

**Green Roof Review Task Force**  
**Meeting #3 – February 14, 2018 – 11:00-2:00**  
**200 W 14th Ave, 2nd Floor, Grand Mesa Room**

Meeting Objectives:

- Create a Framework for a Performance-Based, Chicago-Style Revision to the Ordinance
  - Examine Building Examples
  - Dig into the Options
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11:00 Opening

- Welcome – Opening – Introductions – Preliminary Matters – Agenda Preview and Operating Protocol Reminder
- Framework for Considering Options
  - o Meeting #2 Made it Clear that Exploring a Performance Framework Would Be Worthwhile
  - o Draft Matrix – Two Early Versions

11:15 Denver’s Sustainability and Climate Strategy – Putting the Ordinance in Context  
Presentation – Q&A – Discussion-How Might This Ordinance Fill the Gaps?

11:30 Project Examples

How have real projects used some of the strategies you see in the matrix?

12:30 Returning to Meeting #1

- Evaluating the Ideas and Options

12:35 Beginning to Populate the Framework

- Water
- Solar
- Certifications
- White Roofs
- % Better than Code
- Existing Building Energy Efficiency

Options Discussion – Task Force

- o What’s Missing?
- o What’s Most Promising?
- o What’s Problematic?
- o What Do We Spend Time on Going Forward?

Next Steps – Populating the Framework and Creating a Scoring System

1:50 Next Steps – Meeting #4 on March 1, Data Needs, Wrap-Up

2:00 Adjourn

**Green Roof Review Task Force**  
**Draft Summary – Meeting #3 – February 14, 2018**

Meeting Objectives:

- Data – Presentations, Questions and Answers – Denver’s sustainability programs, Examples of sustainable projects, More data on benefits-water and energy
- Discussion – Framework for Options – Performance-Based Matrix
- Discussion – Options

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The summary below includes questions and answers and discussion and does not replication the presentations. For the presentation materials, please refer to the PDF of the presentation slides.

**I. Opening**

- Beginner’s Mind – open to solutions and possibilities, a spirit of inquiry and discovery
- Go slow to go fast – jumping to solutions will create unnecessary disagreement – let the solutions emerge from the analysis and discussion, guided by core principles and criteria for success

**II. Denver Sustainability Goals**

- Green roofs – linked to 3 goals of the City’s existing goals – climate, energy, and water quality
- An 18% tree canopy goal in addition
- City’s progress to date comes, in part, from larger efforts like national standards for vehicle efficiency and state renewable energy and energy efficiency requirements.
- The City’s plans are all available on the website if you want to learn more about them

Q: Has city staff started analysis of the influence of the ordinance on the 2020 goals?

A: No, not yet, but the Task Force’s modeling from Stantec provides some of this

**III. Project examples**

A. Net-zero-energy building in Virginia

- A net-zero-energy building is definitely possible at no additional cost
- Net zero means consumption and production equal over the course of a year
- This building – maximized roof space for solar panels (leaving the space necessary for roof access
- 7-year positive cash flow, but shorter pay-back is possible

Q: On grid or off grid

A: Connected to the grid

B. PACE financing

- South Bellaire – example – 20-year loan
  - Positive cash flow in year 7
  - The savings and the payments are inherited by any new owner
- Q: If the owner were to sell, would the PACE financing stay in place?

A: Yes, the PACE loan stays with the property

Q: Are these well understood in the market? Do they understand how it works?

A: It hasn’t been around that long; the owner liked that it transfers with the building

Q: Is PACE available to residential?

A: No, today it is only commercial – multifamily apartment projects can use it – they are commercial

Q: Is the loan is not collateralized; what happens if the owner doesn’t pay the loan?

A: Right – it’s tied to a property tax payment – and it would be the same as any non-payment of property tax

C. Industrial Projects – Prologis

Committed to environmental sustainability, greenhouse gas reductions, LEED certification, solar, energy efficiency, cool roofs, water savings, etc.

- We put solar on our warehouses and sell it back to the grid
- Case-by-case – as it makes sense for each building; same with cool roofs

#### D. EPA Building's Green Roof

- Built in 2006 as a living laboratory
- Polarizing – because it doesn't stay green
- Performing as it should
- The roof system was purchased without a maintenance contract; original installer out of business
- It is prolonging the life span of the roof – a benefit that is often overlooked
- Used the roof to study plants and to study the combination of green roof and solar
- Plants can be under the solar – PV works better if its cooler and plants often grow better with some shade from the PV

Q: Does completely shaded work?

A: Yes, but you have to leave space between the panels for maintenance; even the full-sun plants did better in the shade because it is so reflective

Q: Did it impact the roof warranty?

A: It is a concern; we definitely had to make sure we didn't do anything to void the warranty

Q: Is the parking revenue as high as advertised? Does each parking space really bring in \$25,000 per year?

A: Yes – they will confirm

Q: Can you compare with a cool roof?

A: There is an academic paper comparing the two – **will send the reference to staff so the task force can see it**

- Green roofs get a bad rep because they don't look green; the reality is that they will look like any other landscape in Denver in the winter; that's important to remember for public perception
- Some places call them "eco-roof" for that reason

Q: Maintenance costs?

A: Up to \$15 per sq ft.; could be as little as 1 hour per month

Q: Safety

A: You have to have the same safety elements as any accessible roof; these are addressed already in a lot of building codes for cleaning and roof maintenance

Q: The requirements for the buffer zone are the same? If you don't use your roof for anything

A: Yes, because most roofs will have access requirements for HVAC

- Low moisture soil is important for good drainage
- Minimal landscaping costs if the roof is functional rather than ornamental
- Green roofs can be designed to protect the HVAC from the plants

Q: How many green roofs are already in existence?

A: At least 50 in Colorado; the number not known in Denver

Q: Is there a fire problem with dead plants?

A: Yes, it is a concern and will add an element to inspections; fire department wants the trays to be small enough, so they can be moved in case of a fire and the need to break through the roof; the trays are now designed to get fire code approval

- The fire department can provide information if needed – in a later meeting
- Air quality – remember the analysis from meeting #2 – air quality benefits and air quality problems (suspended particulates) are not significant

Q: Can someone describe the irrigation system?

A: Supply pipe and drip irrigation – the same as a garden

- It would be beneficial to use recycled water, but there is a dual-use concern, so it will probably be just potable water

- Important to distinguish between grey and recycled water – very different – Grey water captured water from shower, sink, etc.; purple pipe water comes from Denver water and is not treated to potable levels; it can be sprayed because it has been treated sufficiently

E. Denver housing authority

- A 15-year look at what we have been doing
- As long-term owners, energy efficiency is important to us
- We are always looking for more roof top space for solar
- For the last 7 years our buildings have been LEED Gold or Platinum
- Solar thermal – not the same level of payback
- We have also talked about food, and we have some food production because it brings in activity and culture – on the ground not on the roof
- We are working on an amenity space with green space on the roof

Q: Blue roof?

A: Holding stormwater on the roof

Q: Is it useful to help cool the building?

A: No

Q: Has DHA planned for food production on the roof?

A: No

Q: Amenity space – on the roof, or is there a deck on the roof?

A: A deck

Q: Do you have a buffer between the amenity space and the edge of the roof?

A: Yes, and we use a railing to delineate

Q: Cost more, and how much more?

**A: Yes, increased roof thickness and additional columns to support the weight – will send the cost numbers**

Q: Do your buildings meet the enterprise green communities certification?

A: Yes, most do; we are often close to LEED

Q: What drove you to this design?

A: It allowed us to increase the density of all these sites; we want the building to perform in the market; we want to use the roof to our advantage with energy production; it does increase the original cost

Q: How much green space are you adding?

A: On this campus –10 acres of green space

Q: How much of your consumption does the PV cover?

A: About 72% of common area use

IV. Performance-Based Matrix – Elements of Benefit

A. Water

- If your site is over 20,000 sqft, you need to detain your water, and if you are building downtown, a vault may be the only way to detain the water. But vaults are usually the last option considered.

Q: What is a vault?

A: An underground tank that holds stormwater and drains slowly; because they are hidden from view, so there are concerns that they are not well maintained

Q: If a stormwater vault is required, would the city allow you to reduce the size of your stormwater vault if you use the roof for detention?

Q: Outside of downtown, how many new developments have to use a vault for stormwater detention?

**A: City staff will get the answers**

Q: Why is water quality a secondary benefit?

A: The pollutants and the amount of water coming off of a roof are so much less than what comes off of roads; so, it is not providing a significant water quality benefit; green roofs do a good job of cleaning water, but they don't filter the volume we need

Q: The first version of the matrix has a section for stormwater and one for green space; what are the options for stormwater detention?

A: Street-side planting areas can treat water – things like grassy swales; pervious pavement works too

#### B. Solar

Q: is there an opportunity in the ordinance to purchase solar rather than put it on the roof?

A: Not as it stands today

#### C. Certifications

- Different certifications address different topics – some focus on the building, others on the health of the individuals in the building – very different purposes and very different measures

Q: Can we get a breakdown on which systems focus on new and which on existing buildings?

A: All address new and existing

#### D. Energy Efficiency – Group 14

New buildings and major renovations have to meet Denver's energy code, and it's a very efficient code. Group14 models new buildings for Xcel's Energy Design Assistance program and green building certifications to show the costs and savings from going beyond code. Their modeling finds potential energy cost savings of 18-27% depending on the building type. On average, simple payback on investment in energy efficiency in new construction is 8-12 years (compared to 2-5 years for existing buildings). Based on their findings, it is both ambitious and achievable for new buildings to be, say, 20-25% more efficient than code.

No questions

### V. Early Reactions to the Matrix

- We need to think about how we consider improvements already made to existing buildings; we don't want to create a disincentive for the owner to continue to make improvements
- City staff are working on a stretch code that could serve as an alternative; not adopted yet
- We may need two separate matrices – one for new buildings and one for existing buildings (though that seems to complicate things) or a smaller number of points required for existing buildings
- We could include many different certification systems in the same scorecard; Chicago already does this; we need to decide how many points each would receive
- We should take a closer look at the Chicago system; it considers different certifications
- The different categories in the blank matrices make sense
- The Chicago matrix avoids double counting
- We should prioritize based on the benefits of green roofs and of the ordinance; you get more points based on what has the same benefits of green roofs ordinance
- Urban heat island is an important benefit
- Multitude of benefits are important – green roofs help with efficiency; people want more green space; climate change is important
- We are unique in dealing with the existing buildings; we want to make sure that the matrix is right approach for existing
- It's good that the matrices are divided into the benefit categories
- We want impact across multiple aspects; some things could be mandatory, and others could add points
- We do need to capture each of the original benefits of the ordinance, but every individual building does not necessarily need to capture every individual benefit

Q: How will insurance work? How does this change hail storm coverage? Does this increase the price of the roof replacement? Does it reduce insurance costs because green roof protects the underlying roof material and increases the life of the roof?

A: Not clear; not clear how insurance companies will respond

Q: Does insurance cover the roof, roof and solar, cost of moving the solar to replace the roof?

A: Code requirements are covered items, so they should be included in insurance

- If green space is a priority, can we rename it to the green space ordinance?
- Do we call these 'smart surfaces'?

Q: Do we want to require that a building has to get points in every category? Chicago was designed so that multiple categories are needed

- Energy savings that provide the same benefit as solar at lower cost should be an option
- Existing buildings will be the hardest; there is so much variety in buildings; that will be the biggest challenge; Finding solutions that aren't one-size-fits-all
- The council could change the ordinance to exclude existing buildings; it is dramatic, but it could be done
- That goes against the will of the voters
- It makes more sense to have less strict requirements for existing buildings

## **VI. Next Meeting**

March 1, 1:00-4:00

Staff will use this discussion and the work thus far to begin creating a more detailed pair of matrices