

Attachments to Additional Proposed Changes

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ADD NEW DEFINITION:

Sleeping Unit: A room or space in which people sleep, which can also include 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.

RELEVANT CHANGES:

ACCESSORY STRUCTURE. A structure, the use of which is customarily accessory to and incidental to that of the residential building; the structure is located on the same lot or site as the residential building; the structure does not contain a dwelling unit or a sleeping unit; and (1) is classified as Group U – Utility and Miscellaneous in accordance with the ICC International Building Code, or (2) is classified as accessory in accordance with the ICC International Residential Code, or (3) is classified as accessory to the residential use by a determination of the Adopting Entity.

COMMON AREA(S).

1. Areas within a site or lot that are predominantly open spaces and consist of non-residential structures, landscaping, recreational facilities, roadways and walkways, which are owned and maintained by an incorporated or chartered entity such as a homeowner's association or governmental jurisdiction; or
2. Areas of a multifamily building that are outside the boundaries of a dwelling unit or sleeping unit and are shared among or serve the dwelling units or sleeping units; including, but not limited to, hallways, amenity and resident services areas, parking areas, property management offices, mechanical rooms, and laundry rooms.

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.

ENERGY MONITORING DEVICE. A device installed within a building or dwelling unit or sleeping unit that can provide near real-time data on whole building, ~~or~~ dwelling unit or sleeping unit energy consumption.

MANUFACTURED HOME CONSTRUCTION. Three-dimensional sections of the complete building, ~~or~~ dwelling unit, or sleeping unit built in a factory in conformance with the HUD Manufactured Home Construction and Safety Standards ([24 CFR, Part 3280](#)) and transported to the jobsite to be joined together on a foundation.

MULTIFAMILY BUILDING. A building containing multiple dwelling units or sleeping units and classified as R-2 under the ICC IBC.

PROGRAMMABLE COMMUNICATING THERMOSTAT. A whole building or whole dwelling unit/sleeping unit thermostat that can be monitored and controlled remotely.

REMODELING. The process of restoring or improving an existing building, dwelling unit, sleeping unit, or property.

304 GREEN MULTIFAMILY BUILDINGS

304.1 Multifamily buildings. All residential portions of a building shall meet the requirements of this Standard. Partial compliance shall not be allowed. Unless specifically addressed in other portions of this standard, all units and residential common areas within a multifamily building shall meet all mandatory requirements. Where features similar to dwelling unit/sleeping unit features are installed in the common area, those features shall meet the standard of the ~~dwelling units~~. Green building practices for residential common areas may differ from requirements for dwelling units/sleeping units. Points for the green building practices that apply to multiple units shall be credited once for the entire building. Where points are credited, including where a weighted average is used, practices shall be implemented in all units, as applicable. Where application of a prescribed practice allows for a different number of points for different units in a multifamily building, the fewer number of points shall be awarded, unless noted that a weighted average is used.

305.3 Whole-building rating criteria

305.3.1 Applicability. The provisions of Section 305.3 shall apply to remodeling of existing buildings. In addition to the foundation, at least 50 percent of the structural systems of the existing building shall remain in place after the remodel for the building to be eligible for compliance under Section 305.3.

305.3.1.1 Additions. For a remodeled building that includes an addition, the entire building including the addition shall comply with the criteria of Section 305.3. The total above-grade conditioned area added during a remodel

shall not exceed 75% of the existing building's above-grade conditioned area. For multifamily buildings, the above-grade conditioned area shall be based on the entire building including all dwelling units/sleeping units and common areas.

305.3.5.1 Energy consumption reduction. The reduction in energy consumption resulting from the remodel shall be based on the estimated annual energy cost savings or source energy savings as determined by a third-party energy audit and analysis or utility consumption data. The reduction shall be the percentage difference between the consumption per square foot before and after the remodel calculated as follows:

$$\frac{[(\text{consumption per square foot before remodel} - \text{consumption per square foot after remodel})/\text{consumption per square foot before remodel}]*100}{}$$

The occupancy and lifestyle assumed and the method of making the energy consumption estimates shall be the same for estimates before and after the remodel. The building configuration for the after-remodel estimate shall include any additions to the building or other changes to the configuration of the conditioned space. For multifamily buildings, the energy consumption shall be based on the entire building including all dwelling units/sleeping units and common areas.

305.3.6.1 Water consumption reduction. Water consumption shall be based on the estimated annual use as determined by audit and analysis or use of utility consumption data. The reduction shall be the percentage difference between the consumption before and after the remodel calculated as follows:

$$[(\text{consumption before remodel} - \text{consumption after remodel})/\text{consumption before remodel}]*100\%$$

The occupancy and lifestyle assumed and the method of making the water consumption estimates shall be the same for estimates before and after the remodel. The building configuration for the after-remodel estimate shall include any changes to the configuration of the building such as additions or new points of water use. For multifamily buildings, the water consumption shall be based on the entire building including all dwelling units/sleeping units and common areas.

400.0 Intent. This section applies to land development for the eventual construction of buildings or additions thereto that contain dwelling units/sleeping units. The rating earned under Section 302 based on practices herein, applies only to the site as defined in Chapter 2. The buildings on the site achieve a separate rating level or designation by complying with the provisions of Section 303, 304, 305, or 306, as applicable.

405.7 Density. The average density on a net developable area basis is:

(1) 7 to less than 14 dwelling units/ <u>sleeping units</u> per acre (per 4,047 m2)	5
(2) 14 to less than 21 dwelling units/ <u>sleeping units</u> per acre (per 4,047 m2)	7
(3) 21 or greater dwelling units/ <u>sleeping units</u> per acre (per 4,047 m2)	10

500.0 Intent. This section applies to lot development for the eventual construction of residential buildings, multifamily buildings, or additions thereto that contain dwelling units or sleeping units.

505.3 Density. The average density on the lot on a net developable area basis is:

(1) 7 to less than 14 dwelling units/ <u>sleeping units</u> per acre (per 4,047 m2)	4
(2) 14 to less than 21 dwelling units/ <u>sleeping units</u> per acre (per 4,047 m2)	5
(3) 21 to less than 35 dwelling units/ <u>sleeping units</u> per acre (per 4,047 m2)	6
(4) 35 to less than 70 dwelling units/ <u>sleeping units</u> per acre (per 4,047 m2)	7
(5) 70 or greater dwelling units/ <u>sleeping units</u> per acre (per 4,047 m2)	8

601.1 Conditioned floor area. Finished floor area of a dwelling unit or sleeping unit is limited. Finished floor area is calculated in accordance with ANSI Z765 for single family and ANSI/BOMA Z65.4 for multifamily buildings. Only the finished floor area for stories above grade plane is included in the calculation.

611.2 Sustainable products. One or more of the following products are used for at least 30% of the floor or wall area of the entire dwelling unit or the sleeping unit, as applicable. Products are certified by a third-party agency accredited to ISO 17065.

701.4.3.1 Building Thermal Envelope Air Sealing. The building thermal envelope is durably sealed to limit infiltration. The sealing methods between dissimilar materials allow for differential expansion and contraction. The following are caulked, gasketed, weather-stripped or otherwise sealed with an air barrier material, suitable film, or solid material: Mandatory
(a) All joints, seams and penetrations.

- (b) Site-built windows, doors, and skylights.
- (c) Openings between window and door assemblies and their respective jambs and framing.
- (d) Utility penetrations.
- (e) Dropped ceilings or chases adjacent to the thermal envelope.
- (f) Knee walls.
- (g) Walls and ceilings separating a garage from conditioned spaces.
- (h) Behind tubs and showers on exterior walls.
- (i) Common walls between dwelling units or sleeping units.
- (j) Attic access openings.
- (k) Rim joist junction.
- (l) Other sources of infiltration.

701.4.3.2 Air sealing and insulation. Grade II and III insulation installation is not permitted. Building envelope air tightness and insulation installation is verified to be in accordance with Section 701.4.3.2(1) and 701.4.3.2(2). Testing. Building envelope tightness is tested. Testing is conducted in accordance with ASTM E-779 using a blower door at a test pressure of 1.04 psf (50 Pa). Testing is conducted after rough-in and after installation of penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation, and combustion appliances. Testing is conducted under the following conditions:

- (a) Exterior windows and doors, fireplace and stove doors are closed, but not sealed;
- (b) Dampers are closed, but not sealed, including exhaust, intake, make-up air, backdraft and flue dampers;
- (c) Interior doors are open;
- (d) Exterior openings for continuous ventilation systems and heat recovery ventilators are closed and sealed;
- (e) Heating and cooling systems are turned off;
- (f) HVAC duct terminations are not sealed; and
- (g) Supply and return registers are not sealed.

Multifamily Building Note: Testing by dwelling units, sleeping units, groups of dwelling units, groups of sleeping units, or the building as a whole is acceptable.

Visual inspection. The air barrier and insulation items listed in Table 701.4.3.2(2) are field verified by visual inspection.

701.4.4 High-efficacy lighting. Lighting efficacy in dwelling units or sleeping units is in accordance with one of the following:

703.3.1 Combination space heating and water heating system (combo system) is installed using either a coil from the water heater connected to an air handler to provide heat for the building or dwelling unit, or a space heating boiler using an indirect-fired water heater. Devices have a minimum combined annual efficiency of 0.80 and a minimum water heating recovery efficiency of 0.87.

703.3.7 ENERGY STAR, or equivalent, ceiling fans are installed.

(Points awarded per building.)

(For Tropical Climate Zone and Climate Zones 2B, 3B, and 4B: points awarded per fan where AC is not installed in the dwelling unit or sleeping unit (Max 8 points), and where points awarded in Section 703.3.8 for these specific climate zones, points shall not be awarded in Section 703.3.7)

703.3.8 Whole-building or whole-dwelling unit or whole-sleeping unit fan(s) with insulated louvers and a sealed enclosure is installed.

(Points awarded per building.)

**Table 703.3.8
Whole dwelling unit fan**

Climate Zone		
1-3, Tropical	4-6	7-8
POINTS		
4	3	0

703.7.1 Sun-tempered design.

Multifamily Building Note: The site is designed such that at least 40 percent of the multifamily dwelling units have one south facing wall (within 15 degrees) containing at least 50 percent of glazing for entire unit, Effective shading is required

for passive solar control on all south facing glazing. The floor area of at least 15 feet from the south facing perimeter glazing is massive and exposed to capture solar heat during the day and reradiate at night.

705.2.1.1 Interior lighting. In dwelling units or sleeping units, permanently installed interior lighting fixtures are controlled with an occupancy sensor, or dimmer:

50 percent to less than 75 percent of lighting fixtures.

A minimum of 75 percent of lighting fixtures.

705.6.1 Third-party on-site inspection is conducted to verify compliance with all of the following, as applicable. Minimum of two inspections are performed: one inspection after insulation is installed and prior to covering, and another inspection upon completion of the building. Where multiple buildings or dwelling units of the same model or sleeping units of the same model are built by the same builder, a representative sample inspection of a minimum of 15 percent of the buildings or dwelling units or sleeping units is permitted.

705.6.2.1 Air leakage validation of building or dwelling units or sleeping units. A visual inspection is performed as described in 701.4.3.2(2) and air leakage testing is performed in accordance with ASTM E779 or ASTM E1827.

705.6.3 Insulating hot water pipes. Insulation with a minimum thermal resistance (R-value) of at least R-3 is applied to the following, as applicable:

(Points awarded only where these practices are not required by IECC.)

- (a) piping 3/4-inch and larger in outside diameter
- (b) piping serving more than one dwelling unit or sleeping unit
- (c) piping located outside the conditioned space
- (d) piping from the water heater to a distribution manifold
- (e) piping located under a floor slab
- (f) buried piping
- (g) supply and return piping in recirculation systems other than demand recirculation systems

706.1 Energy consumption control. A whole-building or whole-dwelling unit or whole-sleeping unit device or system is installed that controls or monitors energy consumption.

programmable communicating thermostat with the capability to be controlled remotely

energy-monitoring device or system

energy management control system

programmable thermostat with control capability based on occupant presence or usage pattern

lighting control system

706.5 On-site renewable energy system. An on-site renewable energy system(s) is installed on the property.

(Points shall not be awarded in this section for solar thermal or geothermal systems that provide space heating, space cooling, or water heating, Points for these systems are awarded in Section 703.)

(Where onsite renewable energy is included in Section 702 Performance Path or 704 HERS Index Target Path, Section 706.5 shall not be awarded.)

2 points per kW Divided by number of dwelling units or sleeping units

Multifamily Building Note: Conditioned common area and non-residential space is excluded for the purpose of calculating number of units.

801.3 Showerheads. Showerheads are in accordance with the following:

The total maximum combined flow rate of all showerheads controlled by a single valve at any point in time in a shower compartment is 1.6 to less than 2.5 gpm. Maximum of two valves are installed per shower compartment. The flow rate is tested at 80 psi (552 kPa) in accordance with ASME A112.18.1. Showerheads are served by an automatic compensating valve that complies with ASSE 1016 or ASME A112.18.1 and specifically designed to provide thermal shock and scald protection at the flow rate of the showerhead.

(Points awarded per shower compartment. In multifamily buildings, the average of the points assigned to individual dwelling units or sleeping units may be used as the number of points awarded for this practice, rounded to the nearest whole number.)

All shower compartments in the dwelling unit(s) or sleeping unit(s) and common areas meet the requirements of 801.3(1) and all showerheads are in accordance with one of the following:

- (a) 2.0 to less than 2.5 gpm
- (b) 1.6 to less than 2.0 gpm
- (c) Less than 1.6 gpm

Any shower control that can shut off water flow without affecting temperature is installed.

(Points awarded per shower control.)

801.4.1 Water-efficient lavatory faucets with a maximum flow rate of 1.5 gpm (5.68 L/m), tested at 60 psi (414 kPa) in accordance with ASME A112.18.1, are installed:

a bathroom (all faucets in a bathroom are in compliance)

(Points awarded for each bathroom. In multifamily buildings, the average of the points assigned to individual dwelling units or sleeping units may be used as the number of points awarded for this practice, rounded to the nearest whole number.)

all lavatory faucets in the dwelling unit(s) or sleeping unit(s)

801.5 Water closets and urinals. Water closets and urinals are in accordance with the following:

(Points awarded for 801.5(2) or 801.5(3), not both.)

Gold and emerald levels: All water closets and urinals are in accordance with Section 801.5.

A water closet is installed with an effective flush volume of 1.28 gallons (4.85 L) or less and meets the flush performance criteria when tested in accordance with ASME A112.19.2/CSA B45.1 or ASME A112.19.14 as applicable.

(Points awarded per fixture. In multifamily buildings, the average of the points assigned to individual dwelling units or sleeping units may be used as the number of points awarded for this practice, rounded to the nearest whole number.)

All water closets are in accordance with Section 801.5(2).

All water closets are in accordance with Section 801.5(2) and one or more of the following are installed:

- (a) Water closets that have a flush volume of 1.2 gallons or less.

(Points awarded per toilet. In multifamily buildings, the average of the points assigned to individual dwelling units or sleeping units may be used as the number of points awarded for this practice, rounded to the nearest whole number.)

- (b) One or more urinals with a flush volume of 0.5 gallons (1.9L) or less when tested in accordance with ASME A112.19.2.

- (c) One or more composting or waterless toilets and/or urinals.

801.8 Sediment filters. Water filter is installed to reduce sediment and protect plumbing fixtures for the whole building or the entire dwelling unit or the sleeping unit.

901.1.4 Gas-fired fireplaces and direct heating equipment is listed and is installed in accordance with the NFPA 54, ICC IFGC, or the applicable local gas appliance installation code. Gas-fired fireplaces within dwelling units or sleeping units and direct heating equipment are vented to the outdoors.

11.505.3 Density. The average density on the lot on a net developable area basis is:

7 to less than 14 dwelling units/sleeping units per acre (per 4,047 m²)

14 to less than 21 dwelling units/sleeping units per acre (per 4,047 m²)

21 to less than 35 dwelling units/sleeping units per acre (per 4,047 m²)

35 to less than 70 dwelling units/sleeping units per acre (per 4,047 m²)

70 or greater dwelling units/sleeping units per acre (per 4,047 m²)

11.601.1 Conditioned floor area. Finished floor area of a dwelling unit or sleeping unit after the remodeling is limited. Finished floor area is calculated in accordance with ANSI Z765 for single family and ANSI/BOMA Z65.4 for multifamily buildings. Only the finished floor area for stories above grade plane is included in the calculation.

Less than or equal to 700 square feet (65 m²)

less than or equal to 1,000 square feet (93 m²)

less than or equal to 1,500 square feet (139 m²)

less than or equal to 2,000 square feet (186 m²)

less than or equal to 2,500 square feet (232 m²)

greater than 4,000 square feet (372 m²)

(For every 100 square feet (9.29 m²) over 4,000 square feet (372 m²), one point is to be added the threshold points shown in Table 305.3.7 for each rating level.)

Multifamily Building Note: For a multifamily building, a weighted average of the individual unit sizes is used for this practice.

11.611.2 Sustainable products. One or more of the following products are used for at least 30% of the floor or wall area of the entire dwelling unit or sleeping unit, as applicable. Products are certified by a third-party agency accredited to ISO 17065.

50% or more of carpet installed (by square feet) is certified to NSF 140.

50% or more of resilient flooring installed (by square feet) is certified to NSF 332.

50% or more of the insulation installed (by square feet) is certified to EcoLogo CCD-016.

50% or more of interior wall coverings installed (by square feet) is certified to NSF 342

50% or more of the gypsum board installed (by square feet) is certified to UL 100.

50% or more of the door leaves installed (by number of door leaves) is certified to UL 102.

50% or more of the tile installed (by square feet) is certified to TCNA A138.1 Specifications for Sustainable Ceramic Tiles, Glass Tiles and Tile Installation Materials.

11.701.4.3.1 Building thermal envelope air sealing. The building thermal envelope exposed or created during the remodel is durably sealed to limit infiltration. The sealing methods between dissimilar materials allow for

differential expansion and contraction. The following are caulked, gasketed, weather-stripped or otherwise sealed with an air barrier material, suitable film or solid material:

- (a) All joints, seams and penetrations.
- (b) Site-built windows, doors and skylights.
- (c) Openings between window and door assemblies and their respective jambs and framing.
- (d) Utility penetrations.
- (e) Dropped ceilings or chases adjacent to the thermal envelope.
- (f) Knee walls.
- (g) Walls and ceilings separating a garage from conditioned spaces.
- (h) Behind tubs and showers on exterior walls.
- (i) Common walls between dwelling units or sleeping units.
- (j) Attic access openings.
- (k) Rim joist junction.
- (l) Other sources of infiltration.

11.701.4.3.2 Air sealing and insulation. Grade II and III insulation installation is not permitted. Building envelope air tightness and insulation installation is verified to be in accordance with Section 11.701.4.3.2(1) and 11.701.4.3.2(2).

Testing. Building envelope tightness is tested. Testing is conducted in accordance with ASTM E-779 using a blower door at a test pressure of 1.04 psf (50 Pa). Testing is conducted after rough-in and after installation of penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation and combustion appliances. Testing is conducted under the following conditions:

- Exterior windows and doors, fireplace and stove doors are closed, but not sealed;
- Dampers are closed, but not sealed, including exhaust, intake, make-up air, backdraft, and flue dampers;
- Interior doors are open;
- Exterior openings for continuous ventilation systems and heat recovery ventilators are closed and sealed;
- Heating and cooling system(s) is turned off;
- HVAC ducts terminations are not sealed; and
- Supply and return registers are not sealed.

Multifamily Building Note: Testing by dwelling units, sleeping units, groups of dwelling units, groups of sleeping units, or the building as a whole is acceptable.

Visual inspection. The air barrier and insulation items listed in Table 11.701.4.3.2(2) are field verified by visual inspection.

11.701.4.4 High-efficacy lighting. Lighting efficacy in dwelling units or sleeping units is in accordance with one of the following:

- A minimum of 75 percent of the total hard-wired lighting fixtures or the bulbs in those fixtures qualify as high efficacy or equivalent
- Lighting power density, measured in watts/square foot, is 1.1 or less.

11.901.1.4 Newly installed gas-fired fireplaces and direct heating equipment is listed and is installed in accordance with the NFPA 54, ICC IFGC, or the applicable local gas appliance installation code. Gas-fired fireplaces within dwelling units or sleeping units and direct heating equipment are vented to the outdoors.

12.1.701.4.3.1 Building thermal envelope air sealing. The portions of the building thermal envelope that are exposed or created during the remodel are durably sealed to limit infiltration. The sealing methods between dissimilar materials allow for differential expansion and contraction. The following are caulked, gasketed, weather-stripped, or otherwise sealed with an air barrier material, suitable film, or solid material:

All joints, seams, and penetrations.

Site-built windows, doors, and skylights.

Openings between window and door assemblies and their respective jambs and framing.

Utility penetrations.

Dropped ceilings or chases adjacent to the thermal envelope.

Knee walls.

Walls and ceilings separating a garage from conditioned spaces.

Behind tubs and showers on exterior walls.

Common walls between dwelling units or sleeping units.

Attic access openings.

Rim joist junction.

Other sources of infiltration.

12.1.701.4.4 High-efficacy lighting. Lighting efficacy in dwelling units or sleeping units is in accordance with one of the following:

A minimum of 75 percent of the total hard-wired lighting fixtures or the bulbs in those fixtures qualify as high efficacy or equivalent

Lighting power density, measured in watts/square foot, is 1.1 or less.

12.1.901.1.4 Gas-fired equipment. Newly installed gas-fired fireplaces and direct heating equipment is listed and is installed in accordance with NFPA 54, ICC IFGC, or the applicable local gas appliance installation code. Gas-fired fireplaces within dwelling units or sleeping units and direct heating equipment are vented to the outdoors.

APPENDIX B

WHOLE BUILDING VENTILATION SYSTEM SPECIFICATIONS

New definition

Production homes and townhouses: A production home or townhouse built by a single-builder within one community and involving a limited number of home plans and options.

New Section in Chapter 3

307.0 Criteria for Homes Following the Production Construction Process

307.1 Applicability. The provisions of Section 307 shall apply to the new construction of *production homes and townhouses*. The total above-grade conditioned area of the home shall not exceed 4000 square feet.

307.2 Compliant. Projects that meet all applicable requirements of Chapter 13[?] shall be designated as compliant.

305. 3 Designation. The designation achieved under Section 307.2 is Certified.

305.4 Mandatory. Projects shall satisfy all applicable practices in Chapter 13.

CHAPTER 13

[LOT DEVELOPMENT]

Project team, mission statement, and goals. A knowledgeable team is established and team member roles are identified with respect to green lot design, preparation, and development. The project's green goals and objectives are written into a mission statement. The mission statement is provided to site management personnel, site supervisory personnel, site labor and subcontractor and suppliers.

Landscape plan. When a landscape plan is developed for the lot, non-invasive vegetation that is native or regionally appropriate for local growing conditions is selected to promote biodiversity.

On-site supervision and coordination. On-site supervision and coordination is provided during on-the-lot clearing, grading, trenching, paving, and installation of utilities to ensure that specified green development practices are implemented.

Stormwater Pollution Prevention Plan. A Stormwater Pollution Prevention Plan (SWPPP) is developed for the lot that includes the following measures:

- a. Install silt fencing or equivalent on the lot to control the path and velocity of runoff.
- b. Use tiers, erosion blankets, compost blankets, filter socks, berms, or equivalent to stabilize soils in any area with a slope of 25% or more that is disturbed during construction.
- c. Where the builder has operational control, protect storm sewer inlets, streams, and lakes.

RESOURCE EFFICIENCY

Prefabricated components. At least one precut or preassembled components, or panelized or precast assemblies are utilized:

- (1) floor system
- (2) wall system
- (3) roof system

Capillary Break. A capillary break and vapor retarder are installed at concrete slabs in accordance with ICC IRC Sections R506.2.2 and R506.2.3 or ICC IBC Sections 1907 and 1805.4.1.

Foundation drainage. Where required by the ICC IRC or IBC for habitable and usable spaces below grade, exterior drain tile is installed.

Walls. Dampproof walls are provided below finished grade.

Sealed crawlspace. 6-mil polyethylene sheeting, or other Class I vapor retarder installed in accordance with Section 408.3 or Section 506 of the International Residential Code.

Dry Insulation. Insulation in cavities is dry in accordance with manufacturer's instructions when enclosed (e.g., with drywall).

Water-resistive barrier. Where required by the ICC, IRC, or IBC, a water-resistive barrier and/or drainage plane system is installed behind exterior veneer and/or siding.

Flashing. Flashing is provided as follows to minimize water entry into wall and roof assemblies and to direct water to exterior surfaces or exterior water-resistive barriers for drainage. Flashing details are provided in the construction documents and are in accordance with the fenestration manufacturer's instructions, the flashing manufacturer's instructions, or as detailed by a registered design professional.

Flashing is installed at the following locations, as applicable:

- (1) around exterior fenestrations, skylights, and doors
- (2) at roof valleys
- (3) at all building-to-deck, -balcony, -porch, and -stair intersections
- (4) at roof-to-wall intersections, at roof-to-chimney intersections, at wall-to-chimney intersections, and at parapets
- (5) at ends of and under masonry, wood, or metal copings and sills
- (6) above projecting wood trim
- (7) at built-in roof gutters, and
- (8) drip edge is installed at eave and rake edges.

Tile backing materials. Tile backing materials installed under tiled surfaces in wet areas are in accordance with ASTM C1178, C1278, C1288, or C1325.

Ice barrier. In areas where there has been a history of ice forming along the eaves causing a backup of water, an ice barrier is installed in accordance with the ICC IRC or IBC at roof eaves of pitched roofs and extends a minimum of 24 inches (610 mm) inside the exterior wall line of the building.

Architectural features. All horizontal ledgers are sloped away to provide gravity drainage as appropriate for the application.

Lot Slope. Finished grade at all sides of a building is sloped to provide a minimum of 6 inches (150 mm) of fall within 10 feet (3048 mm) of the edge of the building. Where lot lines, walls, slopes, or other physical barriers prohibit 6 inches (152 mm) of fall within 10 feet (3048 mm), the final grade is sloped away from the edge of the building at a minimum slope of 2 percent.

Moisture control measures. Moisture control measures for newly installed materials are in accordance with the following:

- (1) Building materials with visible mold are not installed or are cleaned or encapsulated prior to concealment and closing.
- (2) Insulation in cavities is dry in accordance with manufacturer's installation instructions when enclosed (e.g., with drywall).

Product or material selection. At least two component are selected complying with the practices (1) – (7) below are implemented.

- (1) **Prefinished materials.** At least one of the prefinished building materials or assemblies listed below have no additional site-applied finishing material installed.
 - a. interior trim not requiring paint or stain
 - b. exterior trim not requiring paint or stain
 - c. window, skylight, and door assemblies not requiring paint or stain on one of the following surfaces:
 - i. exterior surfaces
 - ii. interior surfaces
 - d. interior wall coverings or systems, floor systems, and/or ceiling systems not requiring paint or stain or other type of finishing application
 - e. exterior wall coverings or systems, floor systems, and/or ceiling systems not requiring paint or stain or other type of finishing application

- (2) **Recycled content.** Building materials with at least 25% recycled content are used for two components of the building.
- (3) **Biobased products.** Two or more of the following biobased products are used.
 - a. certified solid wood in accordance with Section 12.1(A).606.2
 - b. engineered wood
 - c. bamboo
 - d. cotton
 - e. cork
 - f. straw
 - g. natural fiber products made from crops (soy-based, corn-based)
 - h. other biobased materials with a minimum of 50 percent biobased content (by weight or volume)
- (4) **Wood-based products.** Wood or wood-based products installed during the remodel are certified to the requirements of one of the following recognized product programs:
 - a. American Forest Foundation’s American Tree Farm System® (ATFS)
 - b. Canadian Standards Association’s Sustainable Forest Management System Standards (CSA Z809)
 - c. Forest Stewardship Council (FSC)
 - d. Program for Endorsement of Forest Certification Systems (PEFC)
 - e. Sustainable Forestry Initiative® Program (SFI)
 - f. National Wood Flooring Association’s Responsible Procurement Program (RPP)
 - g. other product programs mutually recognized by PEFC
- (5) **Resource-efficient materials.** At least one product containing fewer materials are used to achieve the same end-use requirements as conventional products, including but not limited to:
 - a. lighter, thinner brick with bed depth less than 3 inches and/or brick with coring of more than 25 percent
 - b. engineered wood or engineered steel products
 - c. roof or floor trusses
- (6) **Regional Materials.** One or more regional materials are used for major and/or minor components of the building. (To comply at least 75% of the component must be sourced regionally).
- (7) **Product LCA.** A product with improved environmental impact measures compared to another product(s) intended for the same use is selected. At least two of the environmental impact measures selected from below and used in the assessment improved upon the environmental impact measures by an average of 15 percent:
 - a. Primary energy use
 - b. Global warming potential
 - c. Acidification potential
 - d. Eutrophication potential
 - e. Ozone depletion potential
 - f. Smog potential

ENERGY EFFICIENCY

13.701.0 Mandatory requirements. The building shall comply with Section 13.701 AND 13.702.2 (Performance Path), Section 13.703.1 (Prescriptive Path), or Section 13.704.1 (HERS Index Target Path).

13.701.1 Adopting entity review. A review by the Adopting Entity or designated third party shall be conducted to verify design and compliance with Chapter 7.

13.701.2 HVAC system sizing. Space heating and cooling system is sized according to heating and cooling loads calculated using ACCA Manual J, or equivalent. Equipment is selected using ACCA Manual S or equivalent.

13.701.3 Radiant and hydronic space heating. Where installed as a primary heat source in the building, radiant or hydronic space heating system is designed, installed, and documented, using industry-approved guidelines and standards (e.g., ACCA Manual J, AHRI I=B=R, ACCA 5 QI-2010, or an accredited design professional's and manufacturer's recommendations).

13.701.4 Duct air sealing. Ducts are air sealed. All duct sealing materials are in conformance with UL 181A or UL 181B specifications and are installed in accordance with manufacturer's instructions.

13.701.5 Building Thermal Envelope Air Sealing. The building thermal envelope is durably sealed to limit infiltration. The sealing methods between dissimilar materials allow for differential expansion and contraction. The following are caulked, gasketed, weather-stripped or otherwise sealed with an air barrier material, suitable film, or solid material:

- a) All joints, seams and penetrations.
- b) Site-built windows, doors, and skylights.
- c) Openings between window and door assemblies and their respective jambs and framing.
- d) Utility penetrations.
- e) Dropped ceilings or chases adjacent to the thermal envelope.
- f) Knee walls.
- g) Walls and ceilings separating a garage from conditioned spaces.
- h) Behind tubs and showers on exterior walls.
- i) Common walls between dwelling units.
- j) Attic access openings.
- k) Rim joist junction.
- l) Other sources of infiltration.

13.701.6 Air sealing and insulation. Grade II and III insulation installation is not permitted. Building envelope air tightness and insulation installation is verified to be in accordance with Section A and B.

A. Testing. Building envelope tightness is tested and verified as having an air leakage rate not exceeding five air changes per hour and Climate Zone 1 or 2 and three air changes per hour in Climate Zones 3 through 8 [update to 2018 IECC language]. Testing is conducted in accordance with ASTM E-779 using a blower door at a test pressure of 1.04 psf (50 Pa). Testing is conducted after rough-in and after installation of penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation, and combustion appliances. Testing is conducted under the following conditions:

- a) Exterior windows and doors, fireplace and stove doors are closed, but not sealed;
- b) Dampers are closed, but not sealed, including exhaust, intake, make-up air, backdraft and flue dampers;
- c) Interior doors are open;
- d) Exterior openings for continuous ventilation systems and heat recovery ventilators are closed and sealed;
- e) Heating and cooling systems are turned off;
- f) HVAC duct terminations are not sealed; and
- g) Supply and return registers are not sealed.

B. Visual inspection. The air barrier and insulation items listed in Table 13.701.4.3.2(2) are field verified by visual inspection.

13.701.7 Grade I insulation installations are in accordance with the following:

- (1) Grading applies to field-installed insulation products.

- (2) Grading applies to ceilings, walls, floors, band joists, rim joists, conditioned attics basements and crawlspaces, except as specifically noted.
- (3) Inspection is conducted before insulation is covered.
- (4) Air-permeable insulation is enclosed on all six sides and is in substantial contact with the sheathing material on one or more sides (interior or exterior) of the cavity. Air permeable insulation in ceilings is not required to be enclosed when the insulation is installed in substantial contact with the surfaces it is intended to insulate.
- (5) Cavity insulation uniformly fills each cavity side-to-side and top-to-bottom, without substantial gaps or voids around obstructions (such as blocking or bridging).
- (6) Cavity insulation compression or incomplete fill amounts to 2 percent or less, presuming the compressed or incomplete areas are a minimum of 70 percent of the intended fill thickness; occasional small gaps are acceptable.
- (7) Exterior rigid insulation has substantial contact with the structural framing members or sheathing materials and is tightly fitted at joints.
- (8) Cavity insulation is split, installed, and/or fitted tightly around wiring and other services.
- (9) Exterior sheathing is not visible from the interior through gaps in the cavity insulation.
- (10) Faced batt insulation is permitted to have side-stapled tabs, provided the tabs are stapled neatly with no buckling, and provided the batt is compressed only at the edges of each cavity, to the depth of the tab itself.
- (11) Where properly installed, ICFs, SIPs, and other wall systems that provide integral insulation are deemed in compliance with the Grade 1 insulation installation requirements.

INCLUDE Table Air Barrier and Insulation Installation

13.701.8 Fenestration air leakage. Windows, skylights and sliding glass doors have an air infiltration rate of no more than 0.3 cfm per square foot (1.5 L/s/m²), and swinging doors no more than 0.5 cfm per square foot (2.6 L/s/m²), when tested in accordance with NFRC 400 or AAMA/WDMA/CSA 101/I.S.2/A440 by an accredited, independent laboratory and listed and labeled. This practice does not apply to site-built windows, skylights, and doors.

13.701.9 Recessed lighting. Recessed luminaires installed in the building thermal envelope are sealed to limit air leakage between conditioned and unconditioned spaces. All recessed luminaires are IC-rated and labeled as meeting ASTM E283 when tested at 1.57 psf (75 Pa) pressure differential with no more than 2.0 cfm (0.944 L/s) of air movement from the conditioned space to the ceiling cavity. All recessed luminaires are sealed with a gasket or caulk between the housing and the interior of the wall or ceiling covering.

13.701.10 High-efficacy lighting. A minimum of 75 percent of the total hard-wired lighting fixtures or the bulbs in those fixtures qualify as high efficacy or equivalent

13.701.11 Boiler supply piping. Boiler supply piping in unconditioned space is insulated.

13.702.0 Energy performance pathway.

13.702.1 ICC IECC analysis. Energy efficiency features are implemented to achieve energy cost or source energy performance that meets the ICC IECC. A documented analysis using software in accordance with ICC IECC, Section R405, is required.

13.702.2 Energy performance analysis. Energy savings levels above the ICC IECC are determined through an analysis that includes improvements in building envelope, air infiltration, heating system efficiencies, cooling system efficiencies, duct sealing, water heating system efficiencies, lighting, and appliances.

13.703.0 Energy prescriptive pathway

13.703.1 UA Compliance. The building thermal envelope is in compliance with Section 13.703.2 or 13.703.3. Exception: 13.703.2 is not required for Tropical Climate Zone.

13.703.2 Maximum UA. The total building UA is less than or equal to the total maximum UA as computed by IECC Section R402.1.5. The total UA proposed and baseline calculations are documented. REScheck is deemed to provide UA calculation documentation.

13.703.3 R-values and fenestration requirements. The building thermal envelope is in accordance with the insulation and fenestration requirements of IECC Table R402.1.1. The SHGC is in accordance with the IECC requirements.

13.703.4 Building Envelope Leakage. The building thermal envelope is in accordance with IECC R402.4.1.2. Exception: Not required for Tropical Climate Zone.

13.704.0 HERS Index target pathway

13.704.1 HERS index target compliance. Energy efficiency features are implemented to achieve a HERS Index performance that is less than or equal to the EPA HERS Index Target Procedure for Energy Star Qualified Homes as computed based on Steps “1a” through “1d” of the EPA HERS Index Target Procedure.

13.705.0 Application of additional practices. The building shall comply with two practices from below.

- (1) **Interior lighting.** A minimum of 50% of permanently installed interior lighting fixtures are controlled with an occupancy sensor, or dimmer.
- (2) **Exterior lighting.** Photo or motion sensors are installed on 75 percent of outdoor lighting fixtures to control lighting.
- (3) **TDDs and skylights.** A tubular daylighting device (TDD) or a skylight is installed in rooms without windows.
- (4) **Recessed luminaires.** The number of recessed luminaires that penetrates the thermal envelope is less than 1 per 400 square feet (37.16 m²) of total conditioned floor area and they are in accordance with Section **13.701.9**
- (5) **Induction cooktop.** Induction cooktop is installed.
- (6) **Return ducts and transfer grilles.** Return ducts or transfer grilles are installed in every room with a door. Return ducts or transfer grilles are not required for bathrooms, kitchens, closets, pantries, and laundry rooms.
- (7) **HVAC contractor is certified by the Air Conditioning Contractors of Americas Quality Assured Program (ACCA/QA) or by an EPA-recognized HVAC Quality Installation Training and Oversight Organization (H-QUITO) or equivalent.**
- (8) **HVAC installation technician(s) is certified by North American Technician Excellence, Inc. (NATE) or equivalent.**
- (9) **Performance of the heating and/or cooling system is verified by the HVAC contractor in accordance with all of the following:**
 - (a) **Start-up procedure is performed in accordance with the manufacturer’s instructions.**
 - (b) **Refrigerant charge is verified by super-heat and/or sub-cooling method.**
 - (c) **Burner is set to fire at input level listed on nameplate.**
 - (d) **Air handler setting/fan speed is set in accordance with manufacturer’s instructions.**
 - (e) **Total airflow is within 10 percent of design flow.**
 - (f) **Total external system static does not exceed equipment capability at rated airflow.**

- (10) Third-party on-site inspection is conducted to verify compliance with all of the following, as applicable. Minimum of two inspections are performed: one inspection after insulation is installed and prior to covering, and another inspection upon completion of the building. Where multiple buildings or dwelling units of the same model are built by the same builder, a representative sample inspection of a minimum of 15 percent of the buildings or dwelling units is permitted.
 - (a) Ducts are installed in accordance with the ICC IRC or IMC and ducts are sealed.
 - (b) Building envelope air sealing is installed.
 - (c) Insulation is installed in accordance with Section 13.701.6.
 - (d) Windows, skylights, and doors are flashed, caulked, and sealed in accordance with manufacturer's instructions and in accordance with Section 13.701.5
- (11) **HVAC airflow testing.** Balanced HVAC airflows are demonstrated by flow hood or other acceptable flow measurement tool by a third party. Test results are in accordance with both of the following:
 - (a) Measured flow at each supply and return register meets or exceeds the requirements in ACCA 5 QI-2010, Section 5.2.
 - (b) Total airflow meets or exceeds the requirements in ACCA 5 QI-2010, Section 5.2.
- (12) Potable hot water demand re-circulation system is installed.
- (13) **Energy consumption control.** A whole-building device or system is installed that controls or monitors energy consumption for at least one of the items below.
 - (a) programmable communicating thermostat with the capability to be controlled remotely
 - (b) energy-monitoring device or system
 - (c) energy management control system
 - (d) programmable thermostat with control capability based on occupant presence or usage pattern
 - (e) lighting control system
- (14) **On-site renewable energy system.** An on-site renewable energy system(s) is installed on the property.
- (15) **Grid-interactive electric thermal storage system.** A grid-interactive electric thermal storage system is installed.
 - (a) Grid-Interactive Water Heating System, or
 - (b) Grid-Interactive Space Heating and cooling System
- (16) **Electrical vehicle charging station.** A Level 2 or Level 3 electric vehicle charging station is installed on the building site. (Note: Charging station shall not be included in the building energy consumption.)
- (17) **Automatic demand response.** Automatic demand response system is installed that curtails energy usage upon a signal from the utility or an energy service provider is installed

WATER EFFICIENCY

13.801 Water-conserving appliances. If the following appliances are installed, they are ENERGY STAR or equivalent.

- (1) dishwasher
- (2) washing machine

13.802 Showerheads. [NOTE: align with work of the Water Efficiency WG] The average total combined flow rate of all showerheads in a shower compartment is 1.6 to less than 2.5 gpm. Maximum of two valves are installed per shower compartment. The flow rate is tested at 80 psi (552 kPa) in accordance with ASME

A112.18.1. Showerheads are served by an automatic compensating valve that complies with ASSE 1016 or ASME A112.18.1 and specifically designed to provide thermal shock and scald protection at the flow rate of the showerhead.

13.803 Water-efficient lavatory faucets with a maximum flow rate of 1.5 gpm (5.68 L/m), tested at 60 psi (414 kPa) in accordance with ASME A112.18.1, are installed in bathroom(s). (All faucets in a bathroom comply.)

13.805 Water closets are installed with an effective flush volume of 1.28 gallons (4.85 L) or less and meets the flush performance criteria when tested in accordance with ASME A112.19.2/CSA B45.1 or ASME A112.19.14 as applicable.

806 Irrigation systems. Where an irrigation system is installed, one the following is met:

- (1) Sprinkler nozzles have a maximum precipitation rate of 1.20 inches per hour for turf or landscaping. Nozzle performance is tested by an accredited third party laboratory and results are posted on Smart Water Application Technologies website or similar.
- (2) Drip irrigation is installed for all landscape beds and/or subsurface drip irrigation is installed for all turf grass areas.
- (3) Drip irrigation zones specifications show plant type by name and water use/need for each emitter (Points awarded only if specifications are implemented.)
- (4) An irrigation plan and implementation are executed by a qualified professional certified by a WaterSense labeled program or equivalent program as approved by Adopting Entity.
- (5) The irrigation system(s) is controlled by a smart controller or no irrigation is installed.
- (6) Evapotranspiration (ET) based irrigation controller with a rain sensor or soil moisture sensor based irrigation controller.
- (7) Irrigation controllers are labeled by EPA WaterSense program.

INDOOR ENVIRONMENTAL QUALITY

Garages. Garages are in accordance with one of the following:

- (1) Attached garage
 - (a) Doors installed in the common wall between the attached garage and conditioned space are tightly sealed and gasketed AND;
 - (b) A continuous air barrier is provided separating the garage space from the conditioned living spaces.
- (2) A carport is installed, the garage is detached from the building, or no garage is installed.

Carpets. Wall-to-wall carpeting is not installed adjacent to water closets and bathing fixtures.

Structural plywood used for floor, wall, and/or roof sheathing is compliant with DOC PS 1 and/or DOC PS 2. OSB used for floor, wall, and/or roof sheathing is compliant with DOC PS 2. The panels are made with moisture-resistant adhesives. The trademark indicates these adhesives as follows: Exposure 1 or Exterior for plywood, and Exposure 1 for OSB.

Carbon monoxide (CO) alarms. A carbon monoxide (CO) alarm is provided in accordance with the IRC Section R315.

Product or material selection. At least two items from (1) – (9) below are installed.

- (1) **Wood materials.** A minimum of 85 percent of material within a product group (i.e., wood structural panels, countertops, composite trim/doors, custom woodwork, and/or component closet shelving) is manufactured in accordance with the following:

- a. Particleboard and MDF (medium density fiberboard) is manufactured and labeled in accordance with CPA A208.1 and CPA A208.2, respectively
 - b. Hardwood plywood in accordance with HPVA HP-1.
 - c. Particleboard, MDF, or hardwood plywood is in accordance with CPA 4.
 - d. Composite wood or agrifiber panel products contain no added urea-formaldehyde or are in accordance with the CARB Composite Wood Air Toxic Contaminant Measure Standard.
 - e. Non-emitting products
- (2) **Cabinets.** A minimum of 85 percent of installed cabinets are in accordance with one or both of the following:
- (1) All parts of the cabinet are made of solid wood or non-formaldehyde emitting materials such as metal or glass.
 - (2) The composite wood used in wood cabinets is in accordance with CARB Composite Wood Air Toxic Contaminant Measure Standard or equivalent as certified by a third-party program such as, but not limited to, those in Appendix D.
- (3) **Floor materials.** The following types of finished flooring materials are used for a minimum of 10% of conditioned floor space. The materials have emission levels in accordance with CDPH/EHLB Standard Method v1.1. Product is tested by a laboratory with the CDPH/EHLB Standard Method v1.1 within the laboratory scope of accreditation to ISO/IEC 113.7025 and certified by a third-party program accredited to ISO 113.7065, such as, but not limited to, those in Appendix D.
- (a) Hard surface flooring: Prefinished installed hard-surface flooring is installed. Where post-manufacture coatings or surface applications have not been applied, the following hard surface flooring types are deemed to comply with the emission requirements of this practice:
 - 1. Ceramic tile flooring
 - 2. Organic-free, mineral-based flooring
 - 3. Clay masonry flooring
 - 4. Concrete masonry flooring
 - 5. Concrete flooring
 - 6. Metal flooring
 - (b) Carpet and carpet cushion is installed.
- (4) **Wall coverings.** A minimum of 10 percent of the interior wall surfaces are covered and a minimum of 85 percent of wall coverings are in accordance with the emission concentration limits of CDPH/EHLB Standard Method v1.1. Emission levels are determined by a laboratory accredited to ISO/IEC 113.7025 and the CDPH/EHLB Standard Method v1.1 is in its scope. The product is certified by a third-party program accredited to ISO 113.7065, such as, but not limited to, those in Appendix D.
- (5) **Interior architectural coatings.** A minimum of 85 percent of the interior architectural coatings are in accordance with either Section 13.901.9.1 or Section 13.901.9.3, not both. A minimum of 85 percent of architectural colorants are in accordance with Section 13.901.9.2. (Exception: Interior architectural coatings that are formulated to remove formaldehyde and other aldehydes in indoor air and are tested and labeled in accordance with ISO 16000-23, Indoor air -- Part 23: Performance test for evaluating the reduction of formaldehyde concentrations by absorptive building materials.)

- (6) Site-applied interior architectural coatings, which are inside the water proofing envelope, are in accordance with one or more of the following:
 - i. Zero VOC as determined by EPA Method 24 (VOC content is below the detection limit for the method)
 - ii. GreenSeal GS-11
 - iii. CARB Suggested Control Measure for Architectural Coatings (see Table **VOC Content Limits For Architectural Coatings**).
- (7) Architectural coating colorant additive VOC content is in accordance with Table 13.901.9.2.
- (8) Site-applied interior architectural coatings, which are inside the waterproofing envelope, are in accordance with the emission levels of CDPH/EHLB Standard Method v1.1. Emission levels are determined by a laboratory accredited to ISO/IEC 113.7025 and the CDPH/EHLB Standard Method v1.1 in its scope of accreditation. The product is certified by a third-party program accredited to ISO 113.7065, such as, but not limited to, those found in Appendix D.
- (9) **Insulation.** Emissions of 85 percent of wall, ceiling, and floor insulation materials are in accordance with the emission levels of CDPH/EHLB Standard Method v1.1. Emission levels are determined by a laboratory accredited to ISO/IEC 113.7025 and the CDPH/EHLB Standard Method v1.1 in its scope of accreditation. Insulation is certified by a third-party program accredited to ISO 113.7065, such as, but not limited to, those in Appendix D.

Spot ventilation is in accordance with the following:

- (1) Bathrooms are vented to the outdoors. The minimum ventilation rate is 50 cfm (23.6 L/s) for intermittent operation or 20 cfm (9.4 L/s) for continuous operation in bathrooms.
- (2) If installed, clothes dryers (except listed and labeled condensing ductless dryers) are vented to the outdoors.
- (3) Kitchen exhaust units and/or range hoods are ducted to the outdoors and have a minimum ventilation rate of 100 cfm (47.2 L/s) for intermittent operation or 25 cfm (11.8 L/s) for continuous operation. **[Mandatory if a whole-building ventilation system is not installed.]**

Whole Building Ventilation. Where the maximum air infiltration rate is less than 5.0 ACH50, one of the following whole building ventilation systems is implemented and is in accordance with the specifications of Appendix B and an explanation of the operation and importance of the ventilation system is included in [the homeowner's manual practice].

- (1) exhaust or supply fan(s) ready for continuous operation and with appropriately labeled controls
- (2) balanced exhaust and supply fans with supply intakes located in accordance with the manufacturer's guidelines so as to not introduce polluted air back into the building
- (3) heat-recovery ventilator
- (4) energy-recovery ventilator

Radon control. Radon control measures are installed in accordance with ICC IRC Appendix F for Zone 1 as defined in Figure 9(1).

- (a) a passive radon system is installed, or
- (b) an active radon system is installed

Living space contaminants. The living space is sealed in accordance with Section 13.701. to prevent unwanted contaminants.

Kitchen exhaust. If a kitchen exhaust unit(s) that equals or exceeds 400 cfm (189 L/s) is installed, make-up air is provided.

Application of additional practices. The building shall comply with one practice from (1) – (12) below.

- (1) **Building entrance pollutants control.** Pollutants are controlled at all main building entrances by one of the following methods:
 - a. Exterior grilles or mats are installed in a fixed manner and may be removable for cleaning.
 - b. Interior grilles or mats are installed in a fixed manner and may be removable for cleaning.
- (2) **Bathroom and/or laundry exhaust fans** are provided with an automatic timer and/or humidistat. Kitchen range, bathroom, and laundry exhaust are verified to air flow specification. Ventilation airflow at the point of exhaust is tested to a minimum of 100 cfm (47.2 L/s) intermittent or 25 cfm (11.8 L/s) continuous for kitchens, and 50 cfm (23.6 L/s) intermittent or 20 cfm (9.4 L/s) continuous for bathrooms and/or laundry.
- (3) **Exhaust fans** are ENERGY STAR or equivalent, as applicable.
- (4) **Fenestration** in spaces other than those identified in [bathrooms, kitchens, laundry rooms] are designed for stack effect or cross-ventilation in accordance with the following:
 - a. Operable windows, operable skylights, or sliding glass doors with a total area of at least 15 percent of the conditioned floor area are provided.
 - b. Insect screens are provided for all operable windows, operable skylights, and sliding glass doors.
 - c. A minimum of two operable windows or sliding glass doors are placed in adjacent or opposite walls. If there is only one wall surface in that space exposed to the exterior, the minimum windows or sliding glass doors may be on the same wall.
- (5) **Ventilation airflow** is tested to achieve the design fan airflow at point of exhaust in accordance with Section 902.2.1.
- (6) **MERV filters 8 to 13** are installed on central forced air systems and are accessible. Designer or installer is to verify that the HVAC equipment is able to accommodate the greater pressure drop of MERV 8 to 13 filters.
- (7) **Radon control.** Radon control measures are in accordance with ICC IRC Appendix F. Zones as defined in Figure 9(1).
 - a. For buildings located in Zone 1, an active radon system is installed
 - b. For buildings located in Zone 2 or Zone 3, a passive or active radon system is installed
- (8) **HVAC system protection.** One of the following HVAC system protection measures is performed.
 - (1) HVAC supply registers (boots), return grilles, and rough-ins are covered during construction activities to prevent dust and other pollutants from entering the system.
 - (2) Prior to owner occupancy, HVAC supply registers (boots), return grilles, and duct terminations are inspected and vacuumed. In addition, the coils are inspected and cleaned and the filter is replaced if necessary.
- (9) **Cold water pipes** in unconditioned spaces are insulated to a minimum of R-4 with pipe insulation or other covering that adequately prevents condensation.
- (10) **Plumbing is not installed in unconditioned spaces.**
- (11) **Duct insulation.** Ducts are in accordance with one of the following.
 - (1) All HVAC ducts, plenums, and trunks are located in conditioned space.
 - (2) All HVAC ducts, plenums, and trunks are in conditioned space. All HVAC ducts are insulated to a minimum of R4.

(12) **Relative humidity.** In climate zones 1A, 2A, 3A, 4A, and 5A as defined by Figure 6(1), equipment is installed to maintain relative humidity (RH) at or below 60 percent using one of the following: (Credit not awarded in other climate zones.)

- a) additional dehumidification system(s)
- b) central HVAC system equipped with additional controls to operate in dehumidification mode
- (12) **Indoor Air Quality (IAQ) during construction.** Wood is dry before close-in (602.1.7.1(3)), materials comply with emission criteria (901.4- 901.11), sources of water infiltration or condensation observed during construction have been eliminated, accessible interior surfaces are dry and free of visible suspect growth (per ASTM D7338-10 section 6.3), and water damage (per ASTM D7338-10 section 7.4.3).
- (13) **Indoor Air Quality (IAQ) Post Completion.** Verify there are no moisture, mold, and dust issues per 602.1.7.1(3), 901.4-901.11, ASTM D7338 Section 6.3, and ASTM D7338 Section 7.4.3.
- (14) **Humidity monitoring system.** A humidity monitoring system is installed with a mobile base unit that displays readings of temperature and relative humidity. The system has a minimum of two remote sensor units. One remote sensor unit is placed permanently inside the conditioned space in a central location, excluding attachment to exterior walls, and another remote sensor unit is placed permanently outside of the conditioned space.

HOMEOWNER OPERATION AND MAINTAINANCE

Homeowner's manual. A homeowner's manual is provided and stored in a permanent location in the dwelling that includes at least 4 of the non-mandatory items below:

- (1) A National Green Building Standard certificate with a web link and completion document.
MANDATORY
- (2) List of green building features (can include the national green building standard checklist).
MANDATORY
- (3) Product manufacturer's manuals or product data sheet for installed major equipment, fixtures, and appliances. If product data sheet is in the building owners' manual, manufacturer's manual may be attached to the appliance in lieu of inclusion in the building owners' manual. **MANDATORY**
- (4) Maintenance checklist.
- (5) Information on local recycling and composting programs.
- (6) Information on available local utility programs that purchase a portion of energy from renewable energy providers.
- (7) Explanation of the benefits of using energy-efficient lighting systems [e.g., compact fluorescent light bulbs, light emitting diode (LED)] in high-usage areas.
- (8) A list of practices to conserve water and energy.
- (9) Information on the importance and operation of the home's fresh air ventilation system.
- (10) Local public transportation options.
- (11) A diagram showing the location of safety valves and controls for major building systems.
- (12) Where frost-protected shallow foundations are used, owner is informed of precautions including:
 - (a) instructions to not remove or damage insulation when modifying landscaping.
 - (b) providing heat to the building as required by the ICC IRC or IBC.
 - (c) keeping base materials beneath and around the building free from moisture caused by broken water pipes or other water sources.
- (13) A list of local service providers that offer regularly scheduled service and maintenance contracts to ensure proper performance of equipment and the structure (e.g., HVAC, water-heating equipment, sealants, caulks, gutter and downspout system, shower and/or tub surrounds, irrigation system).
- (14) A photo record of framing with utilities installed. Photos are taken prior to installing insulation, clearly labeled, and included as part of the building owners' manual.
- (15) List of common hazardous materials often used around the building and instructions for proper handling and disposal of these materials.
- (16) Information on organic pest control, fertilizers, deicers, and cleaning products.
- (17) Information on native landscape materials and/or those that have low water requirements.

- (18) Information on methods of maintaining the building's relative humidity in the range of 30 percent to 60 percent.
- (19) Instructions for inspecting the building for termite infestation.
- (20) Instructions for maintaining gutters and downspouts and importance of diverting water a minimum of 5 feet away from foundation.
- (21) A narrative detailing the importance of maintenance and operation in retaining the attributes of a green-built building.
- (22) Where stormwater management measures are installed on the lot, information on the location, purpose, and upkeep of these measures.
- (23) Explanation of and benefits from green cleaning in the home.
- (24) Retrofit energy calculator that provides baseline for future energy retrofits.

Training of initial homeowners. Initial homeowners are familiarized with the role of occupants in achieving green goals. Training is provided to the responsible party(ies) regarding equipment operation and maintenance, control systems, and occupant actions that will improve the environmental performance of the building. These include:

- (1) HVAC filters.
- (2) Thermostat operation and programming.
- (3) Lighting controls.
- (4) Appliances operation.
- (5) Water heater settings and hot water use.
- (6) Fan controls.
- (7) Recycling and composting practices.
- (8) Whole-house ventilation systems.

NON-RESIDENTIAL NEW CONSTRUCTION

101.2 Scope. This chapter shall apply to the non-residential portions of buildings. Occupancy classifications shall be determined in accordance with the *International Building Code*.

101.2.1 Exempt buildings and systems. This chapter shall not apply to temporary structures approved under Section 108 or Section 3103 of the *International Building Code*.

101.3 Unoccupied spaces. Specific requirements of this chapter for the inside space shall be satisfied if the requirements are specified in the construction documents, even if the non-residential inside construction is not complete provided:

- 1) The residential space has received occupancy permit(s) or has progressed to the point to receive an ICC 700 certification,
- 2) In the judgment of the authority having jurisdiction for ICC 700, it not practical to implement that specific requirement prior to the residential building receiving an occupancy permit or ICC 700 certification. The non-residential occupancy class being unknown and that specific requirement applying to some, but not all, occupancy classes is a valid reason for that specific requirement being impractical.

The requirements for the thermal envelop and items outside the building shall be met before certification of the building.

105.6 Approved programs and standards. The authority having jurisdiction shall be permitted to deem a national, state or local program or standard to meet or exceed this chapter. Approval for a specified application, limited scope or specific locale shall be permitted. Such programs or standards are not administered under ICC 700. Buildings approved in writing by such a program shall be considered in compliance with this chapter.

401 SITE DEVELOPMENT AND LAND USE

401.1 Intent. Develop and maintain building sites to minimize negative environmental impacts and to protect, restore and enhance the natural features and environmental quality of the site.

402.1 Protected areas. Construction shall comply with jurisdictional, state and Federal regulation concerning park lands, agricultural lands, flood hazard areas, conservation areas, greenfields, brownfields, sites adjacent to surface water bodies and wetlands. Construction documents shall show the location of the protected areas on, or adjacent to the building site. Construction documents shall show any required buffer zones around protected areas.

402.1.1 Flood hazard areas. New construction shall not be permitted in *flood hazard areas*. Where permitted, building site improvements shall comply with this chapter.

402.1.2 Surface water protection. Construction and site improvements shall not occur within the ordinary high-water mark of seas, lakes, rivers and streams. Approved construction in the protected area, including any required mitigation, shall be permitted where the improvements are related to the use of the associated body of water.

Exception: Buildings and associated site improvements permitted under a national wetlands permitting program or otherwise permitted by the authority having jurisdiction.

402.2 Site assessment. An assessment of the *building site* shall:

1. Where *preferred plant species* are defined by the jurisdiction, identify *preferred plant species* on the site.
2. Determine the location of any areas protected by applicable zoning or environmental regulations that are located on, or adjacent to the *building site*;

402.3 Vegetation and soil protection. *Construction documents* shall identify existing vegetation and soils on a *building site* to be preserved and protected. Protected areas and plants with undisturbed soils shall be provided a physical barrier, such as temporary fencing or other physical barrier. Perimeters around trees shall be identified as a circle with a radius of not less than 1 foot (305 mm) for every inch (25.4 mm) of tree diameter, with a minimum radius of 5 feet (1524 mm). Perimeters around shrubs shall be not less than twice the radius of the shrub.

Exception: *Approved* alternative perimeters appropriate to the location and the species of the trees and shrubs shall be permitted.

402.4. Topsoil protection. *Topsoil* that could be damaged by construction or equipment shall be removed and stockpiled for future reuse. *Topsoil* stockpiles shall be protected with temporary or permanent soil stabilization measures to prevent erosion or compaction.

402.5 Soil reuse and restoration. Soils that are being reused shall be prepared, amended and placed to establish or restore the ability of the soil to support the planned vegetation.

402.6 Pervious and permeable pavement. Pervious and permeable pavements including open grid paving systems and open-graded aggregate systems shall be permitted where they do not interfere with access and egress of fire and emergency vehicles or personnel; utilities; or telecommunications lines.

402.6 Stormwater. Stormwater management for the *building site* or complex of building sites *within the development* shall address the potential increase in runoff that would occur resulting from construction and shall either:

1. Manage rainfall on-site to retain, use or infiltrate at a minimum, the volume of a single storm which is equal to the *95th percentile rainfall event*; or
2. Improve, maintain or restore the pre-development stable runoff of the site in an approved manner. Runoff rate and volume shall not exceed predevelopment rates.

402.6.1. Rainwater catchment. Where allowed by the jurisdiction, rainwater catchment shall be permitted to be used as part of stormwater management.

402.6.2. Site infiltration. Infiltration into the site or development shall be permitted to be used as part of stormwater management. Site infiltration includes drainage of impermeable surfaces onto vegetated areas, rain gardens or permeable hardscapes.

402.6.3. Adjoining lots. The stormwater management system shall not cause increased erosion or other drainage related damage to adjoining *lots* or public property.

402.7 Plant selection. Plants selected for use on the building site shall comply with the following:

1. To the extent defined by the jurisdiction, *preferred plant species* shall be used in accordance with the guidelines established by the jurisdiction.
2. *Invasive plant species*, as defined by the jurisdiction, are prohibited. Existing *invasive plant species* on the site shall be contained or removed based on either the jurisdiction's recommendations or guidance by a qualified professional.

402.8 Building site waste management. Land-clearing debris shall be reused or otherwise diverted from landfill or other disposal. Land-clearing debris include rock, trees, stumps and associated vegetation. Land-clearing debris may be temporarily stockpiled on the site until reused. Storage of site waste shall be in compliance with the combustible waste material requirements of Section 304 of the International Fire Code.

Exception: Section 402.8 shall not be required where not in compliance with jurisdictional, state or Federal regulation; or deemed impractical by the authority having jurisdiction.

403.1 Walkways and bicycle paths. Walkways and bicycle paths shall connect to existing paths or sidewalks, and shall be designed to connect to planned future paths. Walkways and bicycle paths shall be designed to support stormwater management. Walkways and bicycle paths shall not interfere with fire and emergency apparatus, vehicle or personnel access.

403.2 Bicycle parking. *Bicycle parking* shall comply with 403.2.1 through 403.2.3.

403.2.1 Number of spaces. Bicycle parking spaces shall be at least one per hundred occupant load, with a minimum of four bicycle parking spaces. Occupant load shall be determined based upon Section 1004 of the *International Building Code*. Accessory occupancy areas shall be included in the calculation of primary occupancy area.

Exception: *Bicycle parking* shall not be required where the conditioned space is less than 1,000 square feet (232 m²).

Bicycle parking spaces for multiple buildings shall be permitted to be combined, provided that the spaces are sufficient for the combined occupant load of the buildings.

403.2.2 Description of spaces. *Bicycle parking* spaces shall comply with the following:

1. Shall be provided with illumination of not less than 1 footcandle at the parking surface;
2. Shall have an area of not less than 18 inches (457 mm) by 60 inches (1524 mm) per bicycle;
3. Shall be provided with a rack or other facility for locking or securing each bicycle.

403.2.3 Location of spaces. The location of bicycle parking shall be designated on the site plan. Vehicle parking spaces, other than those required for local zoning requirements and the accessible parking required by the *International Building Code*, shall be permitted to be used for the installation of *bicycle parking* spaces. Bicycle parking shall comply with both of the following:

1. Bicycle parking spaces shall be located within 200 feet of the main building entrance and visible from the main entrance.
2. Bicycle parking shall be located at the same grade as the sidewalk, or at a location reachable by ramp or accessible route.

Exception: With location signage at the main *building* entrances, *bicycle parking* shall be permitted to be located inside a *building* or other locations not visible from the main entrance.

404.1 Site Hardscape. In climate zones 1 through 4 not less than 50 percent of the site *hardscape* shall have a minimum initial *Solar Reflectance* of 0.30 when determined in accordance with the *CRRC-1 Standard*. Alternately shading shall be provided by structures or trees based on the projected peak sun angle on the summer solstice. Construction documents shall show solar reflectance and shading used to comply with this section.

404.2.2 Shading structures. Shading shall be permitted to be provided by elements of a building or structure.

Shading includes areas covered by *solar photovoltaic* arrays or *solar thermal* collectors. Open trellis-type free standing structures with vegetation shall be permitted to provide shading based on the coverage of mature vegetation.

404.2.3 Shade by trees. Where shading is provided by trees, *construction documents* shall show the planting location and anticipated ten year canopy growth of the trees. Shading by existing trees to be retained shall be permitted to be included in the shading provided by trees. The contribution to hardscape shading by trees shall include only the *hardscape* areas beneath the tree canopy.

500 MATERIAL RESOURCE CONSERVATION AND EFFICIENCY

501.1 Intent. Materials are conserved, resources are used efficiently and negative environmental impacts are reduced.

502.1 Construction waste amount. Construction waste shall meet one of the following criteria:

- 1) Construction waste sent to disposal shall not exceed 3 lb/ft² of *gross floor area*. The materials sent to disposal shall be documented.
- 2) Not less than fifty percent of the construction waste shall be diverted from disposal by reuse, recycle, salvage, donation, or sale. The fifty percent shall be determined by weight or volume, but not both. The materials diverted from disposal and the materials sent to disposal shall be documented. Both sorting and diversion on site and storage of waste materials for sorting and diversion at another location shall be permitted.

501.1.2 Hazardous waste. Hazardous waste shall be handled in accordance with laws, rules and ordinances applicable in the *jurisdiction*.

501.1.2 Waste storage. Storage of construction waste shall be in compliance with the combustible waste material requirements of Section 304 of the *International Fire Code*.

503.1.1 Used materials and components. Salvaged or reused materials and components shall comply with the provisions for such materials in accordance with the applicable code, or shall be approved by the authority having jurisdiction. Reuse of materials and components from other projects shall be treated as a reduction in the construction waste of this project.

503.1.2 Concrete, asphalt and base materials. The use of aggregate, fly ash, slag, and the like in concrete; reuse of asphalt and aggregate to make asphalt; and the reuse of recovered materials as base materials shall be treated as reused material, and shall be treated as a reduction in the construction waste of this project.

503.1.3 Materials and components from other sources. Salvage and reuse of materials and components from other projects shall be treated as a reduction in the construction waste of this project.

A402.1 Construction phase moisture control. Porous or fibrous materials and other materials subject to moisture damage shall be protected from moisture during the construction. Material damaged by moisture or visibly colonized by fungi either prior to delivery or during the construction shall be cleaned and dried, or where damage cannot be corrected, shall be removed and replaced.

600 ENERGY EFFICIENCY AND RENEWABLES

601.2 Intent. This section promotes the effective use of energy and on-site renewable generation.

601.3 Energy calculations. Where used in Section 600, energy costs shall be calculated in accordance with Section C407 of the *International Energy Conservation Code*.

601.3.1 Alternative energy calculations. The energy costs shall be permitted to be calculated in accordance with Appendix G to ASHRAE Standard 90.1. Energy costs shall not include plug loads.

601.3.2 End uses and renewables. The energy costs shall include only the following specific end uses: heating, cooling, service water heating, ventilation including fans, and lighting. On-site energy production from renewable, waste, and recovered energy shall be permitted to be included as a reduction in energy use.

601.4 Electric vehicle charging. Plug-in electric vehicle charging capability shall be provided for at least 2 percent of the parking stalls. The number of charging stations is rounded to the nearest even number. Electrical capacity in main electric panels supports Level 2 charging (208/240V-40 amp). Each stall is provided with conduit and wiring infrastructure from the electric panel to support Level 2 charging (208/240V-40 amp) service to the designated stalls, and stalls are equipped with either Level 2 charging AC grounded outlets (208/240V-40 amp) or Level 2 charging stations (240V/40A) by a third party charging station.

A Level 3 charger with 208V with 3 phase AC shall be permitted to substitute for 8 Level 2 chargers.

602 ENERGY COMPLIANCE ALTERNATIVES

602.1 Compliance options. Buildings shall comply with at least one of the following:

- 1) Section 602.2, or
- 2) Section 602.3, or
- 3) Section 605.

602.2 Prescriptive options. Buildings in compliance with at least 3 items in Table 602.2 shall be deemed to be in compliance with this Section. Items used to comply with the *International Energy Conservation Code* shall not be counted towards the 3 required items.

TABLE 602.2 PRESCRIPTIVE OPTIONS

Measure	Description
Heating and cooling equipment efficiency	-Exceed the equipment efficiency requirements listed in Tables C403.2.3(1) through C403.2.3(7) of the IECC by 10%. A ground source heat pump shall be deemed to meet this requirement. 15% or more of the non-res space that is not heated or cooled, such as outdoor restaurant seating, shall meet this requirement. -Equipment shall be sized and HVAC design loads shall be determined in accordance with ANSI/ASHRAE/ACCA Standard 183 or by an approved equivalent computational procedure. -Equipment shall be commissioned.
Lighting efficiency	Meet lighting power density (LPD) maximum of 90 percent of the lighting power values specified in IECC Table C405.4.2(1). Or 90% of lighting fixtures or lamps over 15w have an efficacy of at least 60 lumens/watt.

Renewable energy	Provide not less than 0.50 watts per square foot (5.4 W/m ²) of conditioned floor area.as renewable energy. Renewables shall be assigned to residential or non-residential, but not both.
UA reduction	Reduce the total building UA by 15% from that specified in the IECC. The total building UA shall be computed as sum of the U-factor times the area for each building thermal envelope component for which a U-factor is specified in IECC Tables C402.1.2 and C402.3. The areas of the envelope components, including windows, shall be as in the building constructed.
Day lighting	Provide day lighting with automated controls for at least 70% of the floor area.
Increased water heating efficiency	For buildings in the <i>water intensive use group</i> , water heating efficiency that complies with Sections 607.1 and 607.2.
Other energy savings	Decrease energy costs by 4% using any approved energy saving measure(s) beyond IECC compliance. The additional 4% shall not count other items selected from this table, or any minimum requirements in this section.

602.3 Compliance based on 10% energy savings. Buildings with projected energy costs at least 10% less than a building complying with the International Energy Conservation Code shall deemed to be in compliance with this section.

605 PRESCRIPTIVE [the rest of energy is in 605]

605.1 HVAC Equipment efficiency. HVAC equipment shall meet the following:

1) a) the HVAC equipment shall exceed the minimum efficiency requirements listed in IECC Tables C403.2.3(1) through C403.2.3(7) by 10 percent. A ground source heat pump shall meet this requirement. 15% or more of the non-res space that is not heated or cooled, such as outdoor restaurant seating, shall meet this requirement.

Equipment shall be sized and HVAC design loads shall be determined in accordance with ANSI/ASHRAE/ACCA Standard 183 or by an approved equivalent computational procedure.

Equipment shall be commissioned.

605.1 Air barriers. The air barrier requirements in IECC section C402.5.1.2 or [insert commercial air tightness test]; or R402.4.1, and shall apply to climate zones 3 through 8.

605.7 Lighting. 90% of the lighting fixtures or lamps over 15w shall have an efficacy of at least 60 lumens/watt. Alternately, the building shall meet the lighting power density (LPD) maximum of 90 percent of the lighting power values specified in IECC Table C405.4.2(1).

607.1 Service water heating equipment efficiency. Service water heating for *water intensive use group buildings* shall be provided by one of the following:

1. Natural gas, propane, or oil water heater with a minimum of an 0.80 energy factor, or with a minimum of an 0.90 thermal efficiency;
2. Electric water heater with a minimum of a 2.0 energy factor;
3. Ground source heat pump;
4. Desuperheater on a vapor compression air conditioner, heat pump, or ground source heat pump projected to supply a minimum of 30% of the energy required for service hot water.
5. Solar water heating system projected to supply a minimum of 30% of the service hot water energy use.
6. Tankless coil with a boiler with a minimum of 85 AFUE.
7. Waste heat recovery projected to provide a minimum of 30% of the energy required by water heating.
8. Any combination of the above projected to provide at least 30% of the service water heating energy.

Definition: Water Intensive Use Groups, as listed in IECC Section C406.7

1. Group R-1: Boarding houses, hotels or motels.
2. Group I-2: Hospitals, psychiatric hospitals and nursing homes.
3. Group A-2: Restaurants and banquet halls or buildings containing food preparation areas.
4. Group F: Laundries.
5. Group R-2: Buildings with residential occupancies.
6. Group A-3: Health clubs and spas.

607.2**Drain water**

heat exchangers. The specified functions shall be provided with drain water heat exchangers that are projected to recover at least 25 percent of the temperature difference between the incoming cold water and the drain water.

1. Group F, Laundries, washing machines;
2. Group R-1, Boarding houses (transient), Hotels (transient), Motels (transient); washing machines that use both hot and cold water,
3. Group R-2 *buildings*, shared shower facilities, shared washing machines
4. Group A-3, Health Clubs and Spas; showers, washing machines that use both hot and cold water,
5. Group I-2, Hospitals, Mental hospitals and Nursing homes; washing machines that use both hot and cold water, staff showers, patient showers if long-term care

Exceptions: The following shall not require drain water heat exchangers:

1. Where the functions are located on the lowest floor of the building and the authority having jurisdiction determines it is not practical to install a drain water heat exchanger.
2. Where washing machines are piped only with cold water and space is provided to add a future drain water heat exchanger.
3. In applications that produce *grease-laden waste* or are required to have grease or oil separators in accordance with Section 1003 of the *International Plumbing Code*.

607.5 Circulating hot water system controls. Controls that allow continuous, timer, or water temperature-initiated (aquastat) operation of a circulating pump are prohibited. Gravity or thermosyphon circulation loops are prohibited. Pumps on circulating hot and tempered water systems shall be activated on demand by either a hard-wired or wireless activation control of one of the following types:

1. A normally-open, momentary contact switch.
2. Motion sensors that make contact when motion is sensed. After the signal is sent, the sensor shall go into a lock out mode for not less than 5 minutes to prevent sending a signal to the electronic controls while the circulation loop is still hot.
3. A flow switch.
4. A door switch.

The controls for the pump shall shut off the pump with a rise in temperature. The controls shall have a lock-out to prevent operation exceeding 105°F degrees in the event of failure of the device that senses temperature rise. The controls shall have a lock out mode for not more than 5 minutes that prevents extended operation of the pump if the sensor fails or is damaged.

700 WATER CONSERVATION AND EFFICIENCY

701.1 Intent. This section is intended to conserve water, protect water quality, provide for safe water consumption and protect water resources.

702.1 Fitting and fixture consumption. Plumbing fixtures and fixture fittings shall comply with the maximum flow rates specified in Table 702.1. Plumbing fixtures and fixture fittings in Table 702.1 shall have a manufacturer's designation for flow rate.

Exceptions: The following fixtures and devices shall not be required to comply with the reduced flow rates in Table 702.1.

1. Clinical sinks having a maximum water consumption of 4.5 gallons (17 L) per flush.
2. Service sinks, bath valves, pot fillers, laboratory faucets, utility faucets, and other fittings designed primarily for filling operations.
3. Fixtures, fittings, and devices whose primary purpose is safety.

TABLE A602.1(1)
MAXIMUM FLOW RATES AND FLUSH VOLUMES

FIXTURE OR FIXTURE FITTING TYPE	MAXIMUM FLOW RATE OR FLUSH VOLUME
Showerhead ^a	2.0 gpm at 80 psi
Lavatory faucet and bar sink-private	1.6 gpm at 60 psi
Lavatory faucet-public (metering)	0.25 gpc ^b at 60 psi
Lavatory faucet-public (non-metering)	0.5 gpm at 60 psi
Kitchen faucet-private	2.2 gpm 1.8 gpm at 60 psi ^d

Kitchen and bar sink faucets in other than dwelling units and guest rooms	2.2 gpm at 60 psi
Urinal	0.5 gpf or nonwater urinal
Water closet	1.28 gpf ^{c,d}
Prerinse Spray Valves	1.3 gpm
Drinking Fountains (manual)	0.7 gpm ^e
Drinking Fountains (metered)	0.25 gpc ^{b,e}

a. Includes hand showers, body sprays, rainfall panels and jets.

b. Gallons per cycle.

c. Dual flush water closets in public bathrooms shall have a maximum full flush of 1.28.

d. The flush volume for water closets that are located at least 30 feet upstream of other drain line connections or fixtures and having less than 1.5 fixture units upstream of the water closet's connection to the drain line shall be not more than 1.6 gpf.

e. Bottle filling stations associated with drinking fountains shall not have limitations for flow rate.^[1]

f. Where a faucet has a pot filler mode, the flow shall not exceed 2.2 gpm at 60 psi. Such faucets shall automatically return to 1.8 gpm when the pot filler mode activation mechanism is released or when the faucet flow is turned off.

702.2 Multiple water outlet showers. For showers with multiple water outlets, the maximum shower flow rate shall apply to the combined flow of all water outlets that are capable of being operated simultaneously. Multiple water outlet showers shall comply with at least one of the following flow rate limits:

1. Shower compartment - 2.0 gpm, or 2.0 gpm per 2600 in² of shower compartment floor area.
2. Gang shower - 2.0 gpm per shower position
3. Shower compartment complying with Chapter 11 of *International Building Code* - 4.0 gpm or 4.0 gpm / 2600 in² of shower compartment floor area.

702.6.1 Once-through cooling for appliances and equipment. Once-through or single-pass cooling with potable or municipal reclaimed water is prohibited.

702.6.2 Clothes washers. Clothes washers rated with a Water Factor (IWF) shall have [insert values from Energy Star 8.0 version 2 for Water Factor (IWF), energy factor (IMEF or MEF J2)].

702.6.3 Food Service.

702.6.3.1 Dipper wells. The water supply to a dipper well shall have a shutoff valve and flow control valve. The maximum flow shall not exceed 1 gpm (3.78 lpm) at a supply pressure of 60 psi (413.7 kPa). The dipper well shall have a manufacturer's designation of flow rate.

702.6.3.2 Food waste disposal. The disposal of food wastes that are collected as part of preparing ware for washing shall be accomplished by one or more of the following:

1. A food strainer (scraper) basket that is emptied into a trash can.
2. A garbage grinder where the water flow into the food waste disposer is controlled by a load sensing device such that the water flow does not exceed 1 gpm under no-load operating conditions and 8 gpm under full-load operating conditions
3. A pulper or mechanical strainer that uses not more than 2 gpm of potable water.

702.6.3.3 Pre-rinse spray heads. Food service pre-rinse spray heads shall have a manufacturers designation of flow rate, shall comply with the maximum flow rate in Table 702.1, and shall shut off *automatically* when released.

702.6.3.4 Hand washing faucets. Faucets for hand washing sinks in food service preparation and serving areas shall be of the self-closing type.

703.1 Heat exchangers. Once-through or single-pass cooling with potable or municipal reclaimed water is prohibited. Heat exchangers shall be connected to a recirculating water system such as a chilled water loop, cooling tower loop, or similar recirculating system.

703.2 Humidification systems. Except where greater humidity is required for medical, agricultural, archival or scientific research purposes, humidification systems shall be capable of limiting humidification to times when the relative humidity in the space is less than 55 percent.

704.1 Water softeners. Water softeners shall comply with Sections 704.1.1 through 704.1.4.

704.1.1 Demand initiated regeneration. Water softeners shall be equipped with demand- initiated regeneration control systems. Such control systems shall automatically initiate the regeneration cycle after determining the depletion, or impending depletion of softening capacity.

704.1.2 Water consumption. Water softeners shall have a maximum water consumption during regeneration of 5 gal (18.9 L) per 1000 grains of hardness removed as measured in accordance with NSF 44.

704.1.3 Waste connections. Waste water from water softener regeneration shall not discharge to *reclaimed, gray water* or rainwater *water* collection systems and shall discharge in accordance with the *International Plumbing Code*.

800 INDOOR ENVIRONMENTAL QUALITY AND COMFORT

801.1 Intent. Improve the interior environment's impact on human health and well-being.

802.2 Duct protection during construction. Duct and other air distribution component openings shall be covered with tape, plastic, sheet metal or other *approved* method from the time of rough-in installation until startup of the heating and cooling equipment. Dust and debris shall be cleaned from duct openings prior to *building* occupancy.

802.3 Sealed air handler. Air handlers with a flow rate less than 3000 cfm shall have a manufacturer's designation of air leakage. The air handler air leakage shall be not more than 2 percent of the design air flow rate when tested in accordance with ASHRAE 193.

802.4 Air handling system access. Air handlers, air filters, fans, coils and condensate pans shall be provided with access for purposes of cleaning, *repair*, and replacement.

802.5 Filters. Filters for air conditioning systems shall be rated at MERV 11 or higher and system equipment shall be designed to be compatible. The air handling system design shall account for the pressure drop across the filter. The pressure drop across clean MERV 11 filters shall be not greater than 0.45 in. wc. at 500 FPM filter face velocity. Filter performance shall be shown on the filter manufacturer's data sheet.

803.1 Venting and combustion air. *Fireplaces* and fuel-burning appliances shall be vented to the outdoors and shall be provided with combustion air from the outdoors in accordance with the *International Mechanical Code and the International Fuel Gas Code*. Solid-fuel-burning *fireplaces* shall be provided with combustion air directly from the outdoors and shall be provided with a means to tightly close off the chimney flue and combustion air outlets when the *fireplace* is not in use.

803.2 Unvented combustion. Permanently installed unvented combustion devices fueled by gas, alcohol or kerosene shall be prohibited.

804 Radon testing. Radon testing shall be performed for Radon Zone 1. Radon zones are as defined by Figure 9(1).

Exception: testing is not required where the authority having jurisdiction has defined the radon zone as Zone 2 or 3.

Testing shall be performed as specified in (a) through (h).

(a) Testing is performed after the building passes its air tightness test.

(b) Testing is performed at the lowest level which will be occupied, even if the space is not finished.

(c) Testing is not performed in a closet, hallway, stairway, laundry room, furnace room, bathroom or kitchen.

(d) Testing is performed with commercially available test kits or continuous radon monitors that can be calibrated. Testing with test kits shall include two tests, which are averaged. Testing shall be in accordance with the manufacturer's instructions.

(e) Testing can be performed by the builder or a third party.

(f) Testing shall extend at least 48 hours or to the minimum specified by the manufacturer, which ever is longer. Testing can extend past occupancy.

(g) The results shall be retained as part of construction documentation.

(h) This section does not require a specific test result, rather it requires the test be performed and the results retained as part of construction documentation.

Chapter 14

NON-RESIDENTIAL EXISTING BUILDINGS

A101.1 Scope. This chapter shall apply to the *alteration, addition, and change of occupancy* of existing *buildings and structures*. Existing relocatable modular buildings shall comply with this section.

A101.2 Building materials, assemblies and systems. *Building* materials shall comply with the requirements of this section.

A101.2.1 Existing systems. Except where specifically noted in this Section, materials, assemblies, and systems already in use in a *building* in conformance with requirements or approvals in effect at the time of their erection or installation shall be permitted to remain in use unless determined to be dangerous to life, health or safety. Where determined to be dangerous, they shall be mitigated or made safe.

A101.2.2 New and replacement systems. Except as otherwise required or permitted by code, materials, assemblies and systems permitted by the applicable code for new construction shall be used. Like materials shall be permitted for *repairs and alterations* provided that a hazard to life, health or property is not created. Hazardous materials shall not be used where the code for new construction would not *permit* their use in a similar occupancy, purpose and location.

101.3 Waste. Site development and construction waste shall be as specified in Chapter 13, Non-residential New Construction.

105.6 Approved programs and standards. The authority having jurisdiction shall be permitted to deem a national, state or local program or standard to meet or exceed this chapter. Approval for a specified application, limited scope or specific locale shall be permitted. Such programs or standards are not administered under ICC 700. Buildings approved in writing by such a program shall be considered in compliance with this chapter.

A102.1 Flood hazard areas. *Additions* shall not be permitted to *buildings and structures* that are located in *flood hazard areas*.

Exception: Where an existing *building or structure* is located such that all habitable space is located not less than 1 foot above the flood elevation, *additions* located not less than 1 foot above the flood elevation shall be permitted.

A103.2 Energy, HVAC and water equipment. Energy, HVAC and water equipment shall comply with the following:

Exception: Where the requirements are determined by the *AHJ* to be infeasible based upon the existing configuration of spaces, unless those spaces will be reconfigured as part of the alteration project.

1. Non-functioning thermostats shall be repaired or replaced.
2. Leaking accessible supply air and return ducts shall be sealed. Although existing duct tape shall not be deemed in noncompliance where a duct is not leaking, duct tape shall not be an acceptable seal.
3. Outside air dampers, damper controls and linkages controlled by HVAC units shall be in good repair and adjustment.
4. Leaks of hot water and steam leaks, defective steam traps and radiator control, relief, and vent valves in accessible piping shall be repaired or replaced.
5. Leaking accessible chilled water lines and equipment shall be repaired or replaced.
6. Furnace combustion units shall have been cleaned and tuned within one year prior to the alteration, or shall be cleaned and tuned. Filters shall be replaced in accordance with the furnace manufacturer's recommendations.
7. Chiller and boiler systems shall have been cleaned and tuned within one year prior to the alteration, or shall be cleaned and tuned.
8. For motor-driven systems and equipment, filters shall be cleaned or replaced, and belts and other coupling systems shall be repaired.

9. HVAC piping and ducts outside conditioned space or located above suspended ceilings, shall be insulated to *R-values* in accordance with the IECC.

Exceptions: Additional insulation shall not be required:

- 1) for piping that is already insulated and the insulation is in good condition
- 2) where the insulation cannot be installed without structural *alteration*.

Where a building cavity or framing space is too small to accommodate the duct or pipe insulation, the minimum insulation thickness shall be the thickness that cavity or framing can accommodate, but shall not be less than 1/2-inch thick.

A103.2.2 Service water systems. Defective hot- and cold-water piping and equipment within service water systems shall be repaired or replaced.

A103.2.3 Motor-driven equipment. Leaks in compressed air or pumped water systems shall be repaired or the equipment replaced.

A103.3.1 Energy audit. A *building* energy audit shall be conducted by an approved party. The audit shall indicate the improvements that the auditor recommends. The report shall be completed prior to certification of the building.

Exception: An energy audit and report shall not be required where an energy audit and report was completed within 24 months prior to the *alteration*.

A103.3.2 Water audit. For buildings in the *water intensive use group* a water audit shall be performed. The water audit shall indicate the improvements that the auditor recommends. The report shall be completed prior to certification of the building.

Exception: A water audit and report shall not be required where a water audit and report was done within 24 months prior to the *alteration*

A103.3.5 Service water systems. Service water systems and equipment shall be in accordance with the following:

1. Water heater and hot water *storage tanks* shall have a combined minimum total of external and internal insulation value of R-16, or shall comply with the minimum efficiency in Section 606.1.
2. Accessible hot supply and *distribution pipes* shall be insulated to *R-values* as specified in this code. The insulation shall not be required to extend beyond the building thermal envelope.
3. In Seismic Design Categories D, E and F, as established in accordance with the *International Building Code*, water heater and water *storage tanks* with a tank capacity of thirty gallons or greater shall be strapped or otherwise secured to a wall, floor, ceiling, or other object that itself is secured to a wall, floor, or ceiling. Water, gas and overflow pipes connected to water tanks shall be similarly secured.
4. Gas water heaters shall have a flexible gas line entering the appliance.
5. Circulating pump systems for hot water supply purposes other than comfort heating shall be controlled as specified in Section 504.6 of the IECC.
6. Showerhead and faucet flow rates shall be in accordance with Table 702.1 of this Chapter 13.
6. Replacement toilet and urinal flow rates shall be in accordance with Table 702.1 of this Chapter 13.

A103.3.6 Replacement lighting. 90% of the lighting fixtures or lamps over 15w shall have an efficacy of at least 60 lumens/watt. Alternately, the building shall meet the lighting power density (LPD) maximum of 90 percent of the lighting power values specified in IECC Table C405.4.2(1).

A103.3.7 Commercial refrigeration equipment. Commercial refrigeration equipment shall be cleaned and tuned for efficiency, including, but not limited to, cleaning of condenser coils and evaporators, and replacement of defective or worn door gaskets and seals.

A103.3.8 Swimming pools and spas. Swimming pools and spas and their equipment shall be in accordance with the following:

1. Heated swimming pools and spas shall be equipped with a cover for unoccupied hours.
2. Pool and spa recirculation pumps shall be under time clock control. **Exception:** Filtration pumps where the public health standard requires 24-hour pump operation.
3. Heaters shall be cleaned and tuned for efficiency, or such cleaning shall have occurred within one year prior to certification.

A104.1 Change of occupancy. Where a change in occupancy of a *building* or tenant space places it in a different division of the same group of occupancy or in a different group of occupancies, as determined in accordance with the *International Building Code*, compliance with Section A103.2 shall be required.

A105.1 Historic buildings. Individual provisions of this chapter shall not be mandatory for *historic buildings* for the following conditions:

1. Where a provision requires a visible change not consistent with the *building's* historic nature, or
2. Where a provision conflicts with a *building* function fundamental with the historic nature of the *building*.

A106.1 Changes to hardscapes and parking. Where existing *hardscapes* and outdoor parking that do not conform to the requirements of Chapter are altered, the *alterations* shall comply with the provisions for hardscape in Chapter 13, New Non-residential construction.

Exception: Where less than 20% of the hardscape and surface parking is altered, materials and assemblies shall be at least the equivalent of those being replaced.

A107 DECONSTRUCTION AND DEMOLITION

A107.1 Deconstruction and demolition. Where *buildings, structures* or portions thereof are *deconstructed* or demolished, a minimum of 50 percent of materials shall be diverted from disposal and incineration. Documentation of the total materials in *buildings, structures* and portions thereof to be *deconstructed* or demolished and materials to be diverted, and evidence of diversion, shall be provided. Material quantities shall be indicated and calculated by weight or volume, but not by both.

[Add to **Chapter 3 of ICC 700-**

Buildings with non-residential portions shall meet both the residential and non-residential requirements for items outside the building, including but not limited to, site development, parking, bike spaces, landscaping, water management and hardscape.]

Appendix [TBD] WRI Calculations and Methodology

Scope. The WRI (Water Rating Index) is a performance-based asset-analysis methodology for water use efficiency, including indoor and outdoor water use. The WRI represents a rating compared to a baseline building.

Capabilities. The WRI shall include the following capabilities:

- a. Both new and existing construction.
- b. The following building types:
 - i. Single-family homes
 - ii. Multifamily buildings as a whole, or individual units provided there is separate meter for each unit)
 - iii. Hospitality
- c. Four types of rating reports shall be available:
 - i. Preliminary reports from plans
 - ii. Final reports from field verification. The final reports shall be reported such that they can be compared side-by-side with the preliminary results.
 - iii. Assessment from field verification of existing conditions
 - iv. Improvements from field verification as recommendations

Water use offset by a water reuse, capture and usage calculation that incorporating the following types of water:

- v. Rainwater harvesting, which is *natural precipitation that falls on a structure*
Use indoors shall require a filtration/purification system and properly sized tank.
- vi. Sitewater¹ which is *natural precipitation that falls on the ground, softscapes, and hardscapes*
- vii. Collected via directed hardscapes.
- viii. Sitewater indoor use shall require a filtration/purification system and properly sized tank
- d. Greywater, which is *untreated wastewater that has not come into contact with toilet waste, kitchen sink waste, dishwasher waste or similarly contaminated sources*
 - i. Only wastewater from bathtubs, showers, lavatories, clothes washers, and laundry tubs shall be used as a part of the offset calculation.
 - ii. Greywater indoor use is not allowed unless a filtration/purification system and properly sized tank are present.²
 - iii. If no filtration/purification system and properly sized tank are present, then Greywater shall only be used outdoors as subsurface irrigation.
- e. Blackwater, which is *the liquid and waterborne waste that would be permitted without special treatment into either the public sewer or a private sewage disposal system*. Only wastewater from kitchen sinks and toilets shall be used as a part of the offset calculation.³

Process. The following are required as part of a WRI implementation:

¹Informative note: Some jurisdictions may require a 3-basin separator for site water collected from driveways and may not allow Rainwater and Sitewater to be combined.

² Informative note. As Greywater and Rainwater are currently not allowed to be combined by most ordinances, only indoor fixtures not already receiving Rainwater or Sitewater would be eligible to receive Greywater.

³ Informative note: Blackwater indoor use is prohibited by most ordinances. Some jurisdictions will allow blackwater outdoor use but only as subsurface irrigation.

1. Trained WRI Verifiers shall provide field verifications, ratings and the associated reports
2. At minimum training shall include
 - a. Confirmation of contract documents such as drawings, specifications, cut sheets, or approved final submittals.
 - b. Visual confirmation of installed site material, fixtures, and equipment.
 - c. Physical field testing of installed fixtures and equipment.

Water use cost calculations. The WRI shall use water costs input by the verifier. The water costs shall be provided by the jurisdiction having authority.

1. All indoor and outdoor water use shall be input into the cost calculation. This includes items for which there is no industry accepted baseline efficiency as specified in "indoor calculations" item 1 and $WF_{(x)}$ - other water fixture use.
2. Water cost inputs shall include:
 - a. Billing unit
 - b. Straight or tiered costs per billing unit
 - c. Peak and off-peak costs if applicable,
 - d. Indoor and outdoor costs, if separated

Indoor water. Indoor water use calculations shall be as follows.

1. Variables (*the sub (x) is either the (v) verified actual/proposed or (e) baseline unless noted otherwise*):
 - a. Toilets
 - i. $T_{(e)}$ - Baseline toilet use in gpd = $[(FF_{base_{(t)}} * IM) * OCC]$
 - ii. $T_{(v)}$ - Verified toilet use in gpd = $[(FF_{ver_{(t)}} * IM) * (OCC * UF_{(t)})]$
 - b. Showers
 - i. $S_{(e)}$ - Baseline shower use in gpd = $[(FF_{base_{(s)}} * IM) * OCC]$
 - ii. $S_{(v)}$ - Verified shower use in gpd = $[(FF_{ver_{(s)}} * IM) * (OCC * UF_{(s)})]$
 - c. Bathtubs
 - i. $B_{(e)}$ - Baseline bathtub use in gpd = $[(FF_{base_{(b)}} * IM) * OCC]$
 - ii. $B_{(v)}$ - Verified bathtub use in gpd = $[(FF_{ver_{(b)}} * IM) * (OCC * UF_{(b)})]$
 - d. Lavatories
 - i. $L_{(e)}$ - Baseline lavatory use in gpd = $[(FF_{base_{(L)}} * IM) * OCC]$
 - ii. $L_{(v)}$ - Verified lavatory use in gpd = $[(FF_{ver_{(L)}} * IM) * (OCC * UF_{(L)})]$
 - e. Faucets
 - i. $F_{(e)}$ - Baseline kitchen faucet use in gpd = $[(FF_{base_{(f)}} * IM) * OCC]$
 - ii. $F_{(v)}$ - Verified kitchen faucet use in gpd = $[(FF_{ver_{(f)}} * IM) * (OCC * UF_{(f)})]$
 - f. Dishwashers
 - i. $D_{(e)}$ - Baseline dishwasher use in gpd = $[(FF_{base_{(d)}} * IM) * OCC]$
 - ii. $D_{(v)}$ - Verified dishwasher use in gpd = $[(FF_{ver_{(d)}} * IM) * (OCC * UF_{(d)})]$
 - g. Clothes Washers
 - i. $CW_{(e)}$ - Baseline clothes washer use in gpd = $[(FF_{base_{(cw)}} * IM * OCC) * CF_{(cw)}]$
 - ii. $CW_{(v)}$ - Verified clothes washer use in gpd = $[(FF_{act_{(cw)}} * IM * OCC) * UF_{(cw)} * CF_{(cw)}]$
 - h. Structural Waste
 - i. $SW_{(x)}$ - structural waste in gpd = $[(VOL_{(x)} * IM) * (OCC * UF_{(sw)})]$
 1. $HF_{(e)}$ - House Footprint - sf of the exterior conditioned space on the ground floor. Exception: the attached garage's sf shall be included if a water heater is located in it.
 2. $EL_{(v)}$ - Estimated Length - The plan verified variable used for unverifiable in the field new construction. The horizontal distance from the water heater to the

furthest fixture⁴. If the project has a recirc loop, then the distance from the loop to the furthest fixture in relation to the recirc loop shall be used.

3. $VOL_{(x)}$ - VOLUME of structural waste - The pipe volume calculations use the following tables and variables:
 - a. PIPE - (cups per foot) the baseline, unverifiable in the field new construction, and actual construction. (

LENGTH OF PIPE THAT HOLDS 8OZ OF WATER				
	3/8" CTS	1/2" CTS	3/4" CTS	1" CTS
	ft/cup	ft/cup	ft/cup	ft/cup
K	9.48	5.52	2.76	1.55
L	7.92	5.16	2.49	1.46
M	7.57	4.73	2.33	1.38
CPVC	N/A	6.41	3.00	1.81
PEX	12.09	6.62	3.34	2.02

b. FLHTm - (feet) Floor Height Vertical Multipliers - this variable is dependent upon the foundation type, location of the water heater, the location DHW using fixtures, and the number of floors. It will be the

same for both the baseline and unverifiable in the field new construction.

- i. 1 story with a basement where the water heater is in the basement but there are no DHW using fixtures in the basement = 1
 - ii. 1 story with a crawlspace where the water heater is in the crawlspace = 1
 - iii. 1 story with a slab on grade = 1.5
 - iv. 1 story with a crawlspace and the water heater is either in the/ in garage or somewhere on the 1st floor = 1.5
 - v. 2 story with a slab on grade = 1
 - vi. 2 story with a basement where the water heater is in the basement but there are no DHW using fixtures in the basement = 2
 - vii. Anything above 2 stories regardless of foundation type or HW location = 1
 - c. $VF_{(x)}$ - Volume Factor - the max amount of water in a pipe in relation to the velocity, which is the water waste as a function of flow rate (real velocity).
4. $VOL_{(e)}$ - (gpd/occ) Volume of structural waste for the baseline as the calculated water volume in DHW pipe supplying the furthest fixture as a worst case.
 - a. $VOL_{(e)} = [(((SQRT(HF_{(e)})*2) + (Floors*FLHTm)) * PIPE)*8] / 128$
5. $VOL_{(v)}$ - (gpd/occ) Volume of structural waste for the indoor use calculation. This variable is provided by one of two methods:
 - a. It is calculated where it is non-verifiable, such as un-built buildings, but where the distance to the furthest fixture can be verified by drawings or visual verification.
 - i. $VOL_{(v)} = [(((EL_{(v)}) + (Floors*FLHTm)) * PIPE)*8] / 128$
 - b. It is replaced in the calculation with the field verified measured volume of water that is collected until the temperature of the water equals 100°F or Celsius equivalent at the furthest fixture for a DHW system.

⁴ Informative note: - Often the master bath shower is the longest distance.

- i. $VOL_{(v)}$ = actual field verified gallons
 - ii. This test shall be performed before any other tests.
 - iii. This test shall use an apparatus that incorporates a thermometer and water catchment vessel. The verifier shall shut off the water once it reaches 95 °F⁵ or Celsius equivalent.
 - c. If there is more than one DHW system, all systems shall be tested for structural waste with the worst performing system entered into the calculation.
- 6. IM is always assumed as (1)
- i. $WF_{(x)}$ - other water fixture use in gpd with sub x corresponding to (v) verified actual/proposed or (e) baseline [$(FF_{(v/f)} * IM)$]
 - i. Other water fixtures (WF) shall be included as a direct use item in both the baseline and actual with the same gpd use if verified as present.
 - ii. WF is for other water fixtures or water using appliances that do not have an established industry baseline efficiency. In all cases the baseline is zero, meaning no device. This includes:
 - 1. Water softeners gpd per manufacturer .
 - 2. Humidifiers - gpd per the manufacturer.
 - 3. Fountains and spas- Water loss usage factor gpd shall be based on pan evaporation rates multiplied by the area.
 - 4. Water filters – reverse osmosis is 4 to 1 waste to consumption
 - 5. Evaporative Coolers - gpd per the manufacturer.
- j. $Reuse_{(v)}$ = WRI_CAPTURE_INDOOR_USE
- k. VL - Verified Leaks
 - i. Leaks are included as a direct use item. Baseline is no leaks. Included in both the if verified as present for assessments or final ratings.
 - ii. Leaks are not included in preliminary or improvements modeling for the following reasons:
 - 1. New construction project water using items are presumed to be installed correctly for preliminary ratings.
 - 2. Existing & verified projects are typically tested and corrected if the pressure test fails.
 - 3. Including leaks in the baseline (whether actual or presumed) can potentially artificially lower the WRI.⁶

2. Factors & Multipliers

- a. $CF_{(x)}$ - Cubic feet with sub (x) corresponding to the specific water using item.
 - i. This value is entered based on field verification for actual CF.
 - ii. The baseline uses the proposed CF as entered as a part of the baseline calculations.
- b. $FF_{base(x)}$ - Fixture Factor with sub (x) corresponding to the specific water using item.
 - i. $FF_{base(x)}$ variables are not verified but are provided per the sources listed below each variable.
 - ii. The baseline Fixture Factors of each specific fixture are as follows:
 - 1. Toilets (8) gpd/occ Sources:
 - a. EPAAct 1992

⁵ Informative note: By the time the verifier sees 95 degrees and reaches to shut off the water, the thermometer reads 100 degrees.

⁶ Informative note: Leaks are not included in the baseline for the following reasons: New construction is assumed to be installed correctly for preliminary ratings. Existing and verified is typically tested and corrected if the pressure test fails. Including leaks in the baseline (whether actual or presumed) can artificially lower the WRI.

- 2. Compact: 4.0 gpc
- c. Existing dishwashers (unless a cut sheet is provided or some other proof of efficiency is provided)
 - i. This default list includes new construction projects where old appliances are re-installed from a previous residence.
 - ii. If purchased after January 29, 2016 and has an Energy Star Label:
 - 1. Standard: 3.5 gpc
 - 2. Compact: 3.1 gpc
 - iii. If purchased after August 11, 2009 but before January 29, 2016 and has an Energy Star Label:
 - 1. Standard: 5.8 gpc
 - 2. Compact: 4.0 gpc
 - iv. If purchased before August 11, 2009 and either has an Energy Star Label or no label:
 - 1. Standard: 6.5 gpc
 - 2. Compact: 4.5 gpc
- 2. Clothes Washer defaults
 - a. New construction / NEW clothes washers (unless a cut sheet is provided or some other proof of efficiency is provided)
 - i. Assume Basic Energy Star
 - ii. Water Factor of 4.3
 - iii. CF of 4 unless known via documentation or labeled on the unit
 - iv. Source: "Clothes Washers Key Product Criteria" as of March 7, 2015 as provided by the Energy Star Program
 - b. Existing clothes washers (unless a cut sheet is provided or some other proof of efficiency is provided)
 - i. This default list includes new construction projects where old appliances are re-installed from a previous residence.
 - ii. Source: "Clothes Washer Product Snapshot May 2008" as provided by the Energy Star Program
 - iii. If purchased after March 7, 2015 and has an Energy Star Label:
 - 1. Water Factor of 4.3
 - 2. CF of 4 unless known via documentation or labeled on the unit
 - iv. If purchased after January 1, 2011 but before March 7, 2015 and has an Energy Star Label:
 - 1. Water Factor of 6
 - 2. CF of 4 unless known via documentation or labeled on the unit
 - v. If purchased after July 1, 2009 but before January 1, 2011 and has an Energy Star Label:
 - 1. Water Factor of 7.5
 - 2. CF of 4 unless known via documentation or labeled on the unit
 - vi. If purchased after January 1, 2007 but before July 1, 2009 and has an Energy Star Label:
 - 1. Water Factor of 8
 - 2. CF of 4 unless known via documentation or labeled on the unit

- vii. NON-ENERGY STAR labeled washers or washers purchased before January 1, 2007:
 - 1. Water Factor of 9.5
 - 2. CF of 4 unless known via documentation or labeled on the unit
- d. Floors - number of floors of conditioned space - Do not include the basement if present. It is accounted for elsewhere through the FLHTm variable. See Structural Waste for more information.
- e. OCC - Occupancy Factor
 - i. General project occupancy based on IRC and ASHRAE 62.2,
 - ii. $OCC = \text{number of verified code recognized bedrooms} + 1$
- f. $OCC_{(MB)}$ - Master Bedroom Occupancy
 - i. Assumption that if a master bedroom is present, then at least two of the calculated occupants will be attributed to it.
- g. IM – Inclusion Multiplier
 - i. If planned for the project or verified as actually installed in the project it equals 1, otherwise 0. Will be the same for the baseline.
 - ii. If a dishwasher, bathtub, or clothes washer will not be used anywhere within the project, the IM shall be set to zero. Verification shall confirm that there are no installed connections. Will be the same for the baseline.
- h. $FFact_{(x)}$ - Actual verified fixture or appliance flow with sub x corresponding to the specific water using item.
- i. $FFactMB_{(x)}$ - Actual verified fixture flow for MASTER BATH fixtures with sub x corresponding to the specific water using item.
- j. $FFactOTHER_{(x)}$ - Actual verified fixture flow for all other fixtures not including master bath fixtures with sub x corresponding to the specific water using item.
- k. $UF_{(x)}$ - Use Factor with sub x corresponding to the specific water using item. The Use Factors of each specific fixture per occupant per day are from the following:
 - i. The listed $UF_{(x)}$ factors are not verified but are provided per the sources listed below each factor.
 - ii. The Use Factor of each specific fixture will be the same for both the baseline and the verified actual / proposed as follows:
 - 1. Toilets (5) upd/occ Source:
 - a. EPA ESMFHR PPC 1.3 of October 30, 2013
 - 2. Showerheads
 - a. WITHOUT TSV (5.382) upd/occ Source:
 - i. REUWS 2016
 - b. WITH TSV (4.7035) upd/occ Sources:
 - i. REUWS 2016
 - ii. Based on "Pilot Study for a Thermostatic Shower Restriction Valve" by Anders Wood, Cadmus, Boulder, CO and Joseph D'Acquisto, PPL Electric, Allentown, PA
 - iii. Consultation with Gary Klein, President of Gary Klein & Associates.
 - iv. showerheads shall have tsv installed to use this factor
 - 3. Bathtubs (.07) upd/occ Source:
 - a. REUWS 2016
 - 4. Lavatories (1.25) upd/occ Source:
 - a. EPA ESMFHR PPC 1.3 of October 30, 2013
 - 5. Kitchen Faucets (4) upd/occ Source:

- a. EPA ESMFHR PPC 1.3 of October 30, 2013
- 6. Dishwashers (.26) upd/occ Source:
 - a. REUWS 2016
- 7. Clothes Washers (.78) upd/occ Source:
 - a. REUWS 2016 (single family projects only)
- 8. Structural Waste (1) upd/occ Source:
 - a. Assumption is the worst case - that all DHW supply pipes are uninsulated and that the hot water has time to cool down between occupant uses for each occupant.

3. Indoor Use Calculation:

$$\text{WRI_INDOOR_BASELINE}_{(gpd)} = [T_{(e)} + S_{(e)} + B_{(e)} + L_{(e)} + F_{(e)} + D_{(e)} + CW_{(e)} + SW_{(e)} + WF_{(e)} + VL]$$

$$\text{WRI_INDOOR_USE}_{(gpd)} = [T_{(v)} + S_{(v)} + B_{(v)} + L_{(v)} + F_{(v)} + D_{(v)} + CW_{(v)} + SW_{(v)} + WF_{(v)} + VL] - \text{Reuse}_{(v)}$$

WATER CAPTURE AND USAGE

Capture Calculations

1. Variables (*the sub (x) for each variable is either the (v) verified actual/proposed or (e) baseline unless noted otherwise*):
 - a. RSF_(x) - Verified Rainwater Square feet with sub (x) corresponding to the specific capture sf for Rainwater with (r) roof or (s) site
 - b. SS_(x) - Verified Site surface texture (*The California Water Boards*)

Asphalt <Default>	0.83
Concrete	0.88
Brick	0.78
Patios, stone or other pavers	0.88
NONE	0.00
Unknown - Needs further verification	0.50

- c. RS_(x) - Verified Roof surface texture (*NEW MEXICO OFFICE OF THE STATE ENGINEER & "Roof selection for rainwater harvesting: Quantity and quality assessments in Spain"*)

Asphalt / sloped <Default>	0.90
Concrete or Tile / sloped	0.90
Metal / sloped	0.95
Tar & Gravel / sloped	0.80
Membrane / sloped	0.90
Concrete or Tile / flat	0.81
Foam & Gravel / flat	0.62
Foam / flat	0.90
Membrane / flat	0.90

Unknown - Needs further verification	0.50
**shakes are not allowed by code	

- d. $RC_{(x)}$ - Rainwater capture in gpmth (Sitewater is included in this calculation) = $[(RSF_{(r)} * CUR * RS_{(x)}) + (RSF_{(s)} * CUR * SS_{(x)})]$
- e. $GC_{(x)}$ - Greywater capture in gpmth = $[(S_{(x)} * UF_{(s)} * cUF_{(s)}) + (B_{(x)} * UF_{(b)} * cUF_{(b)}) + (L_{(x)} * UF_{(L)} * cUF_{(L)}) + (CW_{(x)} * UF_{(CW)} * cUF_{(CW)})]$
- f. $BC_{(x)}$ - Blackwater capture in gpmth = $[(T_{(x)} * UF_{(t)} * cUF_{(t)}) + (F_{(x)} * UF_{(f)} * cUF_{(f)})]$
- g. $RT_{(x)}$ - Rainwater tank sizing = $[CS_{(r)} * (RUi + RUo) * TSF_{(r)}]$
- h. $GT_{(x)}$ - Greywater tank sizing = $[CS_{(g)} * (GUi + GUo) * TSF_{(g)}]$
- i. $BT_{(x)}$ - Blackwater tank sizing = $[CS_{(bw)} * (BUi + BUo) * TSF_{(bw)}]$

2. Usage Calculations

- a. $RUi_{(x)}$ - Rainwater usage INDOOR in gpmth = $[(S_{(x)} * UF_{(s)} * cUF_{(s)}) + (B_{(x)} * UF_{(b)} * cUF_{(b)}) + (L_{(x)} * UF_{(L)} * cUF_{(L)}) + (CW_{(x)} * UF_{(CW)} * cUF_{(CW)}) + (T_{(x)} * UF_{(t)} * cUF_{(t)}) + (F_{(x)} * UF_{(f)} * cUF_{(f)}) + (D_{(x)} * UF_{(d)} * cUF_{(d)})]$
- b. $GUi_{(x)}$ - Greywater usage INDOOR in gpmth = $[(S_{(x)} * UF_{(s)} * cUF_{(s)}) + (B_{(x)} * UF_{(b)} * cUF_{(b)}) + (L_{(x)} * UF_{(L)} * cUF_{(L)}) + (CW_{(x)} * UF_{(CW)} * cUF_{(CW)}) + (T_{(x)} * UF_{(t)} * cUF_{(t)}) + (F_{(x)} * UF_{(f)} * cUF_{(f)}) + (D_{(x)} * UF_{(d)} * cUF_{(d)})]$
- c. $BUi_{(x)}$ - Blackwater usage INDOOR in gpmth = [FUTURE]
- d. $RUo_{(x)}$ - Rainwater usage OUTDOOR in gpmth = $[RR_{(x)} - ((OUTRirr_{(x)} * cUF_{(OUTRirr)}) + (OUTRdi_{(x)} * cUF_{(OUTRdi)})]$
- e. $GUo_{(x)}$ - Greywater usage OUTDOOR in gpmth = $[GR_{(x)} - (OUTGirr_{(x)} * cUF_{(OUTGirr)}) + (OUTGdi_{(x)} * cUF_{(OUTGdi)})]$
- f. $BUo_{(x)}$ - Blackwater usage OUTDOOR in gpmth = $[BR_{(x)} - (OUTBdi_{(x)} * cUF_{(OUTBdi)})]$
- g. $RR_{(x)}$ - Rainwater remaining/available for outdoor usage in gpmth = $[(RC - RUi)]$
- h. $GR_{(x)}$ - Greywater remaining/available for outdoor usage in gpmth = $[(GC - GUi)]$
- i. $BR_{(x)}$ - Blackwater remaining/available for outdoor usage in gpmth = [FUTURE]
- j. $T_{(v)}$ - Verified toilet use in gpd from the indoor water use calculations
- k. $S_{(v)}$ - Verified shower use in gpd from the indoor water use calculations
- l. $B_{(v)}$ - Verified bathtub use in gpd from the indoor water use calculations
- m. $L_{(v)}$ - Verified lavatory use in gpd from the indoor water use calculations
- n. $F_{(v)}$ - Verified kitchen faucet use in gpd from the indoor water use calculations
- o. $CW_{(v)}$ - Verified clothes washer use in gpd from the indoor water use calculations
- p. $OUTRirr_{(x)}$ - Rainwater outdoor use as surface irrigation
- q. $OUTRdi_{(x)}$ - Rainwater outdoor use as sub-surface irrigation
- r. $OUTGirr_{(x)}$ - Greywater outdoor use as surface irrigation
- s. $OUTGdi_{(x)}$ - Greywater outdoor use as sub-surface irrigation
- t. $OUTBdi_{(x)}$ - Blackwater outdoor use as sub-surface irrigation

3. Factors & Multipliers

- a. CUR - Conversion unit for 1" of rainfall volume in one square foot of area
- b. $TSF_{(x)}$ - Tank safety factor with sub (x) corresponding to (r) Rainwater or (g) Greywater or (bw) blackwater
- c. $UF_{(x)}$ - Use Factor with sub (x) corresponding to the specific water using item from the indoor water calculations
- d. $cUF_{(x)}$ - Capture Use Factor with sub (x) corresponding to the specific water using item
- e. $CS_{(x)}$ - Capture Systems (qualified) with sub (x) corresponding to (r) Rainwater or (g) Greywater or (bw) blackwater

4. Reuse Calculations:

$$WRI_CAPTURE_INDOOR_USE = [(((RUi_{(x)} + GUI_{(x)} + BUi_{(x)}) * 12) / 365)]$$

$$WRI_CAPTURE_OUTDOOR_USE = [(RU_{O(x)} + GU_{O(x)} + BU_{O(x)})]$$

The above calculations are limited by the final tank size and qualified capture system for each type of alternative water source system.

Outdoor Calculations. The outdoor water use shall be calculated as follows.

1. Variables:

- a. MAX_ALLOW_LANDSCAPING_(x) - verified landscaping in square feet of area.
 - i. DEFAULTS - In order for the WRI to be calculated, a portion of outdoor water use needs to be attributed. The calculation shall provide an automatic minimum of 10% of the remaining landscapeable so that the WRI verifier can input this default for the project information inputs and set it to "Trees - High" and "No Irrigation" for the outdoor calculation.
- b. MEM_(x) - Maximum ETo Monthly with sub (x) corresponding to month - this variable is as per the EPA provided data as noted in section "DATA" item #2.
- c. OUTReuse_(v) = WRI_CAPTURE_OUTDOOR_USE - it is derived from the Reuse Calculations.
- d. ZSF_(x) - zone square footage area - verified landscape zone with verified water using plant material as per comparative identification to resources provided by the USDA, a local cooperative extension, or landscape professional.
- e. LWR_(x) - Line item calculated landscape watering requirement based on verified information with sub (x) corresponding to the line item entry

$$LWR_{(x)} = [\sum_{n=1}^{12} ((MEM(n) * WD) - ARF(a)) * ZSF(a) * CUR(a)) UF(a)) * (1/IF(a))]$$
 where n is the months 1 through 12.

2. Factors & Multipliers

- a. CUR - Conversion unit for 1" of rainfall volume in one square foot of area
- b. IF_(x) - irrigation factor - The efficiency of a specific type of irrigation as per the draft ANSI/ASABE S623
- c. WD_(x) - water demand - amount of water needed before plant material shows a significant amount of stress as per the draft ANSI/ASABE S623.
 - i. For outdoor exposed pools, spas, and fountains, the water demand WD is based on an **uncovered** feature with a K_L of 0.80 and DU_{LQ} of 0.65.
 - ii. For outdoor **covered** pools, spas, and fountains, the water demand WD has no distinction from uncovered, except for pools with motorized covers.
- d. oUF_(x) - Outdoor Use Factor - this value is zero when the month is not a watering month as per the "World Water and Climate Atlas" provided by the International Water Management Institute.
- e. ARF_(x) - Average Reduction Factor - allowable WD reduction based on the verified presence and operation of:
 - i. Rain Sensor
 - ii. EPA Watersense Smart Controller
 - iii. A combination of i and ii that integrates daily weather tracking

3. Outdoor Use Calculation:

$$WRI_OUTDOOR_USE_{(gpy)} = [\sum_{n=1}^{\infty} LWR(n)] - OUTReuse_{(v)}$$

$$WRI_OUTDOOR_BASELINE_{(gpy)} = [\sum_{n=1}^{12} MEM(n) * MAX_ALLOW_LANDSCAPING * UF(e) * CUR]$$

where n is the months 1 through 12.

Water Rating Index Calculation. The WRI calculation shall be as follows.

1. Variables:
 - a. WRI_INDOOR_USE_(gpd) - is in gallons per day and converted to gpy for the WRI calculation. It is derived from the Interior Water Use calculations.
 - b. WRI_OUTDOOR_BASELINE_(gpy) - is in gallons per year and is derived from the Exterior Water Use calculations
2. Factors & Multipliers
 - a. QTy - Quantity multiplier for water use per year conversion
3. Calculation:

$$\text{WRI} = \frac{((\text{WRI_INDOOR_USE}_{(gpd)} * \text{QTy}) + \text{WRI_OUTDOOR_USE}_{(gpy)})}{((\text{WRI_INDOOR_BASELINE}_{(gpd)} * \text{QTy}) + \text{WRI_OUTDOOR_BASELINE}_{(gpy)})} * 100$$