deposits water on sloping final grade  $\geq 5$  ft. from foundation or to underground catchment system  $\geq 10$  ft. from foundation.<sup>11</sup>

18

11. The assessment of whether the soil is expansive or collapsible shall be completed by a certified hydrologist, soil scientist, or engineer. Gutters shall be not required in dry climates as shown in 2009 IECC Figure 301.1 and Table 301.1. A roof design without gutters is also acceptable if it deposits rainwater to a grade-level rock bed with a waterproof liner and a drain pipe that deposits water on a sloping finish grade  $\geq 5$  ft. from foundation. Rainwater harvesting systems may also be used to meet this requirement when designed to properly drain overflow, meeting the discharge-distance requirements above.


4.3

4.4

4.5

# Items that don't apply to this home



 **ENERGY STAR**  
Water Management System Builder Checklist

**Water-Managed Site and Foundation**

1.1

1.2

1.3

~~1.4~~

1.5

1.6

1.7

1.8

4.3 In Warm-Humid climates, Class 1 vapor retarders not installed on the interior side of air permeable insulation in above-grade walls, except at shower and tub walls. <sup>6</sup>

**Water-Managed Roof Assembly**

3.1

~~3.2~~

3.3

3.4

**Water-Managed Building Materials**

4.1

4.2


~~4.3~~

4.4

4.5

# Items that require no action



 **ENERGY STAR**  
Water Management System Builder Checklist

**Water-Managed Site and Foundation**

1.1

1.2

1.3

~~1.4~~

1.5

~~1.6~~

1.6 Class 1 vapor retarders not installed on the interior side of air permeable insulation in exterior below-grade walls. <sup>6</sup>

2.2

2.3

**Water-Managed Roof Assembly**

3.1

~~3.2~~

3.3

3.4

**Water-Managed Building Materials**

4.1

4.2


~~4.3~~

4.4

4.5

# Items that require no action



 **ENERGY STAR**  
Water Management System Builder Checklist

**Water-Managed Site and Foundation**

1.1

1.2

1.3

~~1.4~~

1.5

~~1.6~~

1.7

1.8

4.1 Wall-to-wall carpet not installed within 2.5 ft. of toilets, tubs, and showers.

2.3

**Water-Managed Roof Assembly**

3.1

~~3.2~~

3.3

3.4

**Water-Managed Building Materials**

~~4.1~~

4.2


~~4.3~~

4.4

4.5

# Items that require no action



 **ENERGY STAR**  
Water Management System Builder Checklist

**Water-Managed Site and Foundation**

1.1

1.2

1.3

~~1.4~~

1.5

~~1.6~~

1.7

1.8

4.4 Building materials with visible signs of water damage or mold not installed. <sup>14</sup>

2.3

**Water-Managed Roof Assembly**

3.1

~~3.2~~

3.3

3.4

**Water-Managed Building Materials**

~~4.1~~

4.2


~~4.3~~

~~4.4~~

4.5

# Items that require no action



 **ENERGY STAR**  
Water Management System Builder Checklist

**Water-Managed Site and Foundation**

1.1

1.2

1.3

1.4

1.5

1.6

1.7

1.8

4.5 Interior walls not enclosed (e.g., with drywall) if either the framing members or insulation products have high moisture content. <sup>15</sup>

2.3

**Water-Managed Roof Assembly**

3.1

3.2

3.3

3.4

**Water-Managed Building Materials**

4.1

4.2


4.3

4.4



# Remaining action items



 **ENERGY STAR**  
Water Management System Builder Checklist

**Water-Managed Site and Foundation**

- ✓
- ✓
- ✓
- ✗
- ✓

4.2 Cement board or equivalent moisture-resistant backing material installed on all walls behind tub and shower enclosures composed of tile or panel assemblies with caulked joints. Paper-faced backerboard shall not be used. <sup>13</sup>

- ✓
- ✓

**Water-Managed Roof Assembly**

- ✓
- ✗
- ✓
- ✓

**Water-Managed Building Materials**

- ✗
- ✓
- ✗
- ✗
- ✗

# Just bureaucratic paperwork?



# The value of checklists

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- A simple medical inspection checklist was developed to reduce infections from intravenous lines.
- The checklist included five steps; straightforward advice, no new science, nothing controversial.
- The checklist was used by intensive care units in MI over 18 months.
- It nearly eliminated intravenous line infections.
- It saved ~1,500 lives.
- It saved the hospitals ~\$175 million in treatment costs.

# Summary

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- The Water Management System Builder Checklist can reduce the risk of water damage and provide a more durable home.
- Making mistakes can be costly.
- Overview of the checklist items.
- Not all homes need to meet all of the items.



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# Q&A

# Discussion



## ENERGY STAR Certified Homes

Main: [www.energystar.gov/newhomespartners](http://www.energystar.gov/newhomespartners)

Technical: [www.energystar.gov/newhomesguidelines](http://www.energystar.gov/newhomesguidelines)

Training: [www.energystar.gov/newhomestraining](http://www.energystar.gov/newhomestraining)

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