

**DEPARTMENT OF COMMUNITY PLANNING AND DEVELOPMENT AND  
DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT RULES GOVERNING  
GREEN BUILDINGS**

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**ARTICLE I. GENERAL PROVISIONS**

**Section 1.01 Authority.**

These rules and regulations are adopted by the City and County of Denver’s Executive Director of the Department of Community Planning and Development pursuant to Article II of Chapter 12 (“Community Planning and Development” or “CPD”) of the Denver Revised Municipal Code of the City and County of Denver (“DRMC”) and by the City and County of Denver Board of Public Health and Environment promulgated by the Manager of the Department of Public Health and Environment in accordance with the authority in Denver Charter Section 2.12.3. These rules and regulations are adopted for the purpose of administering and enforcing the provisions of Green Buildings, codified at Article XIII, Chapter 10 (Buildings and Building Regulations) of the DRMC (the “Green Buildings Ordinance”).

**Section 1.02 Severability.**

Should any section, clause, or provision of these regulations be declared by a court of competent jurisdiction to be invalid, such decision shall not affect the validity of the regulations as a whole, or any part thereof, other than the part declared to be invalid.

**Section 1.03 Definitions.**

Terms or phrases specific to or introduced in this document are defined below and/or referenced to equivalent terms in the Green Buildings Ordinance

*Addition* - Means an extension or increase in gross floor area or height of a building or structure. A connecting element of limited width as required by the International Building Code for a pedestrian walkway does not create an addition to a building.

*Annual benchmarking report* – The report provided each year to the Department of Public Health and Environment to meet the requirements of Chapter 4, Article V “ENERGY EFFICIENCY IN COMMERCIAL AND MULTIFAMILY BUILDINGS”.

*Available roof space* - Means the total roof area of a building excluding the following:

- (1) Private terraces no greater in area than the gross floor area of the abutting unit at the roof level;
- (2) Outdoor amenity spaces of buildings, including, but not limited to, areas for recreational or social use;
- (3) Areas of rooftop mechanical, electrical or other equipment, including cell towers or other equipment leasing space on the roof, and all required clearances around these areas;
- (4) Areas covered by skylights;
- (5) Areas consisting of glass-covered atriums;
- (6) Areas covered with glazing (windows); and
- (7) Areas for renewable energy devices.

*Building* - Means any structure used or intended for supporting or sheltering any use or occupancy. The boundary of any single building is defined by its surrounding exterior walls. Party walls as constructed in accordance with the International Building Code shall create separate buildings.

*Building Official* - Means the person authorized and directed to act on behalf of the Building Permitting and Inspections Services in the interpretation and enforcement of the Building Code of the City and County of Denver, and appointed by the Executive Director of Community Planning and Development.

*Building roof area* – The area of the building, measured horizontally, that is covered by roofs.

*Campus* - Means a tract of contiguous property with one or more owners and that contains or will contain more than one building, that is planned, developed and operated as an integrated facility for a number of individual uses with special attention to coordinated circulation, parking, utility needs, aesthetics and compatibility. For purposes of this definition, the presence of public rights-of-way shall not destroy contiguity of land area. A campus may contain only existing buildings, existing buildings and proposed new buildings, or only proposed new buildings.

*Character defining roof* – A *visible roof* where the roof's relationship to the overall shape of the building, as well as the roof's distinctive materials, craftsmanship, and/or decorative details are important to the overall visual character of the building; if the materials, color or shape of the roof were to change, it would impact the visual character of the building.

*Cool Roof* – A roof or portion of a roof containing roof covering material meeting the solar reflectance values in Table 1 in order to mitigate or assist in reducing urban heat island effect.

*Denver Building and Fire Code* - Has the same meaning as in Section 10-16, D.R.M.C.

*ENERGY STAR Portfolio Manager* - The online tool created by the U.S. Environmental Protection Agency used to measure and track a building's energy use, water consumption, and greenhouse gas emissions.

*Energy Use Intensity (EUI)* – The energy used (kbtus) per square foot.

*Executive director of CPD* - Means the executive director of community planning and development, or his/her designee.

*Executive director of DDPHE* - Means the executive director of the department of public health and environment, or his/her designee.

*Green space* - Means any area that is open to the sky and proposed to contain trees, groundcover, shrubs, urban agriculture, natural grass/turf, or vegetated roofs.

*Greenhouse* -Means a structure or a thermally isolated area of a building that maintains a specialized sunlit environment exclusively used for, and essential to, the cultivation, protection

or maintenance of plants, that sells its commodities for a profit, or on behalf of a non-profit, and is constructed or planned to be constructed as either an F-1 occupancy or a U occupancy.

*Gross floor area* – The floor area within the inside perimeter of the exterior walls of the building under consideration, exclusive of vent shafts and courts, without deduction for corridors, stairways, ramps, closets, the thickness of interior walls, columns, or other features. The floor area of a building, or portion thereof, not provided with surrounding exterior walls shall be the useable area under the horizontal projection of the roof or floor above. The gross floor area shall not include shafts with no openings, interior courts, or areas used exclusively for the storage or parking of vehicles.

*Individual roof section* - Means a portion of roof bounded on all sides by one or more of the following features: a wall or parapet; the roof edge; an expansion joint; or a roof divider.

*International Building Code (IBC)* - Means the 2015 International Building Code, as amended by the 2016 Denver amendments and all subsequent amendments and reenactments.

*International Fire Code (IFC)* - Means the 2015 International Fire Code, as amended by the 2016 Denver amendments and all subsequent amendments and reenactments.

*International Energy Conservation Code (IECC)* - Means the 2015 International Energy Conservation Code, as amended by the 2016 Denver amendments and all subsequent amendments and reenactments.

*International Plumbing Code (IPC)* - Means the 2015 International Plumbing Code, as amended by the 2016 Denver amendments and all subsequent amendments and reenactments.

*Low-sloped roofs* – A roof having a slope less than 2 units vertical in 12 units horizontal.

*Net zero energy building* - Means an energy-efficient building where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy.

*Owner* - Means any person, agent, operator, entity, firm, or corporation having any legal or equitable interest in the building or property; or any person authorized to act on the owner's behalf.

*Renewable energy device* - Means a device that obtains energy derived from solar radiation, wind, landfill gas, biomass, the internal heat of the earth, or another source with the approval of the departments of community planning and development and public health and environment.

*Residential building* - Means a building where more than sixty percent (60%) of the gross floor area of the building is used, designed or intended to be used for a household living use type as defined in the Denver Zoning Code, including accessory residential uses; however, a residential building shall not include a nursing home or hospice use, a residence for older adults use, or a lodging accommodation use, all as defined in the Denver Zoning Code.

*Roof* – The overhead structural component of a building which functions primarily to shelter the interior of the building from the effects of weather and the infiltration of water.

*Roof covering materials* – The exposed covering or coating of a roofing system or roof structure protecting the building.

*Roof recover* – The process of installing an additional layer of roof covering over a prepared existing roof covering without removing the existing roof covering.

*Roof replacement* -- The process of removing the existing roof covering, repairing any damaged substrate, and installing a new roof; or the reconstruction or renewal of any part of an existing roof for the purposes of its maintenance.

*Roof section*– A portion of roof bounded on all sides by one or more of the following features: a wall or parapet, the roof-edge, an expansion joint or a roof divider.

*Solar Reflectance* – The reflective properties of roofing materials and coatings as tested and rated by the Cool Roof Rating Council for any of the following values: Initial solar reflectance, 3-year-aged solar reflectance, initial solar reflectance index (SRI) and 3-year-aged solar reflectance index (SRI).

*Steep-sloped roofs* – A roof having a slope equal to or greater than 2 units vertical in 12 units horizontal.

*Total roof area* - Means the square footage of all roofs and roof sections located on a building. Roofs covering a story or stories below grade, as determined in accordance with the International Building Code as adopted in the Denver Building and Fire Code, shall not be included in the calculation of total roof area of a building.

*Urban Agriculture* - The process of cultivating and processing herbs, fruits, flowers and or vegetables.

*Vegetated roof* - Means an assembly of interacting components designed to waterproof and normally insulate a building's top surface that includes, by design, vegetation and related landscape elements. A vegetative roof shall meet requirements as set forth in rules and regulations. Another term for vegetated roof is a green roof.

*Visible roof* – A *roof section* that is at least partially visible from a person of average height in a public vantage point such as a city park, public street, campus grounds, or a private street with a public access easement.

#### **Section 1.04 Green Buildings Ordinance compliance options.**

The Green Buildings Ordinance contains various compliance options and the requirements associated with those options. Those requirements and options are listed in Appendix A to these rules and regulations.

## **ARTICLE II: GENERAL ADMINISTRATION**

### **Section 2.01 Process for determining whether ordinance applies to project.**

The Building Official shall have the sole responsibility for determining whether a project must comply with the Green Buildings Ordinance or if the project is subject to an applicable exemption as outlined in the ordinance. The Building Official shall also be responsible for verifying the owner's selected compliance path, and that it meets all applicable code requirements in consultation with other agencies.

### **Section 2.02 No permits issued until city approves green building requirements.**

The Building Official shall not issue any building or roofing permits for a project subject to the provisions of the Green Buildings Ordinance, except for permits such as those for shoring, preparatory demolition, phased construction, or foundation permits, prior to a project documenting compliance with the Green Buildings Ordinance.

### **Section 2.03 Permitting requirements.**

- (a) The Building Official is delegated the authority to establish submittal requirements to document compliance with the Green Buildings Ordinance. These requirements will be available on CPD's webpage and at CPD's offices. Regardless of compliance option, each building permit submittal that includes a roof replacement or a new roof must provide the building's total roof area on the roof plan.
- (b) Buildings 25,000 or greater in gross floor area, including those who must only comply with the provision of a cool roof, must submit required documents for review when constructing either a new roof or a roof replacement, or seeking to document compliance as a Campus as outlined in Article V. Owners seeking a character defining roof determination shall submit the required documentation as outlined in Article III. Renewable energy devices being used to fulfill a Green Buildings Ordinance requirement shall also be submitted for review, regardless of the size of the system.
- (c) The owner of a building subject to the Green Buildings Ordinance shall submit to CPD a Green Building Declaration Form for either a new or existing building. This form will be available on CPD's website.
- (d) Depending on the compliance method chosen, required permits are subject to change, but are summarized below. Any new construction, additions, or roof replacement that includes compliance with the Green Buildings Ordinance, shall follow the procedures for permit issuance in the administrative section of the Denver Building and Fire Code . Owners are required to comply with all other applicable City regulations and permit requirements.
- (e) Any new construction, addition, or roof replacement that includes a vegetated roof must receive a separate permit for the vegetated roof (a commercial construction permit for a green roof), in addition to a roof permit for the underlying roof/waterproof membrane of the building. A Denver licensed green roof installer must sign the permit form for the vegetated roof.
- (f) For vegetated roofs, the following additional permits are required:
  - (i) A plumbing permit for irrigation on the vegetated roof which may include a

backflow preventer so long as the permit form is signed by a licensed plumber. If an irrigation contractor signs the permit form, then a separate plumbing permit shall be required for the backflow preventer and associated equipment.

- (ii) Fire prevention for extension of any standpipes on existing buildings.
- (g) A separate electrical permit is required for any renewable energy device. A zoning permit will also be required for all solar panels that do not meet the definition in the Denver Zoning Code for “solar panels, flush-mounted”.
- (h) A site development plan (SDP) and resulting zoning permit, if applicable, is required for green space located at grade.
- (i) As required by the Denver Building and Fire Code and associated policies, additional permits shall be obtained for related work, including, but not limited to:
  - (1) General Construction;
  - (2) Roofing;
  - (3) Fire Protection systems;
  - (4) Mechanical systems;
  - (5) Plumbing systems;
  - (6) Electrical systems;
  - (7) Irrigation systems; and
  - (8) Zoning permits.

#### **Section 2.04 Inspection requirements.**

The following inspection requirements are in addition to any other required inspections of issued permits, including but not limited to, final roof inspection and final building inspection for vegetated roof.

- (a) Pre-construction meeting required: Upon issuance of a roofing permit and vegetated roof permit (under a commercial construction permit for a green roof), the roofing contractor and green roof installer must schedule a pre-construction meeting with the appropriate construction inspector prior to beginning construction on the building’s roof.
- (b) Leakage testing report for a vegetated roof: Prior to installation of the vegetated roof, an inspection for the roofing permit must be requested in order to verify that the membrane and other aspects of the roofing system have been installed per the approved plans. Additionally, the owner must provide a signed and stamped leakage testing report by a Colorado licensed architect or engineer, or a registered roof consultant, showing a successful leakage test.

- (c) Vegetated roof irrigation inspection: An inspection will be required of the backflow preventer, verification of the control system, water test of the irrigation system, and connection to the irrigation main.
- (d) Any green space not on the roof shall be inspected by CPD’s Zoning/Neighborhood Inspections to ensure compliance with the site development plan and/or zoning permit that documents compliance with the green space requirements.

**ARTICLE III: COOL ROOFS**

**Section 3.01 In General**

The Green Buildings Ordinance requires new buildings containing 25,000 square feet or more of gross floor area, and existing buildings containing 25,000 square feet or more of gross floor area upon a roof replacement or roof recover for more than five percent (5%) of either the total roof area or individual roof section(s) to provide a cool roof. See Appendix A for reference.

**Section 3.02 Requirements.**

- (a) **Applicability.** Roof covering materials shall contain a minimum solar reflectance in accordance with Table 1 for a new roof, roof replacement, or roof recover of new or existing buildings containing 25,000 square feet or greater of gross floor area.

- (b) **Requirements**

Table 1.

	Initial Minimum Reflectance	3-Year Minimum Reflectance	Initial SRI Minimum	3-Year SRI Minimum
<b>Low Sloped Roofs</b> Slope less than 2:12				
Low Slope roofs (except materials specified below).	0.70	0.55	78	64
Low Slope metal roofs	0.50	not available	not available	not available
Low Slope concrete pavers or a concrete surface or stone roofs	0.20	not available	not available	not available
Character defining roof	Per Section 3.02(a)	Per Section 3.02(a)	Per Section 3.02(a)	Per Section 3.02(a)
<b>Step Sloped Roofs</b> Slope 2:12 or steeper				
Step Slope roofs (except materials specified below)	0.25	0.15	39	32

Clay or Concrete roof tile installed on elevated battens	None Required	not available	not available	not available
Character defining roof	Per Section 3.02(a)	Per Section 3.02(a)	Per Section 3.02(a)	Per Section 3.02(a)

NOTE: Owners may apply for an administrative modification when proposing specific roof materials not itemized or included in the above table.

The roofing system shall be designed to prevent condensation. The use of a vapor retarder, air barrier, insulation and ventilation shall be considered to prevent or control where condensation occurs and to allow it to dissipate.

- (i) Where a roof recover or roof replacement project introduces a cool roof where none previously existed, the roof shall be demonstrated, or modified, to meet one of the following designs:
  - (1) Steep sloped roofs shall be designed and installed to meet IBC 1203.2 Ventilation Requirements.
  - (2) Low sloped roofs shall be designed and installed to include at least a Class III vapor retarder at the roof deck in addition to an air barrier at the roof deck, a single layer may be used to provide both preventative measures. The roof shall also be installed with insulation on top of the roof deck that exceeds the R-value of any interior insulation by a minimum of R-18 thermal insulating value, and all other requirements of the International Energy Conservation Code, as amended.
  - (3) The roofing system shall be designed by a professional roofing consultant, architect, or engineer who must submit an analysis of the existing roofing system. The analysis shall calculate and identify the dew-point, and include a section-detail of the roofing system documenting the vapor retarder, air barrier and other roof components used to minimize condensation within the roof system.

**Section 3.02 Exceptions**

- (a) Where approved by the Building Official, the solar reflectance of roof covering materials for use on a character-defining roof may be reduced as is technically and financially feasible to allow the use of materials and colors in keeping with the visual character of the building.
  - (i) A submission requesting a character defining roof determination shall include the following, though the Building Official may ask for additional information:
    - (1) Roof plan (new buildings only or existing buildings if a roof plan exists)
    - (2) Photographs of the building and roof from public vantage points (existing buildings only)



- (3) Elevations (new buildings only – as photographs would not exist)
  - (4) Demonstration of at least one of the following criteria:
    - a. The roof is highly visible and contributes to the architectural identity of the building or its context.
    - b. There are certain roof features important to the profile of the building against the sky or its background, such as cupolas, multiple chimneys, dormers, cresting, or weather vanes.
    - c. The roofing material's color or patterns (such as patterned slate tile) is more noticeable than the shape or slope of the roof.
    - d. The roof is identified as being an integral part of the building's character and an identified feature for any historically designated building in its designation materials. Such historical designation may be local, state or national.
  - (5) The application shall also include general information about the proposed roofing materials, color and finish, the materials' solar reflectance, and the importance of the roof in context of the building or its location.
  - (6) Any other information the Building Official requests in order to make a determination.
- (ii) CPD will use the following process to determine whether a roof is a character defining roof:
- (1) CPD staff shall review all submitted materials to determine if the above criteria are applicable and if the definition of character defining roof is met.
  - (2) The review team shall, at minimum, consist of at least three staff: a member of the Landmark Preservation team, an architectural/structural plan reviewer, and a member of the urban design team. Other staff may be consulted as deemed necessary. The team shall prepare a recommendation to the Building Official who shall have the final determination if the roof may or may not be characterized as a character defining roof.
  - (3) Upon a determination that the roof is a character defining roof, then a roofing permit may be issued using the information provided by the customer.
  - (4) Upon a determination that the roof is not a character defining roof, then the owner shall be notified and must make a resubmittal to provide roofing materials that comply with the cool roof provisions identified above before a roofing permit may be issued.
  - (5) The determination of the Building Official shall be appealable to the Board of Appeals per the Denver Building and Fire Code.
- (b) In the case of a roof recover, where the roof system analysis (item a.iii., above)

determines that the existing roof would need to be replaced to control condensation, the roof section analyzed is exempt from meeting cool roof requirements.

- (c) The following roofs and portions of roofs are exempt from the requirements of Table 1:
- (i) Portions of the roof that include or are covered by the following:
    - (1) Photovoltaic systems or components.
    - (2) Solar air or water-heating systems or components.
    - (3) Vegetated roofs.
    - (4) Above-roof decks or walkways.
    - (5) HVAC systems and components, and other opaque objects mounted above the roof.
  - (ii) Roof covering materials that are swimming pools, sport surfaces (such as tennis courts) and glazing.
  - (iii) Portions of the roof shaded during the peak sun angle on the summer solstice by neighboring buildings or other portions of the same building.
  - (iv) Portions of roofs that are ballasted with a minimum stone ballast of 15 pounds per square foot or, in the case of an existing ballasted roof, the weight of ballast for which the roof was originally designed.
  - (v) The solar reflectance of roof covering materials for use on a visible roof, as defined in Section 3.01, may be reduced for no more than 10% of the total roof area unless a roof is determined to be a character defining roof.
  - (vi) A roof section, as defined in Section 3.01, where not less than 75 percent of the roof covering materials comply with this Section.

## **ARTICLE IV: COMPLIANCE OPTIONS**

### **Section 4.01 In general**

The Green Roofs Ordinance provides a number of options for compliance with green building requirements. Please reference Appendix A for specific compliance options and requirements. The following sections in Article IV provide additional requirements for compliance options.

### **Section 4.02 Green Space Requirements**

- (a) General Administration Requirements
- (i) Owners may provide green space requirements either through providing a vegetated roof, and/or at-grade green space.
  - (ii) Owners cannot use existing green space at their site at the time of permit for a new roof or roof replacement, unless specifically allowed in these rules and regulations. Buildings are allowed to provide more than the required green space and to allow

that to count towards a future building's compliance.

- (iii) For at-grade green space, plans shall be submitted for review through a site development plan. Submissions shall include at a minimum a cover sheet including the building area calculation, site plan, roof plan, maintenance plan and a landscape plan. If new lighting is being installed, then the SDP must also include a photometric plan. This SDP shall follow the typical SDP process as outlined in the zoning code. The SDP must contain the following note when green space is chosen as a compliance method for this ordinance.

Green space is shown on this site development plan for compliance with Article XIII of Chapter 10, must be maintained, and cannot be used for purposes other than that shown on this site development plan. Should a future amendment change the amount or location of this green space, then additional green space must be provided to document compliance or payment of cash-in-lieu fees will be required.

- (iv) Vegetated roof plans should be submitted through the site development plan and the building permitting process.

(b) Vegetated roofs

(i) General Requirements –

(1) Permitting:

- a. All vegetated roofs on commercial buildings (i.e. buildings constructed to meet the International Building Codes) shall require a Green Roof Construction Permit issued to a licensed Green Roof contractor.
- b. As required by the Denver Building and Fire Code and adopted policies, additional permits shall be obtained for related work, including, but not limited to:
  - i. General Construction
  - ii. Roofing
  - iii. Fire Protection systems
  - iv. Plumbing systems
  - v. Irrigation systems

(2) Code Compliance:

- a. The design and construction of vegetated roofs shall comply with Denver Building and Fire Code provisions and with this standard.

Where a vegetated-roof is intended for occupancy, Denver Building and Fire Code requirements for occupied roof-decks shall apply in addition to the requirements for vegetated roofs.

- b. Adopted Denver Building and Fire Code provisions governing vegetated roofs include, but are not limited to, the following current sections and standards these provisions are subject to change through code adoption cycles:

- i. IBC Sections 1503, 1505.10, 1507.16, 1507.16.1, 1607.12.3, & 1607.12.3.1
- ii. IFC Sections 304.1.2, 317 & 905.3.8
- iii. IPC Sections 1106 & 1108
- iv. ANSI/SPRI VF-1, ANSI/SPRI RP-14, ASCE 7, ASTM E108, ASTM E2397, ASTM E2396M-15 & ASTM E2788M-18

(3) Design Considerations:

- a. Vegetative roofing systems shall be either extensive, intensive, or semi-intensive systems, and shall include:

- i. Vegetation,
- ii. Growing medium,
- iii. Filter fabric,
- iv. Drainage layer,
- v. Root barrier,
- vi. Waterproofing membrane, and
- vii. Other elements as required by the Denver Building and Fire Code or this standard (insulation, tie-downs, irrigation etc.).

- b. For new buildings, where vegetated roofs are covered by renewable energy devices, the overlapping coverage areas of the vegetated roof and the renewable energy devices shall be allowed to count twice when calculating green roof coverage.

- c. Existing vegetated roofs on existing buildings may be deemed compliant with the Green Buildings Ordinance if they meet the standards of this section.

(ii) Fire Protection

(1) Construction Materials:

- a. The fire-resistance of the structural frame and roof construction supporting the vegetative roof shall comply with the IBC. The

roofing covering material shall be as required by the IBC and ANSI/SPRI VF-1 (tested to ASTM E108).

- b. An owner who desires to install a vegetated roof Owners who Vegetated roofs on buildings of Type V, IV, III, or II-B construction without a tray system shall include permit submittal design information demonstrating the alternative means for providing building ventilation during firefighting efforts and post-fire salvage & overhaul operations. Some examples of recognized methods include mechanical smoke control systems and fixed smoke/heat vents as outlined in IFC 910. An owner seeking this approval should have a pre-meeting with the Denver Fire Department to establish what will be necessary to achieve this goal on their building prior to submitting the vegetated roof permit.

(2) Vegetated Roof Layout:

- a. Area Dividers, Firebreaks & Border Zones shall be provided as required by the IFC and ANSI/SPRI VF-1.
- b. The roof shall include the following clearance zones:
  - i. 3ft-wide vegetation-free border-zones at non-combustible roof rooftop structures, roof joints and penetrations (at parapet walls, penthouses, vents, mechanical equipment, roof drains etc.).
  - ii. 6ft-wide area covered with stone ballast or concrete pavers where vegetative roof systems abut combustible vertical surfaces and when terminating at a Fire Barrier.
  - iii. A 13ft-wide area that meets Class A fire classification requirements shall divide vegetated roofs into areas not exceeding 15,625sf or 125ft in length or width.
  - iv. In buildings less than 4-stories in height, there shall be a minimum 8 foot wide clear perimeter around the edges of the roof.
  - v. In buildings 4-stories and greater in height, all roofs containing vegetated areas shall be afforded access via exit stairways and fixed permanent ladders to upper roofs. Access points shall be separated by minimum of 10 feet from the vegetated areas.
- c. Required clearance zones shall not count towards required green roof coverage.

(3) Fire Protection Systems:

- a. Fire Protection Systems shall comply with the IFC. Where the building requires a standpipe system, it shall extend to the roof.

- b. In high rise buildings, activation of rooftop manual pull stations shall not activate building vertical pressurization systems.

(4) Maintenance:

- a. Maintenance shall be provided as required by the IFC. The requirement for maintenance shall be conveyed by the designer to the building owner, and it shall be the building owner's responsibility to maintain the vegetative roof system.
- b. A maintenance plan shall be submitted as part of the Green Roof permit application and shall include:
  - i. A description of the maintenance and care necessary for the survival of the specified vegetation in the specified growing-media and how it will be provided.
  - ii. A plan for maintaining the design depth of the growing-medium.
  - iii. A plan for replanting the vegetated roof, in the event replanting becomes necessary.
  - iv. A plan for the removal of overgrown, dead and decaying vegetation at regular intervals not less than two times per year.
  - v. A plan for the storage of combustible materials for the maintenance of the roof and compliance with the IFC for such storage.
  - vi. A plan for the winterization and maintenance of irrigation systems.
  - vii. Identification of IBC-compliant access to the vegetated-roof and fall-protection where the vegetated-roof is within 10ft of a roof edge.

(5) Supplemental Irrigation:

- a. An irrigation system is required. Irrigation plans shall be submitted as part of the Green Roof permit application. The system shall be designed as described in the maintenance plan as necessary for the survival of the specified vegetation in the vegetative roofing system.
- b. Plumbing connections shall meet Denver Building and Fire Code including applicable IPC requirements.

(6) Vegetation:

- a. Vegetation shall be specified on plans and coordinated with the maintenance plan.

(iii) Waterproofing

- (1) Code requirements:
  - a. The roof covering materials shall be designed in accordance with the Denver Building and Fire Code, the IBC and ANSI/SPRI VF-1.
- (2) Testing:
  - a. When the roof cover is not impervious to root penetration a root barrier shall be installed.
  - b. Prior to the installation of the vegetative roof system, the roof's water-tightness shall be tested and a report documenting a successful test, signed by a registered roofing consultant or licensed architect or engineer, shall be provided to the building-inspector for approval.
  - c. Testing shall follow ASTM Standards and utilize one of the following methods:
    - i. Flood test
    - ii. Electrified field vector mapping
    - iii. Impedance test
    - iv. Infrared thermal imaging
    - v. Low voltage testing
    - vi. High voltage testing
    - vii. Moisture sensors

(iv) Roof Drainage

- (1) Code requirements: The roof-drainage system shall be designed to meet the IBC and IPC requirements and the requirements of this Standard.
- (2) Design considerations:
  - a. The reference-point for overflow scuppers and drains shall be clearly indicated on drawings to be the roof-membrane and not the vegetated roof surface or other layer above the waterproofing.
  - b. The root-barrier, vegetation, and border materials shall be designed to limit debris and to prevent the blockage of roof drains.
  - c. The roof drainage layer of the vegetative-system shall be designed to improve the ability of plants in the system to survive.
    - i. Systems designed to detain water utilizing geocomposite drainage layers shall meet ASTM E2398-05.
    - ii. Systems designed to detain water with a moisture retention mat and granular drainage layer shall meet ASTM E2396M-15.

(v) Structural Design

- (1) Submittal requirements: Structural design shall comply with the IBC and the submittal requirements shall be as required for commercial construction projects.
- (2) Gravity loads:
  - a. The roof structure and deck shall be engineered to support the load of fully-hydrated growing-media, the vegetative-roof system, and all other design loads.
  - b. Live loads and vegetative-roof loads shall be computed as follows:
    - i. The weight of all landscaping materials shall be considered as dead load and shall be computed on the basis of saturation of the soil as determined in accordance with ASTM E2397.
    - ii. The uniform design live load in unoccupied landscaped areas on roofs shall be 20psf.
    - iii. The uniform design live load for occupied landscaped roofs shall be determined in accordance with IBC Table 1607.1.
- (3) Wind loads: The roofing-system and the additional vegetative-roof system shall be structurally designed to resist wind loads as follows:
  - a. Design meeting ANSI/SPRI RP-14 Wind Design Standard and utilizing ASCE 7 shall be considered to comply with the IBC.
  - b. Documented manufacturer-testing of wind-resistance for proprietary-systems may be accepted by the reviewer in lieu of structural-engineering, as appropriate.
  - c. For buildings over 150ft in height, the submittal shall include design by a wind design engineer or the results of a wind tunnel study.
- (4) Existing structures: Existing structures shall be demonstrated as capable of supporting added loads and, where unable to support a vegetated-roof, shall be modified as required by the Denver Building and Fire Code.

(vi) Vegetative Roofing System –

- (1) Submittal Requirements: The vegetative-system shall be fully specified, including the growing-media and vegetation.
- (2) Growing media:
  - a. Growing media shall be specifically designed for use in vegetative-roofing systems and may be composed of a combination of organic and inorganic materials complying with ASTM performance standards.





- (2) Providing 1,000 cubic feet of uncompacted clay loam soil with an irrigation system is preferred to create an optimal growing condition for the long-term success of large healthy trees.
  - (3) In order for existing trees to be approved and counted towards at-grade green space, a tree protection plan shall be submitted including the following: tree location, species, trunk diameter at 4.5 feet above ground, surveyed drip line of existing tree canopy edge, and a maintenance plan to protect tree health during construction which must include continued irrigation of the tree.
  - (4) Projects proposing to use existing trees for at-grade green space must follow the City’s tree retention and protection specifications. <http://www.denvergov.org/content/dam/denvergov/Portals/747/documents/forestry/tree-protection-detail.pdf>
  - (5) If the tree dies during construction or up to 3 years after completion of construction for an existing building or issuance of a temporary certificate of occupancy or certificate of occupancy, whichever comes first, then the tree shall be replaced with a tree of similar type, as approved by the City Forester, and any resultant green space difference between the existing canopy and the 10-year canopy shall be added elsewhere on the site, or an applicable payment must be made to the Green Building Fund.
- (ii) Groundcover, Shrubs, and Urban Agriculture. In order to comply with required at-grade green space using groundcover, shrubs, or urban agriculture, climate appropriate vegetation shall be used. Proposed vegetation must be included in one of the following resources and be appropriately selected for hardiness zone, light requirements, and water availability:
- (1) “Plant Select” lists. <http://plantselect.org/>
    - a. Tool on the website to help users narrow down the appropriate plant: <http://plantselect.org/plants/find-a-plant/>
  - (2) Colorado Native Plant Society list at: <https://conps.org/gardening-with-native-plants/>
  - (3) Plants meeting the definition of Urban Agriculture.
- (iii) Turfgrass and Xeric Grasses. Turfgrass that does not meet the above standards may be installed in the following amounts. Such installations must be designed to use as little water as possible.
- (1) 25% of the green space requirement may be met with climate appropriate, turfgrass or xeric grasses.
  - (2) An additional 25% of the green space requirement may be met with a climate appropriate, water-wise turfgrass or a xeric grasses blend, if the grass areas also provide pollution removal and volume reduction from adjacent impervious areas per UDFCD’s Urban Storm Drainage Criteria Manual (Volume 3, Chapter 4, Fact Sheet T-1 –Grass Buffer).

- a. For xeric grasses see Table B-3 of UDFCD's Urban Storm Drainage Criteria Manual (Volume 3, Chapter 4, Fact Sheet T-3) at: [https://udfcd.org/wp-content/uploads/uploads/vol3%20criteria%20manual/05\\_T-03%20Bioretention.pdf](https://udfcd.org/wp-content/uploads/uploads/vol3%20criteria%20manual/05_T-03%20Bioretention.pdf)
- (iv) Soil. All projects shall demonstrate that they have met the following soil remediation and irrigation standards:
- (1) Required at-grade green space located in the right-of-way shall conform with Public Works Rules and Regulations for Encroachments in the Public Right of Way.
  - (2) Soil analysis from a credited, local, soil analysis laboratory with experience in local urban soils shall be required when plants are to be installed in greenspace landscaped areas. All soil remediation shall be based on the soil analysis.
    - a. Minimum soil analysis must determine soil texture and structure, pH balance, soil salinity, free lime, organic matter (OM) content, plant available nutrients, and compaction
    - b. Depth of landscape soil analysis shall be 24" for trees and 18" for all other areas
  - (3) Grades shall be set to allow for proper drainage away from structures. Grades shall maintain smooth profiles and be free of surface debris, bumps, and depressions.
  - (4) Private property shrub bed/planting areas shall be mulched to a depth of 2-4". Perennials and groundcover areas shall be mulched with a 3" layer. No weed barrier shall be installed over top of tree root balls.
    - a. Mulch shall be an organic shredded wood mulch certified pathogen, weed and chemical free;
    - b. Surface coverage shall be a minimum 3' radius from the trunk for trees where possible; and
    - c. Mulch shall be kept a minimum of 4-6" away from tree trunks and not touching the base of other woody landscape plants.
  - (5) All landscape plant material and grass will be irrigated with an appropriate automatic system.
- (v) Irrigation.
- (1) When potable water is required to provide supplemental water beyond the stormwater discharge, if applicable, then the irrigation system must meet the following:

- a. Designed to use a maximum of 10 gallons per square foot of potable water irrigation per year
  - b. Automatic system that has rain sensors and evapotranspiration clocks.
  - c. Shrubs and trees shall be installed on a separate zone from turf.
- (2) When a localized system water is used for irrigation salt tolerant plants shall be used. Maintenance for landscape will be by the property owners.
- (vi) Applicability of existing or otherwise required at-grade green space
- (1) New Buildings: Green space must be above-and-beyond any at-grade green space currently required by the zoning code, unless otherwise noted below.
- a. For projects subject to a zoning requirement for open space, all or a portion of that open space requirement can be used to fulfill the green space requirement so long as it complies with the green space standards above. However, any open space on a property that will be dedicated to the City for a designated park shall not count.
  - b. Areas designed to provide water quality treatment of storm water as determined by Public Works may be used to fulfill the green space requirement so long as:
    - i. All water quality treatment is met through a vegetated water quality facility and in conformance with UDFCD's *Stormwater Criteria Manual* (Volume 3, Chapter 4, Factsheets T-3), and/or Public Works' *Ultra Urban Green Infrastructure Guidelines* criteria for vegetated bioretention facilities.
    - ii. If underground, vegetated structural storage systems (Also known as Tree Trenches, or Tree Pits) are utilized to provide both stormwater volume and pollution reduction, then both the tree canopy square footage and the measured square footage for the footprint of the structural modules may be counted toward the green space requirements.
- (2) Existing Buildings: Existing green space cannot be used to meet the green space requirements for existing buildings except when existing green spaces are improved through the following measures:
- a. The addition of trees meeting the standards above.
  - b. The addition of an above-grade water quality facility that is vegetated and in conformance with UDFCD's *Stormwater Criteria Manual* (Volume 3, Chapter 4, Factsheets T-1 or T-3), and/or

Public Works' *Ultra Urban Green Infrastructure Guidelines* criteria for above-ground, vegetated bioretention facilities.

- (3) Projects completed in the right-of-way are not allowed except in the following circumstances:
  - a. An existing building that does not have available at-grade land to provide required green space may provide new street trees within the right-of-way so long as the trees do not reduce sidewalk width below the minimum required by Public Works. Such areas within the right-of-way must provide sufficient soil volume conducive to root development which will sustain tree growth
  - b. A new building may count existing trees that are protected and preserved in the right-of-way. .

#### **Section 4.03 Solar Requirements.**

(a) On-site solar panels.

- (i) Projects providing solar panels to comply with the Green Buildings Ordinance shall submit the information typically required by CPD for the review of such systems. Solar panels are required to have a minimum efficiency rating of 16%, and must provide manufacturer's specifications outlining this efficiency rating with the permit submittal.
- (ii) When a project proposes to provide 70% of the total roof area with solar panels, a roof plan must be provided that clearly outlines the total area of the roof, and identifies all removable elements and areas for removable elements .
- (iii) For existing buildings proposing to provide solar panels that generate at least one hundred percent of the building's electricity usage, the customer must provide the most recent complete year's annual average electricity usage so that CPD may determine that the requirement is met. Solar panels providing electricity to existing buildings that are in place prior to the passage of the Green Buildings Ordinance may count towards this requirement so long as adequate coverage is provided and the panel efficiency rating of 16% is demonstrated.
- (iv) New buildings shall provide an energy model indicating the estimated annual average electricity usage.
- (v) New buildings seeking to provide a renewable energy device other than solar panels, shall submit documentation required to demonstrate that the renewable energy device provides a similar generation capacity as solar panels, and meets the requirements above depending upon the compliance path chosen – either 70% of the available roof area, or an area required to provide 100% of estimated annual average electricity used at the building.

(b) Off-site

- (i) For new construction projects choosing the off-site solar option an energy model indicating anticipated consumption and an affidavit from the building owner committing to purchase the required percentage of off-site solar as demonstrated in the option chosen. Prior to issuance of the CO the building owner must present the minimum five (5) year contract indicating the appropriate amount of solar energy being provided by the utility company.
  - (ii) For existing buildings electricity consumption will be verified through the annual benchmarking report. The building owner must present the minimum five (5) year contract indicating the appropriate amount of solar energy being provided by the utility company.
  - (iii) DDPHE shall review and enforce that off-site solar contracts are renewed after 5 years.
- (c) Net zero buildings. At permit/plan review, the owner must submit an anticipated energy model and EUI that indicates the amount of energy anticipated to be used annually will be offset by the onsite renewable energy source provided in the design documents. At the end of 12 months at 60% of a normal level of occupancy for that building type, the owner must provide a confirmation to DDPHE that the systems and building are performing as anticipated and the building has met the requirements of a Net-zero energy building. The documentation shall include analysis of the solar panels or other renewable energy source and a continuous 12 month period of utility bills starting after the TCO was obtained and 60% of normal occupancy levels were achieved. A variance of 5% will be considered as a successful application. If the variance is greater than 5%, a reevaluation of the system and proposed corrective measures will need to be presented to both CPD and DDPHE.

#### **Section 4.04 Energy Cost Savings**

- (a) The owner must submit (at permit/plan review submission) an energy model indicating the base line code compliance. Additionally, the report must identify those above code items being included in the design and demonstrate the additional above code performance in the report as a separate section to clearly delineate the additional scope of work or systems and or performance features. At the completion of the project a preliminary commissioning report must be submitted indicating that these items have been installed in accordance with the manufacturers recommendations and are performing as designed and intended, prior to obtaining the TCO.
- (b) Substantive requirements. The owner shall demonstrate a minimum of 12% annual energy cost savings above the current Denver Building and Fire Code. For example, under the IECC 2015, projects can use either of the following methods:
  - (i) 2015 IECC - Section C407, Total Building Performance method: Demonstration of a minimum 27% energy cost savings relative to the C407 standard reference design building. Projects must meet all mandatory requirements of the 2015 IECC.
  - (ii) ASHRAE 90.1-2013 - Chapter 11, Energy Cost Budget method: Demonstration of a minimum 12% annual energy cost savings relative to the energy cost budget. Projects must meet all the mandatory requirements of ASHRAE 90.1-2013.

- (iii) Projects using either of these methods should also submit a predicted EUI for the building and the assumptions that went into making that prediction.
- (iv) Projects using either of these methods should meet all other energy code compliance submittal requirements to document compliance with the selected method as required by the City & County of Denver: [https://www.denvergov.org/content/dam/denvergov/Portals/696/documents/Denver\\_Building\\_Code/2016\\_Code\\_Policies/IECC\\_SectionsR101.5.1\\_R103.2\\_C101.5.1\\_C103.2\\_C408.2.4.pdf](https://www.denvergov.org/content/dam/denvergov/Portals/696/documents/Denver_Building_Code/2016_Code_Policies/IECC_SectionsR101.5.1_R103.2_C101.5.1_C103.2_C408.2.4.pdf)
- (v) Additional energy savings or exceptional calculations for loads or efficiency measures that are not already addressed by the methods above may only be claimed with prior approval by the Building Official.

#### **Section 4.05 Building Certification**

- (a) At permit/plan review, the owner must submit the LEED scorecard and all ancillary documentation associated with meeting the criteria for certification. This applies for all alternative methods including, but not limited to, Enterprise Green Communities ratings.
- (b) **New Buildings:** The owner shall achieve LEED Gold, Enterprise Green Communities, National Green Building Standard Gold, or equivalent approved green building certification. For buildings or additions pursuing compliance via certification, the LEED design package or equivalent must be submitted at the time of permitting the building. To be issued a certificate of occupancy, the building must be pre-certified or submit the LEED design review (or equivalent) with a plan for how any requested changes will be made. Proof of certification would need to be submitted to DDPHE 18 months after the certificate of occupancy is given.
- (c) **Existing Buildings:** The owner shall achieve LEED Silver, Enterprise Green Communities, National Green Building Standard Silver/, or equivalent approved green building certification. Certification should be submitted to CDP with the roof permit application.
- (d) **Alternative certification.** The Building Official may allow an alternative method of certification so long as the alternative certification program's criteria encompass the entire building.

#### **Section 4.06 Combination requirements**

- (a) **Green and Renewable Energy-** Owners must submit floor plans, site plans, solar panel location plans, and provide a complete analysis of all area calculations located on all plans for all options including but not limited solar panels on the roof, solar panels on grade, vegetated roofs, at-grade green space, building floor area, roof area, available roof area, mechanical equipment, etc. The submission must clearly identify the desired path/option chosen and the percentages of each aspect of the submission (green & solar). Note that solar area includes code required access and around the panels; however, the vegetated roof area does not include required area for access and other clearances as mentioned in these rules and regulations, the IFC, and the IBC. Green space shall be a minimum of 30% of the required coverage under the alternative coverages of green spaces and on-site solar

panel option allowed in Ordinance Section 10-301a (2)f.4.

- (b) **Green and Off-site Solar** – Owners must submit all of the items noted in the Green and renewable energy option above, as applicable, plus all of the offsite documentation as outlined in section 4.03(b), Off-site solar option.
- (c) **Green and Energy Efficiency.** Owners must demonstrate a minimum of 5% annual energy cost savings above the current City & County of Denver energy code. Under the current energy code, projects can use either of the following methods:
  - (i) 2015 IECC - Section C407, Total Building Performance method: Demonstration of a minimum 20% energy cost savings relative to the C407 standard reference design building. Projects must meet all mandatory requirements of the 2015 IECC.
  - (ii) ASHRAE 90.1-2013 - Chapter 11, Energy Cost Budget method: Demonstration of a minimum 5% annual energy cost savings relative to the energy cost budget. Projects must meet all the mandatory requirements of ASHRAE 90.1-2013.
  - (iii) Projects using either of these methods should also submit a predicted EUI for the building and the assumptions that went into making that prediction.
  - (iv) Projects using either of these methods should meet all other energy code compliance submittal requirements to document compliance with the selected method as required by the City & County of Denver: [https://www.denvergov.org/content/dam/denvergov/Portals/696/documents/Denver\\_Building\\_Code/2016\\_Code\\_Policies/IECC\\_SectionsR101.5.1\\_R103.2\\_C101.5.1\\_C103.2\\_C408.2.4.pdf](https://www.denvergov.org/content/dam/denvergov/Portals/696/documents/Denver_Building_Code/2016_Code_Policies/IECC_SectionsR101.5.1_R103.2_C101.5.1_C103.2_C408.2.4.pdf)
  - (v) Additional energy savings or exceptional calculations for loads or efficiency measures that are not already addressed by the methods above may only be claimed with prior approval by the Building Official.

#### **Section 4.07 Payment to the Green Building Fund**

- (a) An owner whose building is subject to the requirements of the Green Buildings Ordinance may choose to comply by paying an amount to the Green Building Fund. An owner must make this request upon notification from CPD that its development is subject to the Ordinance. Upon the owner's request to comply through payment to the Green Building Fund, CPD shall calculate the appropriate fee to be paid to the fund. The owner must pay the applicable fee at the same time as payment of building permits. CPD will not issue any building permit for a new buildings and additions or roof permit for an existing building until the owner has paid the applicable fee to the Green Building Fund.
- (b) Revenue received through payments to the fund will offset the cost undertaken by the City in providing new or improved green space within the City. In selecting projects for funding, the City will strive to give priority or preference to the following:
  - (i) Low income areas that currently have less green space and trees;



- (ii) Highest impact projects. Prioritize projects that will make substantial impacts in alignment with the uses and purposes outlined in the Green Building Ordinance; and
- (iii) Green spaces located near the buildings that paid into the fund where feasible.

#### **Section 4.08 Energy Program**

- (a) The Energy Program shall be administered by the Department of Public Health and Environment.
- (b) An owner may enroll in the Energy Program at the time of roof replacement, or prior to roof replacement. If the owner enrolls early, then no further action will be required at the time of roof replacement. Enrollment in the Energy Program will be valid for the longer of 20 years or through one roof replacement. When a building owner enrolls in the Energy Program they have up to 5 years from June 1<sup>st</sup> following their enrollment date to demonstrate they have achieved one of the following:
  - (i) ENERGY STAR score of 85 or higher. The score must be maintained annually after initial compliance and will be verified via the building's annual energy benchmarking report.
  - (ii) LEED Silver, Enterprise Green Communities certification or equivalent.
  - (iii) Installation of on-site solar panels, or other on-site energy technologies that achieve equal to or greater additional, new greenhouse gas emission reductions. Solar panels must be a minimum of 16% efficiency and must cover at minimum the lesser of the following areas:
    - (1) 5% times gross floor area
    - (2) 42% of the roof
    - (3) An amount required to meet 100% of estimated average electricity used at the location.
  - (iv) Purchase off-site solar equivalent to 100% of electricity used in the building with a minimum of a 5-year contract. Contract renewal will be required every 5 years.
  - (v) Purchase off-site renewable energy with a minimum of a 5-year contract, contract renewal will be required every 5 years, and reduce EUI as follows:
    - (1) Buildings with a gross floor area of 25,000 – 49,999 square feet will invest in off-site solar equivalent to 10% of the energy used in the building with a minimum 5-year contract and reduce their EUI 5% below their baseline;
    - (2) Buildings with a gross floor area of 50,000 square feet or larger will invest in off-site solar equivalent to 15% of the energy used in the building with a minimum 5-year contract and reduce their EUI 7.5% below their baseline
    - (3) The off-site renewable energy purchase must be met through a minimum five year contract for a subscription, lease, or purchase of a share in a voluntary renewable energy program offered by Xcel Energy or a

community solar project for which a dedicated renewable energy resource located in Public Service Company of Colorado territory is built for that customer program, and which has dedicated customer capacity or energy to fulfill that customer's subscription.

- (vi) Reduction of weather normalized EUI as follows:
  - (1) Buildings with a gross floor area of 25,000 – 49,999 square feet will reduce their EUI by 10% below their baseline;
  - (2) Buildings with a gross floor area of 50,000 square feet or larger will reduce their EUI 15% below their baseline.
  
- (vii) For EUI improvement compliance options the EUI baseline and required savings will be determined based on the building's annual energy benchmarking report. The required savings must be maintained annually after initial compliance and will be verified via the building's annual energy benchmarking report. For buildings with manufacturing use types the owner may apply to use energy consumption per items produced or similar appropriate metric in place of EUI.
  - (1) The building's default baseline EUI will be the EUI reported in the building's energy benchmarking report the year prior to enrollment. Alternately, the building owner may select a different calendar year up to 5 years prior to enrollment into the energy program to use as a baseline.
  - (2) An owner may petition for a change in their baseline if they can demonstrate a major shift in building use type. An engineer's report estimating what the new adjusted baseline should be based on the new building use type will be required.
  - (3) If an owner has not yet achieved the required savings in the calendar year prior to the June 1<sup>st</sup> deadline 5 years after enrollment in the program, then they have the option to instead submit proof of completion of an energy efficiency project. They must submit report from an energy efficiency contractor showing they have made energy efficiency improvements to the building with an estimated energy savings equal to the required energy savings. In this case, the benchmarking report submitted 2 years later must demonstrate they have actually achieved the estimated savings.
  - (4) For owners that submit an energy efficiency project, default baseline EUI will be the EUI reported for the calendar year prior to the completion of the project. Alternately, the building owner may select a different calendar year up to 5 years prior to completion of the project to use as a baseline. For example, any building submitted improvements in 2018 may select a baseline year as far back as 2013; any building submitting improvements in 2023 may select a baseline year as far back as 2018

#### **Section 4.08 Additions**

For additions, CPD will calculate any coverage requirements using the square footage of the building addition or roof of the building addition, as applicable. . When an addition is less than 25,000 square feet of gross floor area, and the building undergoes a roof replacement or recover,

then the gross floor area of the addition will be included in calculation of the gross floor area of the building.

## **ARTICLE V: CAMPUSES**

### **Section 5.01 Administration**

- (a) Documentation. Compliance with the campuses requirement shall be demonstrated through a Site Development Plan, IMP, or similar site plan document and subsequent building plans. If a campus is required to do an IMP or similar document for other reasons, then compliance with the Green Buildings Ordinance shall be accomplished in that document. If an IMP is not required, then documentation of compliance with the green buildings ordinance shall occur on a site development plan with subsequent building permits, if required. Submissions should provide information detailing compliance on related sheets, including as applicable, but not limited to, the Cover Sheet, Site Plan, Roof Plan, and Landscape Plan.
- (b) Campus Extent. The owner(s) of buildings within a campus shall identify the extent of the proposed campus By including all new and existing buildings as well as all surrounding ground level areas utilized to meet the campuses requirement and all surrounding streets.
- (c) Phasing. Any campus that is proposing to meet their obligation under the terms of the Green Building Ordinance through a phased approach must enter into a development agreement with the City in addition to any other required documentation for review and approval by the City that outlines the timing for the provision of applicable green space, on-site solar panels, or other renewable energy devices.
- (d) Cool roof requirements. Owners of buildings within a campus must comply with any applicable cool roof requirements at the time of roof replacement or application for a permit for a new roof, unless the owner can demonstrate that the roof will contain solar panels or a vegetated roof which must be in place prior to that building receiving a certificate of occupancy or final inspection for a roof permit.

### **Section 5.02 Compliance Options**

Owners of new buildings within a campus may comply with the green building requirements by providing green space, on-site renewable energy purchase, or a combination of green space and on-site renewable energy purchase at a campus-wide level. Owners of existing buildings within a campus may comply with the green building requirements by providing green space or on-site renewable energy devices at a campus-wide level instead of complying with each individual building in the campus or each zone lot.

### **Section 5.03 Energy Master Plan**

- (a) When Required. An Energy Master Plan is required for a campus when complying with:
  - (i) New Buildings: provision of on-site renewable energy or a combination of green space and on-site renewable energy .
  - (ii) Existing Buildings: provision of on-site solar panels

- (b) Documentation. Campuses seeking to document compliance utilizing the Energy Master Plan shall provide the following in addition to the requirements of Article IV
  - (i) Any new or existing building roof plans
  - (ii) A campus site plan showing the location of any new, existing or future building locations
- (c) Energy Master Plan. The submission shall include the following elements:
  - (i) A detailed calculation of what renewable energy generation would have been had individual building on the campus complied at the individual level with the renewable energy requirements.
  - (ii) A summary of the renewable energy projects that will be undertaken in existing and new buildings on the campus. Calculations should be included showing how those projects will generate as much energy as if individual buildings on the campus had complied.
  - (iii) Commitment to a deadline by which each project will be complete by and who is responsible for completing it and reporting its completion to DDPHE.
  - (iv) Identify interim project steps that will be reported to track progress and deadlines by which each step will be complete and submitted to DDPHE.
  - (v) Plan for how the projects will be funded and financed.
  - (vi) A protocol for continuing to monitor energy production to ensure the energy generation is realized.
- (d) DDPHE shall be responsible for reviewing and approving the energy master plan as well as enforcing compliance with the plan.

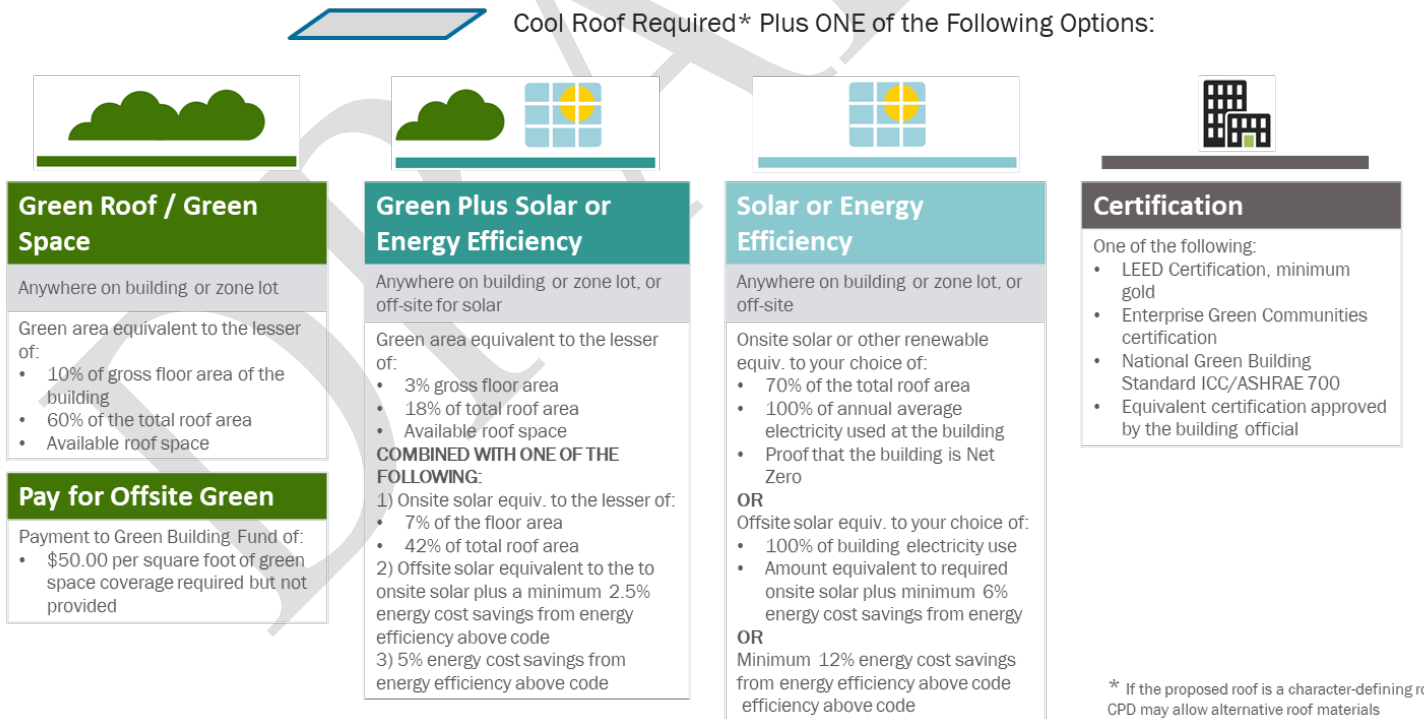
## **ARTICLE VI**

Every twelve (12) months, CPD and DDPHE shall prepare a written report of the activities related to, and an assessment of outcomes of, this article, and report their findings and any recommendations to the city council.

- The report shall include information about the number of buildings that have selected each compliance option and the total number of cool roofs, square footage of green roofs and green spaces, amount of solar panels, and efficiency improvements installed.
- The report will also characterize what implications those installations will have for improving the urban heat island, adding green space to the City, improved water and storm water management, and reduced greenhouse gas emissions.





## APPENDIX A

### Green Building Ordinance - Compliance Options for New Buildings



Green Building Ordinance - Compliance Options for Existing Buildings

 At Roof Replacement: Cool Roof Required\* plus ONE of the Following Options:

			
<p><b>Green Roof / Green Space</b></p> <p>Anywhere on building or zone lot</p> <p>Green area equivalent to the least of:</p> <ul style="list-style-type: none"> <li>• 2% of floor area of the building</li> <li>• 18% of the total roof area</li> <li>• Available roof space</li> </ul>	<p><b>Solar</b></p> <p>Anywhere on building or zone lot</p> <p>Onsite solar or other renewable equivalent to the least of:</p> <ul style="list-style-type: none"> <li>• 5% of the floor area</li> <li>• 42% of the total roof area</li> <li>• An area equal to an amount required to provide 100% of building electricity use</li> </ul>	<p><b>Certification</b></p> <p>One of the following:</p> <ul style="list-style-type: none"> <li>• LEED Certification, minimum silver</li> <li>• Enterprise Green Communities certification</li> <li>• National Green Building Standard ICC/ASHRAE 700</li> <li>• Equivalent certification approved by the building official</li> </ul>	<p><b>Energy Program</b></p> <p>Enroll in a flexible energy program that includes various energy efficiency and renewable options designed to achieve similar greenhouse gas emission reductions as the on-site solar option.</p> <ul style="list-style-type: none"> <li>• Comply with one of many pathways in the Energy Program within 5 years.</li> <li>• Can enroll early to “bank” efficiency projects for next roof replacement</li> </ul>
<p><b>Pay for Offsite Green</b></p> <p>Payment to Green Building Fund of:</p> <ul style="list-style-type: none"> <li>• \$50.00 per square foot of green space coverage required but not provided</li> </ul>			

\* If the roof is a character-defining roof, CPD may allow alternative roof materials

**I. New Building Options**

(a) *In General.* Except as provided in subsection (c) below, an owner constructing a building after the effective date of this ordinance, and containing 25,000 square feet or greater of gross floor area must provide the following green building requirements:

- (1) A cool roof; and
- (2) One of the following options:
  - a. Green space covering an area in one of the following amounts, whichever is least:
    1. Ten percent (10%) of the gross floor area of the building;
    2. Sixty percent (60%) of the total roof area on the building; or
    3. The available roof space on the building.
- (ii) On-site solar panels covering an area anywhere on the building or zone lot equal to seventy percent (70%) of the total roof area or an area equal to an amount required to provide one hundred percent (100%) of estimated annual average electricity used at the building; other renewable energy devices may be used in

place of on-site solar panels so long as the owner proves similar generation capacity. Any net zero energy building complies with this subsection (b).

- (iii) Off-site renewable purchase with the following requirements:
  - 1. The off-site renewable energy purchase must be met through a minimum five year contract for a subscription, lease, or purchase of a share in a voluntary renewable energy program offered by Xcel Energy or a community solar project for which a dedicated renewable energy resource located in Public Service Company of Colorado territory is built for that customer program, and which has dedicated customer capacity or energy to fulfill that customer's subscription.
  - 2. The term of purchase must be renewed a minimum of every five years for the life of the building; and
  - 3. The off-site renewable energy purchase must cover the equivalent energy production of either (i) the estimated one hundred percent (100%) of electricity the building will use, or (ii) the amount that would have been provided with required on-site solar panels and demonstration of decreased energy consumption measured as estimated cost savings of a minimum six percent (6%) above requirements in the applicable Denver Building and Fire Code.
- (iv) Demonstration of decreased energy consumption measured as estimated cost savings of at least twelve percent (12%) above requirements in the applicable Denver Building and Fire Code.
- (v) Building certification of LEED Gold, Enterprise Green Communities, or an equivalent certification approved by the executive director of community planning and development, or his/her designee.
- (vi) A combination of green space, and renewable energy device(s) with the following required coverages:
  - 1. Green space covering an area in one of the following amounts, whichever is least:
    - (i) Three percent (3%) of the gross floor area of the building;
    - (ii) Eighteen percent (18%) of the total roof area on the building; or
    - (iii) The available roof space on the building; and
  - 2. On-site solar panels located anywhere on the subject zone lot covering an area in one of the following amounts, whichever is least:
    - (i) Seven percent (7%) of the gross floor area of the building,

- (ii) Forty-two percent (42%) of the total roof area on the building,  
or
  - (iii) The available roof space on the building; or
- 3. Renewable energy devices, other than solar, so long as the renewable energy devices achieve equivalent total energy production to the required amount of on-site solar panels in subsection (2)(f)2 above; or
- 4. Alternative coverages of green space and on-site solar panels may be approved by the city so long as the combination covers an area in one of the following amounts, whichever is least:
  - (i) Ten percent (10%) of the gross floor area of the building;
  - (ii) Sixty percent (60%) of total roof area on the building; or
  - (iii) The available roof space on the building.
- g. A combination of green space and off-site renewable energy purchase, with the following requirements:
  - 1. Green space covering an area in one of the following amounts, whichever is least:
    - (i) Three percent (3%) of the gross floor area of the building;
    - (ii) Eighteen percent (18%), of total roof area on the building;  
or
    - (iii) Available roof space on the building;
  - 2. The off-site renewable energy purchase must be met through a minimum five year contract for a subscription, lease, or purchase of a share in a voluntary renewable energy program offered by Xcel Energy or a community solar project for which a dedicated renewable energy resource located in Public Service Company of Colorado territory is built for that customer program, and which has dedicated customer capacity or energy to fulfill that customer's subscription. The term of purchase must be renewed a minimum of every five years after initial purchase.
  - 3. The off-site renewable energy purchase must cover the amount that would have been provided with required on-site solar panels would have provided and demonstration of decreased energy consumption measured as estimated cost savings of a minimum two and a half percent (2.5%) above requirements in the Denver Building and Fire Code.
- h. A combination of green space and increased energy efficiency with the following requirements:



1. Green space covering an area in one of the following amounts, whichever is least:
  - (i) Three percent (3%) of the gross floor area of the building;
  - (ii) Eighteen percent (18%) of total roof area on the building;or
  - (iii) The available roof space on the building; and
2. The building must demonstrate decreased energy consumption measured as estimated cost savings of a minimum five percent (5%) above requirements in the applicable Denver Building and Fire Code during plan review.

(b) *Payment into fund.* An owner may pay an amount to the green building fund of \$50.00 per square foot of green space coverage required in subsections (a)(2)a, f, g, or h above, but not provided. In cases where an owner is unable to provide the entirety of green space coverage required, the owner may pay \$50.00 per square foot for no more than twenty-five percent (25%) of the green space required but not provided.

(c) *Exceptions.*

- (1) Subsection (a) of this section shall not apply to the following:
  - a. One- and two-family dwellings constructed under the provisions of the International Residential Code;
  - b. Dwelling units constructed in a group of three or more attached units in which each unit extends from foundation to roof and is not more than three (3) stories above grade plane;
  - c. Temporary structures, air supported structures, and greenhouses.
- (2) Subsection (a)(1) of this section shall not apply to the following:
  - a. Portions of proposed roofs that include the following:
    1. Photovoltaic systems or components;
    2. Solar-, air-, or water-heating systems of components;
    3. Vegetated roofs;
    4. Above-roof decks or walkways; or
    5. HVAC systems and components, and other opaque objects mounted above the roof.
  - b. Portions of the proposed roof shaded during the peak sun angle on the summer solstice by neighboring buildings or other portions of the same building;
  - c. Portions of the proposed roof that are ballasted with a minimum stone ballast of fifteen pounds per square foot.
  - d. Roofing materials covering less than twenty five percent (25%) of an individual roof section; or
  - e. Visible roofs for no more than ten percent (10%) of the total roof area.

- (3) Subsection (a)(2) of this section shall not apply to residential buildings five stories or fewer, or less than 62.5 feet in height, and with 25,000 square feet or more of gross floor area.
- (d) When a proposed roof is determined to be a character defining roof, the Building Official may allow alternative roof materials.
- (e) Any owner who submits a building permit for a roof replacement or construction including roof replacement, and has complied with subsection (a) of this section, does not have to comply with the requirements of Section II(a), but shall maintain compliance with the selected option from Section I(a) or demonstrate compliance with another option from this subsection upon completion of any roof replacement which must be submitted and approved by the building official.
- (f) Owners of buildings subject to the requirements of Sec. I(a) must provide one of the requirements of I(a)(2) for the duration of the building's existence.

## II. Existing Building Options

- (a) *In General.* Except as provided in subsection (d) below, any owner of a building that has received a certificate of occupancy prior to the effective date of this ordinance and whose building contains 25,000 square feet or greater of gross floor area, must provide the following green building requirements upon a roof replacement for more than five percent (5%) of either the total roof area or individual roof section(s), as applicable, in any calendar year:
  - (1) A cool roof; and
  - (2) One of the following options:
    - a. Green space covering an area in one of the following amounts, whichever is least:
      1. For total roof area replacement: two percent (2%) of the gross floor area of the building; for individual roof section replacement: two percent (2%) of the gross floor area of the building, multiplied by the area of individual roof section(s) being replaced, divided by the total roof area of the building.;
      2. For total roof area replacement: eighteen percent (18%) of the total roof area on the building; for individual roof section replacement: eighteen percent (18%) of the individual roof section(s) being replaced; or
      3. Available roof space on the total roof area of the building, or the individual roof section(s) being replaced, as applicable;
    - b. On-site solar panels located anywhere on the building or zone lot and covering an area in the least of the following:
      1. For total roof area replacement: five percent (5%) of the gross floor area of the building; for individual roof section replacement: five

percent (5%) of the gross floor area of the building, multiplied by the area of roof section(s) being replaced, divided by the total roof area of the building

2. For total roof area replacement: forty-two percent (42%) of the total roof area on the building; for individual roof section replacement: forty-two percent (42%) of the individual roof section(s) being replaced; or

3. An area equal to an amount required to provide one hundred percent (100%) of estimated annual average electricity used at the building;

c. Building certification of LEED Silver, Enterprise Green Communities, or an equivalent certification approved by the executive director of community planning and development, or his/her designee.; or

d. Enrollment in the energy program.

(b) *Payment into fund.* An owner may pay an amount to the green building fund of \$50.00 per square foot of green space coverage required in subsection (a)(2)a above, but not provided. In cases where an owner is unable to provide the entirety of green space coverage required, the owner may pay \$50.00 per square foot for no more than twenty-five percent (25%) of the green space required but not provided.

(c) *Individual roof section replacements.* Any excess coverage requirements provided on an individual roof section replacement may be applied to later roof replacements of individual roof sections of the building.

(d) *Exceptions.*

(1) Subsection (a) of this section shall not apply to the following:

- a. One- and two-family dwellings constructed under the provisions of the International Residential Code;
- b. Dwelling units constructed in a group of three or more attached units in which each unit extends from foundation to roof and is not more than three (3) stories above grade plane;
- c. Temporary structures, air supported structures, and greenhouses; and
- d. Buildings that have complied with Section 4.01(a).

(2) Subsection (a)(1) of this section shall not apply to the following:

- a. Portions of the roof that include or are covered by the following:
  1. Photovoltaic systems or components;
  2. Solar-, air-, or water-heating systems or components;
  3. Vegetated roofs;
  4. Above-roof decks or walkways; or
  5. HVAC systems and components, and other opaque objects mounted above the roof.

- b. Portions of the roof shaded during the peak sun angle on the summer solstice by neighboring buildings or other portions of the same building;
  - c. Portions of roofs that are ballasted with a minimum stone ballast of fifteen pounds per square foot, or, in the case of an existing ballasted roof, the weight of ballast for which the roof was originally designed.
  - d. A individual roof section containing less than twenty-five (25%) of available roof space; or
  - e. Visible roofs for no more than ten percent (10%) of the total roof area.
- (3) Subsection (a)(2) of this section shall not apply to the following:
- a. Residential buildings five stories or fewer, or less than 62.5 feet in height and with 25,000 square feet or more of gross floor area;
  - b. A building that must replace its roof due to an emergency, including, but not limited to, fire or wind damage to be determined by the building official; Hail shall not count as an emergency.
  - c. A building that must replace its roof due to hail damage in the first year after the effective date of this ordinance when the building owner can demonstrate a gap in insurance coverage. Such gap exists where the building owner has insurance coverage that includes the cost of meeting any new code requirements, but had a cost limit on that coverage that is insufficient to meet the additional costs of this ordinance, and the insurance policy is not yet due for renewal; and
  - d. A building that contained a vegetative roof prior to January 1, 2018, so long as the vegetative roof is replaced upon any roof replacement.
- (e) When a proposed or existing roof is determined to be a character defining roof, the building official may allow alternative roof materials, as determined in rules and regulations.
- (f) *Roof recovers.* Any owner proposing a roof recover of more than five percent (5%) of either the total roof area or individual roof section in any calendar year, and whose building contains 25,000 square feet or greater of gross floor area must comply with Sec. II(a)(1) for that portion of roof being recovered, but need not comply with the requirements of Sec. II(a)(2). When an analysis of any individual roof section prior to a roof recover determines that application of a cool roof will result in condensation, then an owner may choose not to provide a cool roof.
- (g) Owners of buildings subject to the requirements of Sec. II(a)(2) must provide one of the requirements of Sec. II(a)(2) for the duration of the building's existence.

### III. Additions

- (a) Any owner proposing an addition of 50,000 square feet of gross floor area or greater to a building shall comply with Sec. I for that addition.

(b) Any owner proposing an addition of 25,000 or more and less than 50,000 square feet of gross floor area to a building shall provide a cool roof, as applicable, and comply with any of the following:

- (1) Any of the requirements of Sec. II(a)(2)a-c for that addition;
- (2) The requirements of Sec. II(a)(2)b for that addition; or
- (3) Estimated energy cost savings of at least four percent (4%) above requirements in the Denver Building and Fire Code for that addition.

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