Achieving USGBC’s LEED™ Silver Rating: The Greening of One and Two Potomac Yard

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Elizabeth W. Adams, LEED AP
Elena M. S. Garrison, R.A.
Daniel B. Kohlhepp, Ph.D.

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CRESSENT RESOURCES, LLC
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Introduction

According to the United Nations World Commission on Environment and Development, sustainable development “…meets the needs of the present without compromising the ability of future generations to meet their own needs.”1 A member of the U.S. Green Building Council (USGBC), Crescent Resources, LLC is demonstrating its commitment to sustainable development, or “green” building practices, as the developer of One and Two Potomac Yard.2 Crescent Resources’ goal is to earn at least a Silver Rating for both buildings in the project under USGBC’s Leadership in Energy and Environmental Design (LEED™) Green Building Rating System. As it implements LEED design strategies, Crescent Resources is also meeting the specific environmental requirements of the project’s primary tenant, the U.S. Environmental Protection Agency (EPA).

Crescent Resources worked closely with James G. Davis Construction Company to build the more than 650,000-square-foot, two-building office project, located on Land Bay A, which is at the corner of Crystal Drive and Potomac Avenue in Arlington, Virginia. The drawing in Figure 1 shows the Land Bays of Potomac Yard Arlington

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2 Crescent Resources is the master developer of Potomac Yard, a 300-acre redevelopment of the former Richmond Fredericksburg and Potomac Railroad (RF&P) rail transfer station in Arlington and Alexandria, Virginia. Upon completion, the mixed-use project will include 4.5 million square feet of office space, 3,000 residential units, 200,000 square feet of retail space, 1,250 hotel rooms, and 92.4 acres of open space and parks.
and the oblique aerial photograph in Figure 2 shows Potomac Yard Arlington before redevelopment. The construction of the project was completed in March 2006. This case study examines the “greening” of One and Two Potomac Yard by summarizing the following:

- EPA-lease requirements
- LEED Green Building Rating System
- LEED certification process
- LEED points Crescent Resources is pursuing to earn at least a Silver Rating for each of the two office buildings in the project
- Challenges and lessons learned from the greening of One and Two Potomac Yard

**Figure 2:** Oblique Aerial Photograph of Potomac Yard Arlington

**EPA-Lease Requirements**

While developing One and Two Potomac Yard met Crescent Resources’ corporate goals of caring for the environment and the communities it serves, Crescent Resources’ objective of attaining at least a LEED Silver Rating for the project complements its need to satisfy certain lease requirements of EPA. Under a ten-year lease beginning in March 2006, EPA occupies more than 405,000 square feet of the office project. The lease agreement includes requirements for the following:

- Indoor air quality (IAQ) testing
- Limiting levels of volatile organic compounds (VOCs) in building materials, including adhesives, sealants, caulks, paints, coatings, carpet systems, wood products, etc.
- Building energy-cost savings of 20% compared to baseline energy costs and an ENERGY STAR® building label
- Incorporating recycled-content products in the buildings according to EPA’s Comprehensive Procurement Guidelines (CPG)
- Construction-waste management
- Standards of performance for heating, ventilating, and air-conditioning (HVAC) systems, including airflow and filter requirements
- Bicycle storage and changing and shower facilities
- Recycling rooms

USGBC’s LEED Green Building Rating System addresses each of these lease requirements. The subsequent summaries of the Rating System, certification process, and Crescent Resources’ efforts to earn at least a Silver Rating for each building in the project illustrate the integrated design approach required to satisfy the EPA-lease requirements.

**LEED Green Building Rating System**

To quantify the implementation of green building practices, USGBC developed the LEED Green Building Rating System as a national, consensus-based, building evaluation system. LEED for New Construction and Major Renovations (LEED–NC) guides and distinguishes high-performance commercial and institutional projects, with a focus on office buildings.

Six categories of green-building design and construction are the basis of LEED–NC: Sustainable Sites, Water Efficiency, Energy & Atmosphere, Materials & Resources, Indoor Environmental Quality, and Innovation & Design. To earn a certification level, a project must meet seven prerequisites distributed among four of the green-building categories. After meeting prerequisites, the project’s certification level depends on the number of points it earns out of the 69 points that are possible among all of the categories. The levels of certification are, in ascending order, Certified (26-32 points), Silver (33-38 points), Gold (39-51 points), and Platinum (52 or more points). Satisfying the requirements of credits earns points; each green-building design and construction category has a different number of credits and points possible. Some credits are broken down into subordinate credits. In some cases, the subordinate credits provide an opportunity to earn points independently; in other cases, the subordinate credits are cumulative (earning a point for one subordinate credit is required to qualify for the point for the subsequent subordinate credit). The table in Figure 3 summarizes the prerequisites, credits, and points possible in each category.
LEED–NC Certification Process

Project registration provides online access to LEED application submittals and credit interpretations. To maximize the potential for a building project to achieve certification and to promote an integrated whole-building design approach, registration of a project with USGBC should occur early in the development process.

As soon as a project is registered, the project team should begin preparing the submittal documentation required by LEED–NC for each prerequisite and for each credit that they anticipate the project will satisfy. In 2004, USGBC issued LEED–NC Version 2.1, an administrative update of the Version 2.0 Rating System intended to reduce the complexity and cost of documenting points while retaining the stringency and integrity of the LEED Version 2.0 standards. In January 2006, USGBC issued LEED-NC Version 2.2 to reduce further the administrative complexity of Version 2.1 and to clarify several ambiguous provisions. The table in Figure 4 summarizes the differences between Versions 2.1 and 2.2. However, the EPA lease requires that Crescent Resources submit One and Two Potomac Yard for certification using Version 2.1.

<table>
<thead>
<tr>
<th>GREEN-BUILDING CATEGORY</th>
<th>PREREQUISITES</th>
<th>CREDITS</th>
<th>POINTS POSSIBLE</th>
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</thead>
<tbody>
<tr>
<td>Sustainable Sites (SS)</td>
<td>1</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>Water Efficiency (WE)</td>
<td>–</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Energy &amp; Atmosphere (EA)</td>
<td>3</td>
<td>6</td>
<td>17</td>
</tr>
<tr>
<td>Materials &amp; Resources (MR)</td>
<td>1</td>
<td>7</td>
<td>13</td>
</tr>
<tr>
<td>Indoor Environmental Quality (EQ)</td>
<td>2</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>Innovation &amp; Design Process (ID)</td>
<td>–</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>TOTAL</td>
<td>7</td>
<td>34</td>
<td>69</td>
</tr>
</tbody>
</table>

Figure 3: LEED–NC, Prerequisites, Credits, and Points Possible
LEED-NC Version 2.2 Fact Sheet

As the first green building rating system in the United States, LEED® for New Construction (LEED-NC) has grown remarkably since its release in 2000. The new version, LEED-NC Version 2.2, was recently approved by our members. To help you understand what is new about LEED-NC v2.2, the following summarizes major technical changes and frequently asked questions (FAQs) on the transition.

Major Credit Changes from LEED-NC v2.1 to v2.2

| SSC5-2 | Site Development: Maximize Open Space | Open space definition has been refined to address both urban and suburban settings |
| SSC6-3 | Stormwater Design: Quality Control | Stormwater control systems must be capable of treating 90% of runoff and removing 80% of total suspended solids. System performance information on phosphorous removal is no longer required. |
| SSC7-2 | Heat Island Effect: Roof | New performance metric (Solar Reflectance Index) |
| SSC8 | Light Pollution Reduction | Requirements for control of interior lighting to prevent spillover and restructuring of the exterior lighting requirement |
| WC1-2 | Water Efficient Landscaping | Use of municipally provided non-potable water is acceptable for credit compliance |
| The Commissioning Credits (EAp1 and EAc3) | Major clarifications were made to the credit to standardize LEED Commissioning Scope of Work |
| The Energy Performance Credits (EAp2 and EAc1) | Updated Referenced Standard (ASHRAE 90.1-2004), new energy modeling protocol, two new prescriptive compliance paths |
| EAc4 | Enhanced Refrigerant Management | Credit is now based on refrigerant management methodology established in TSAC refrigerant report |
| MsC4 | Recycled Content | Updated Referenced Standard (ISO 14201) |
| MsC5-1 | Regional Materials | New requirements on what constitutes "regional" |
| EqP1 | Minimum IAQ Performance | Updated Referenced Standard (ASHRAE 62.1-2004) |
| EqC2 | Increased Ventilation | Credit basis has been changed from ventilation effectiveness to provision of higher than code minimum ventilation |
| EqC3-2 | Construction IAQ Management Plan: Before Occupancy | Clarification on building flush-out procedures provided. New IAQ testing protocol has been established. Requirement for installation of MERV 13 filters has been moved to EQC5 |
| EqC4-3 | Low-Emitting Materials: Carpet Systems | Updated, Enhanced Referenced Standard (Green Label Plus) |
| EqC4-4 | Low-Emitting Materials: Composite Wood & Agrifiber Products | Revised definition of composite wood. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins |
| EqC5 | Indoor Chemical & Pollutant Source Control | Provision of properly sized and maintained walk off mats is now acceptable. Mechanically ventilated buildings must have MERV 13 or higher filtration media. |
| EqC6 | Controllability of Systems | Re-structured credit basis: EqC6.1 - lighting, EqC6.2 - thermal control based on ASHRAE 55-2004 |
| EqC7 | Thermal Comfort | EqC7.1 and EqC7.2 have an updated Referenced Standard (ASHRAE 55-2004). EqC7.2 now requires a survey method for verification |
| EqD1 | Daylight & Views: Daylight 75% of Spaces | Credit can be achieved by three compliance paths: calculation of glazing factor; daylight simulation; or direct measurement of daylighting performance in completed building |

Alternative compliance paths have been added for the following credits: SSC2 - Development Density and Community Connectivity, SSC4-3 - Alternative Transportation: Low-Emitting and Fuel-Efficient Vehicles, SSC4-4 - Alternative Transportation: Parking Capacity, SSC6-1 - Stormwater Design: Quality Control, and EAc6 - Green Power. In addition, the submittals section is no longer part of the Rating System to ensure that documentation can be more flexible and streamlined. Detailed submittal guidelines are outlined on the USGBC website and in the Reference Guide. Virtually every credit has been altered to some degree. If you are interested in a particular credit you do not see listed here, please read through the Rating System or Reference Guide for more specifics.

**Figure 4:** Comparison of LEED—NC Versions 2.1 and 2.2
Regardless of the version of LEED—NC being used, the actual submission of the LEED documentation occurs at the end of the building project when the LEED Certification Manager receives the application materials for USGBC technical review. The LEED–NC application materials include:

- LEED Letter Template (refer to Figure 5 and Figure 6);
- Submittals for each prerequisite and credit;
- LEED registration information;
- LEED Project Checklist/Scorecard indicating the prerequisites and credits that the project is expected to satisfy and the anticipated total score for the project; and
- Drawings and photos that illustrate the project.

Administrative approval of the application indicates USGBC’s acceptance of the completed application. Within 30 days of administrative approval, USGBC issues a Preliminary LEED Review document noting the credits and points it expects the project to achieve, the pending credits and points, and the denied credits and points. Additionally, USGBC selects up to six prerequisites and/or credits for audit and further scrutiny. The project team has 30 days from receiving the Preliminary Review to provide a supplementary submittal containing corrections, clarifications, and additional supporting documents. USGBC conducts a Final LEED Review of the application within three weeks of receiving the resubmittal and notifies the project contact of the certification status. If USGBC denies two or more audited credits under Version 2.1, it may select additional credits for a second audit, which might prompt a Second Preliminary LEED Review before a Final LEED Review.

**One and Two Potomac Yard: Pursuing LEED Silver Ratings**

Crescent Resources’ USGBC membership and its dedication to environmentally responsible development logically led it to strive for LEED recognition of One and Two Potomac Yard. When pursuing the lease with EPA, Crescent Resources established the objective of attaining at least a Silver Rating for the buildings under the LEED–NC Version 2.1 United States Green Building Rating System. Crescent Resources registered One Potomac Yard with USGBC on 25 June 2004, and submitted the LEED application package on 23 March 2006. Crescent Resources registered Two Potomac Yard on 31 January 2005 and submitted the LEED application package 13 April 2006.
INSTRUCTIONS: Please complete all required fields below. All numeric fields should be entered without punctuation. Upon completion, click submit to securely process your order. You will receive email confirmation once your registration has been received.

* Indicates a Required Field

PROJECT TYPE

<table>
<thead>
<tr>
<th>RATING SYSTEM TYPE</th>
<th>MEMBER PRICE</th>
<th>NON-MEMBER PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEED-NC v2.2</td>
<td>$450</td>
<td>$600</td>
</tr>
<tr>
<td>LEED-EB v2.0</td>
<td>$450</td>
<td>$600</td>
</tr>
<tr>
<td>LEED-CC v2.0</td>
<td>$450</td>
<td>$600</td>
</tr>
<tr>
<td>LEED-CS PILOT</td>
<td>$450</td>
<td>$600</td>
</tr>
<tr>
<td>APPLICATION GUIDE PILOTS</td>
<td>$2000</td>
<td>$3000</td>
</tr>
</tbody>
</table>

Please select a project type and indicate whether you are a USGBC National Member to determine your registration fee.

| Select a Rating System Type | $0.00 |

Are you a member of USGBC? Amount Due

GENERAL PROJECT INFORMATION

* Project Title

* Is Project Confidential?

* Project Address

* How Did You Hear About LEED?

* Project City

* State/Province (US & Canada Only)

* Project Country

* Project Zip Code

PRIMARY CONTACT INFORMATION

* Primary Contact First Name

* Primary Contact Last Name

* Primary Contact Title

* Organization Name

* Address

* City

* State/Province (US & Canada Only)

* Country

* Zip Code

* Primary Contact Phone Number

* Primary Contact Fax Number

* Primary Contact Email Address

Figure 5: LEED Letter Template, Page 1
Figure 6: LEED Letter Template, Page 2
Project Team

The LEED team members for One and Two Potomac Yard include the following:

- Developer/Owner: Crescent Resources, LLC
- Architect and Interior Design: Davis Carter Scott
- Structural Engineer: Fernandez & Associates Structural Engineers, P.C.
- Mechanical & Electrical Engineer: Girard Engineering
- Civil Engineer: christopher consultants, ltd.
- Landscape Architect: Oculus
- Lighting Design: Moran Coventry Lighting Associates
- Energy Modeler: Econergy International Corporation
- General Contractor: James G. Davis Construction Corporation
- Site Contractor: Metro Earthworks
- Commissioning Agent: Advanced Building Performance, Inc.
- IAQ Testing: Healthy Buildings International
- Environmental Advisor: Sustainable Design Consulting
- Attorney: Edward V. Gregorowicz
- Leasing: Millenium Realty Advisors
- Property Manager: Woodmark Real Estate Services
- Primary Tenant: EPA
- Tenant Representative: General Services Administration (GSA)
- Tenant Coordinator: Kramer Consulting

LEED Scorecards

To achieve at least a LEED Silver Rating for One and Two Potomac Yard, Crescent Resources anticipates that the buildings will satisfy all prerequisites and earn points according to the checklists/scorecards shown in Figure 7 and Figure 8 for One Potomac Yard and Figure 9 and Figure 10 for Two Potomac Yard. There are minor differences between the scorecards for the two buildings. For example, building Two will receive a point for SS Credit 5.1 – Reduced Site Disturbance and building One will not, while building One will receive one more point for EA Credit 1 – Optimize Energy Performance than building Two. Crescent Resources is only pursuing EA Credit 5 – Measurement & Verification for building One.

A summary of prerequisites Crescent Resources must meet and the credits and points that it is pursuing for One and Two Potomac Yard in each green-building category follows the scorecards. Note that Crescent is applying for 44 points for building One and 43 points for building Two. If successful in obtaining all of the points Crescent Resources is pursuing, both buildings will achieve a Gold Rating!
### One Potomac Yard Checklist

**Arlington, Virginia**

#### Sustainable Sites (10 Credits, 14 Points)

<table>
<thead>
<tr>
<th>Credit</th>
<th>Points</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Erosion &amp; Sedimentation Control</td>
<td>1</td>
<td>Required</td>
</tr>
<tr>
<td>2. Site Selection</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3. Development Density</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4. Brownfield Redevelopment</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4.1. Alternative Transportation, Public</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Transportation Access</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.2. Alternative Transportation, Bicycle</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Storage &amp; Changing Rooms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.3. Alternative Transportation, Alternative</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Fuel Vehicles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.4. Alternative Transportation, Parking</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Capacity &amp; Carpooling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.1. Reduced Site Disturbance, Protect</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>or Restore Open Space</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.2. Reduced Site Disturbance, Development</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Footprint</td>
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<td>6.1. Stormwater Management, Rate and Quantity</td>
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<td></td>
</tr>
<tr>
<td>6.2. Stormwater Management, Treatment</td>
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<td></td>
</tr>
<tr>
<td>7.1. Heat Island Effect, Non-Roof</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7.2. Heat Island Effect, Roof</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8. Light Pollution Reduction</td>
<td>1</td>
<td></td>
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</table>

#### Water Efficiency (4 Credits, 5 Points)

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<th>Points</th>
<th>Requirement</th>
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</thead>
<tbody>
<tr>
<td>1.1. Water-Efficient Landscaping, Reduce</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>by 50%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2. Water-Efficient Landscaping, No Potable</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Water Use or No Irrigation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Innovative Wastewater Technologies</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3.1. Water-Use Reduction, 20% Reduction</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3.2. Water-Use Reduction, 30% Reduction</td>
<td>1</td>
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</tbody>
</table>

#### Energy & Atmosphere (7 Credits, 17 Points)

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<tr>
<th>Credit</th>
<th>Points</th>
<th>Requirement</th>
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</thead>
<tbody>
<tr>
<td>1. Fundamental Building Systems Commissioning</td>
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<td>Required</td>
</tr>
<tr>
<td>2. Minimum Energy Performance</td>
<td>1</td>
<td>Required</td>
</tr>
<tr>
<td>3. CFC Reduction in HVAC&amp;R Equipment</td>
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<td>Required</td>
</tr>
<tr>
<td>1. Optimize Energy Performance</td>
<td>1 to 10</td>
<td></td>
</tr>
<tr>
<td>2.1. Renewable Energy, 5%</td>
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</tr>
<tr>
<td>2.2. Renewable Energy, 10%</td>
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<tr>
<td>2.3. Renewable Energy, 20%</td>
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</tr>
<tr>
<td>3. Additional Commissioning</td>
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<td>4. Ozone Depletion</td>
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<td>5. Measurement &amp; Verification</td>
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<tr>
<td>6. Green Power</td>
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**Figure 7:** One Potomac Yard Checklist/Scorecard, Page 1
<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
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### Materials & Resources

<table>
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</tr>
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<td>Credit 1.1</td>
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<td>Recycled Content, Specify 10% (post-consumer + ½ post-industrial)</td>
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<td>Construction IAQ Management Plan, Before Occupancy</td>
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<td>Low-Emitting Materials, Composite Wood &amp; Agrifiber</td>
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<td>Controllability of Systems, Non-Perimeter</td>
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### Innovation & Design Process

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**Figure 8:** One Potomac Yard Checklist/Scorecard, Page 2
**Version 2.1 Registered Project Checklist**

Two Potomac Yard  
Arlington, Virginia

### Sustainable Sites  

<table>
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**Figure 9:** Two Potomac Yard Checklist/Scorecard, Page 1
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<td>Building Reuse, Maintain 100% Shell &amp; 50% Non-Shell</td>
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<td>Construction Waste Management, Divert 50%</td>
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<td>Recycled Content, Specify 5% (post-consumer + ½ post-industrial)</td>
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<td>Local/Regional Materials, of 20% Above, 50% Harvested Locally</td>
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<td>Environmental Tobacco Smoke (ETS) Control</td>
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<td>Carbon Dioxide (CO₂) Monitoring</td>
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<td>Ventilation Effectiveness</td>
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<td>Innovation in Design: Green Housekeeping Plan</td>
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<td>Innovation in Design: Green User Ed Program</td>
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<td>Innovation in Design: 40% Water Reduction</td>
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**Figure 10: Two Potomac Yard Checklist/Scorecard, Page 2**
**Sustainable Sites (SS)**

**SS Prerequisite 1 – Erosion & Sedimentation Control (Required)**

The intent of this prerequisite is to reduce the negative impacts of erosion during building construction on water and air quality. It requires the design to include an erosion- and sedimentation-control plan that meets EPA requirements or local standards and codes, whichever are more stringent. The plan must include provisions that:

- Prevent the loss of soil during construction from stormwater runoff or wind;
- Prevent the sedimentation of the storm sewer or streams receiving stormwater runoff; and
- Prevent pollution of the air with dust or particulate matter.

One and Two Potomac Yard’s erosion-and sedimentation-control plan, designed by christopher consulting, ltd., follows Arlington County and Commonwealth of Virginia regulations. Metro Earthworks, the site contractor, implemented the plan before earth-moving activities began and maintained the erosion- and sedimentation-control measures until after final building inspections. The photograph in Figure 11 shows the site with sedimentation-control fences in place before construction began.

**Figure 11: Land Bay A with Sedimentation-Control Fences**

**SS Credit 1 – Site Selection (1 Point)**

This credit encourages developers to avoid building on inappropriate sites and to reduce the negative environmental impacts of development by appropriately locating buildings on sites. To comply with requirements for the credit, the improved site area cannot be:

- Prime farmland as defined by U.S. Department of Agriculture;
- Lower than five feet above the elevation of the 100-year flood as defined by the Federal Emergency Management Agency;
- Identified as a habitat for any species on federal or state government threatened or endangered lists;
• Within 100 feet or the distance required by state or local regulations, whichever is greater, of water, wetlands, isolated wetlands, or areas of special concern identified by state or local rule; and

• Public parkland acquired for development unless land of equal or greater value was accepted in trade for the parkland by the public landowner who transferred the property (park authority projects are exempt).

The sites of One and Two Potomac Yard do not include sensitive site elements and restrictive land types; therefore, both building sites comply with the requirements of the credit to earn the point.

**SS Credit 2 – Development Density**

**(1 Point)**

This credit encourages developers to channel development to urban areas that have existing infrastructure to protect previously undeveloped land (greenfields) and preserve natural habitats and resources. To comply with the requirements for the credit, a building project’s site must be in an area that is already densely developed or that is comprehensively planned for dense development. The project must increase the development density of the surrounding area (localized density) to conform to the existing or desired density goals. The minimum existing development density is 60,000 square feet per acre, which requires at least two-story construction. Because the development surrounding One and Two Potomac Yard is at a density greater than 60,000 square feet per acre, each building satisfies the credit to earn the point. The photomontage in Figure 12 shows One and Two Potomac Yard in the context of the existing development of Crystal City to the north of the site.

![Figure 12: Photomontage of Land Bay A with Crystal City to the North](image)

![Figure 13: Potomac Yard Circa 1985](image)
SS Credit 3 – Brownfield Redevelopment
(1 Point)

This credit encourages developers to rehabilitate damaged sites (brownfields) where development is complicated by real or perceived environmental contamination. Costs and liabilities associated with brownfields increase the economic pressure to develop greenfield sites, leading to a development pattern of “leap frogging” over brownfields. By encouraging brownfield redevelopment, this credit attempts to reduce the pressure to develop greenfields. To comply with requirements for the credit, a building project must develop a site documented as contaminated or on a site classified as a brownfield by a local, state, or federal government agency. It must also effectively remediate the existing site contamination.

To earn the point for this credit, Crescent Resources worked with EPA Region III to declare the sites of One and Two Potomac Yard brownfields. After Crescent Resources presented several environmental and remediation reports for review, EPA determined that the sites, parts of the former RF&P railroad yard, met the requirements for a brownfield designation.\(^3\) The aerial photograph in Figure 13 shows the site in its previous use as a rail-switching yard.

SS Credit 4 – Alternative Transportation

SS Credit 4 includes four subordinate credits that promote alternative means of transportation. They encourage developers to provide means to reduce automobile generated pollution and the negative affects of land development on transportation systems, such as increasing the need for roadways. The subordinate credits are not cumulative; a project does not have to satisfy the requirements for one to qualify for another. Crescent Resources is pursuing all four subordinate credits for One and Two Potomac Yard.

SS Credit 4.1 – Alternative Transportation: Public Transportation Access
(1 Point)

To satisfy the requirements for this credit, a project must be within one-half mile of a commuter rail, light rail, or subway station or within one-quarter mile of two or more public or campus bus lines available for use by building occupants.

Two major bus lines serve the project, which is well within the required distance of a Washington Metrorail and a Virginia Railway Express (VRE) station; therefore, both building sites satisfy the credit to earn the point for each building.

---

\(^3\) More than 256 documents are on the web site of the US EPA Region III Hazardous Site Clean-up Division, Administrative Records. The Web site address is: “http://loggerhead.epa.gov/advanced_search.jsp”. At the site, enter “Virginia,” then “Richmond Fredericksburg and Potomac Railroad,” and then “Potomac Yard.”
SS Credit 4.2 – Alternative Transportation: Bicycle Storage & Changing Rooms
(1 Point)

To satisfy the requirements for this credit, a project must include secure bicycle storage and changing and shower facilities within 200 yards of the building for at least five percent of the regular office-building occupants (different requirements apply to residential uses). To earn the point for this credit for each building, Crescent Resources is providing 201 bicycle lockers and changing rooms with 28 showers for tenants at One and Two Potomac Yard. The photograph in Figure 14 shows the bicycle storage lockers adjacent to changing rooms in One Potomac Yard.

Figure 14: Bicycle Storage Lockers in One Potomac Yard

SS Credit 4.3 – Alternative Transportation: Alternative-Fuel Vehicles
(1 Point)

To satisfy the requirements for this credit, the developer of a project must either provide alternative-fuel vehicles and preferred parking for the vehicles for three percent of building occupants or install alternative-fuel refueling stations for three percent of the total vehicle parking capacity on the site. To earn the point for this credit for each building, Crescent Resources is providing electric-vehicle recharging stations to encourage building occupants to purchase alternative-fuel vehicles. The photograph in Figure 15 shows the recharging stations in One Potomac Yard.

Figure 15: Electric Vehicle Recharging Stations
SS Credit 4.4 – Alternative Transportation: Parking Capacity & Carpooling
(1 Point)

To satisfy the requirements of this credit, a new project's parking capacity must meet, but not exceed, minimum local-zoning requirements and provide preferred parking spaces for carpools or vanpools capable of serving five percent of the building occupants (other requirements apply to rehabilitation projects). To earn the point for this credit for each building and to discourage the use of single-occupant vehicles, Crescent Resources is providing 50% fewer parking spaces at One and Two Potomac Yard than is typically provided for office buildings in the project’s market and is providing carpool and vanpool spaces. The photograph in Figure 16 shows the parking areas reserved for carpools and vanpools.

SS Credit 5 – Reduced Site Disturbance

SS Credit 5 includes two subordinate credits that encourage developers to conserve existing natural areas and restore damaged areas to provide wildlife habitats and promote biodiversity. The subordinate credits are not cumulative; a project does not have to satisfy the requirements for SS Credit 5.1 to qualify for SS Credit 5.2. Crescent Resources is pursuing one subordinate credit, SS Credit 5.1, for Two Potomac Yard (only).

SS Credit 5.1 – Reduced Site Disturbance: Protect or Restore Open Space
(1 point)

To satisfy the requirements for this credit, a project must limit site disturbance, including earthwork and clearing, on greenfield sites or, on previously developed sites, restore a minimum of 50% of the site area (excluding the building footprint) by replacing impervious surfaces with native or adapted vegetation. To earn the point for this credit, the site and landscaping plans for Two Potomac Yard meet the restoration requirements
for previously developed sites. The photograph in Figure 17 shows the restored area under the bridge to Reagan National Airport, which is just north of building Two.

**SS Credit 6 – Stormwater Management**

SS Credit 6 includes two subordinate credits that encourage developers to avoid disrupting natural water flows by eliminating stormwater runoff, increasing on-site infiltration, and eliminating stormwater contaminants. The subordinate credits are not cumulative; a project does not have to satisfy the requirements for SS Credit 6.1 to qualify for SS Credit 6.2. Crescent Resources is pursuing only SS Credit 6.2 for One and Two Potomac Yard.

**SS Credit 6.2 – Stormwater Management: Treatment (1 Point)**

This credit requires implementing EPA’s Best Management Practices (BMPs) or those of the local government, whichever are more stringent, for site stormwater-treatment systems. A single sand filter, rather than two separate ones, serves One and Two Potomac Yard. Christopher consultants calculated that the filter reduces the total suspended solids (TSS) in runoff by 83% and the total phosphorus (TP) in runoff by 41%, so the shared filter complies with the requirements of this credit to earn a point for each building. The drawing in Figure 18 shows a cross-section of the sand filter that treats stormwater runoff at One and Two Potomac Yard.

**SS Credit 7 – Heat Island Effect**

SS Credit 7 includes two subordinate credits that encourage developers to reduce heat islands (thermal gradient differences between developed and undeveloped land areas) to minimize the negative impact of development on microclimates and human and wildlife habitats. The subordinate credits are not cumulative; a project does not have to satisfy the requirements for SS Credit 7.1 to qualify for SS Credit 7.2. Crescent Resources is pursuing both subordinate credits for One and Two Potomac Yard.

**SS Credit 7.1 – Heat Island Effect: Non-Roof (1 Point)**

This credit requires complying with one of the following options:

- Providing shade (within five years of planting) for at least 30% of the site’s non-roof impervious surfaces, including parking lots, walkways, plazas, etc.; using materials that are light in color and that reflect a high
proportion of the electromagnetic radiation that strikes their surfaces, including visible light (a very small part of the spectrum); and/or using open grid pavement; or

- Placing a minimum of 50% of parking spaces underground or in covered parking structures, or using an open-grid pavement system (less than 50% impervious) for a minimum of 50% of the parking-lot area.

To earn the point for this credit for each building, all parking at One and Two Potomac Yard is in an underground or a covered garage. The building cross-section in Figure 19 shows the location of parking. Three levels of parking are above grade and three levels of parking are below grade.

**SS Credit 7.2 – Heat Island Effect: Roof (1 Point)**

This credit requires using an ENERGY STAR compliant (highly reflective) roof covering that efficiently emits radiant heat gain (highly emissive) on a minimum of 75% of the roof surface or providing a “green” (vegetated) roof on at least 50% of the roof surface. Alternatively, a project can combine highly reflective and highly emissive roof areas with vegetated roof areas to cover 75% of the total roof surface collectively.

Both One and Two Potomac Yard have two separate roof covering systems—a flat-roof and a curved-roof system. The flat system is a Carlisle White EPDM (ethylene propylene diene monomer) system, the curved is a Berridge system with a LEED-compliant, field-applied coating. Using these two systems satisfies the requirements of the credit to earn a point for each building. The photograph in Figure 20 shows the curved roof of One Potomac Yard. Appendix Two provides photographs of the green roof areas at One and Two Potomac Yard.
SS Credit 8 – Light Pollution Reduction
(1 Point)

To avoid lighting the night sky and adjoining areas, called light trespass, this credit encourages developers to focus night lighting inward in the building and on the site. Its intent is to improve the visibility of the night sky and reduce the negative impact of development on nocturnal environments. To satisfy the requirements of the credit, lighting fixtures must provide illumination levels that do not exceed those recommended by the Illuminating Engineering Society of North America (IESNA); i.e., the project cannot be “over lit.” Based on the amount of light, or lumens, an exterior lighting fixture is designed to produce, there are also requirements for providing various types of shielded fixtures, which block the light from spilling into areas not meant to be lit. Additionally, the maximum luminous intensity (candela value) of all interior lighting must fall within the building (not outside through its windows) and the maximum candela value of all exterior lighting must fall within the property boundaries. Any lighting fixture within a distance of 2.5 times its mounting height from the property boundary must have shielding that prevents the light from the fixture from crossing the property boundary. To earn the point for this credit for each building, the lighting designs for One and Two Potomac Yard satisfy all of these requirements. The photographs in Figure 21 show LEED-compliant exterior building lighting fixtures.

![LEED-Compliant Exterior Lighting Fixtures](image)

**Figure 21: LEED-Compliant Exterior Lighting Fixtures**

Water Efficiency (WE)

WE Credit 1 – Water-Efficient Landscaping

WE Credit 1 includes two subordinate credits that encourage developers to limit or eliminate the use of potable water for landscape irrigation. The subordinate credits are cumulative; a project must satisfy the requirements for WE Credit 1.1 to qualify for WE Credit 1.2. Crescent Resources is pursuing both subordinate credits for One and Two Potomac Yard.
WE Credit 1.1 – Water-Efficient Landscaping: Reduce by 50% (1 Point)

This credit requires using high-efficiency irrigation technology or using captured rain or recycled site water to reduce potable water consumption for irrigation by 50% compared to conventional means. To earn the point for this credit, Oculus chose drought-tolerant landscape materials for One and Two Potomac Yard that need only rain for irrigation and that do not depend on artificial irrigation systems to survive. The photograph in Figure 22 shows landscaping at One Potomac Yard, which features Armstrong Red Maples and Allegheny Spurge.

![Figure 22: Drought-Resistant Landscaping](image1)

WE Credit 1.2 – Water-Efficient Landscaping: No Potable Water Use or No Irrigation (1 Point in addition to WE Credit 1.1)

This credit requires using only captured rain or recycled site water to eliminate potable water use for site irrigation (except for initial watering to establish plants), or the elimination of permanent landscape irrigation systems. To earn the point for this credit, Oculus’ choice of drought-tolerate landscape materials for One and Two Potomac Yard eliminated the need for permanent landscape irrigation systems. The photograph in Figure 23 shows the under-bridge landscaping at Two Potomac Yard, which is watered from only scuppers in the bridge above.

![Figure 23: Non-Irrigated Under-Bridge Landscaping](image2)

WE Credit 3 – Water-Use Reduction

WE Credit 3 includes two subordinate credits that encourage developers to maximize the water efficiency of plumbing systems in buildings to reduce the
burden of buildings on municipal water-supply and wastewater systems. The subordinate credits are cumulative; a project must satisfy the requirements for WE Credit 3.1 to qualify for WE Credit 3.2. Crescent Resources is pursuing both subordinate credits for One and Two Potomac Yard.

**WE Credit 3.1 – Water-Use Reduction: 20% Water Reduction (1 Point)**

To satisfy the requirements for this credit, a building’s plumbing system must be designed to use, in aggregate, 20% less water than the water-use baseline for the building (not including irrigation) calculated based on the plumbing-fixture performance requirements of the Energy Policy Act of 1992. To earn the point for this credit, the plumbing systems at One and Two Potomac Yard incorporate low-flow fixtures, including low-flush urinals, dual-flush toilets, and low-flow showerheads and faucets, that reduce the use of potable water. The photographs in Figure 24 show low-flow fixtures that were installed at One Potomac Yard.

**WE Credit 3.2 – Water-Use Reduction: 30% Reduction (1 Point in addition to WE Credit 3.1)**

To earn a point in addition to the point for WE Credit 3.1, plumbing fixtures in buildings must be designed to use, in aggregate, 30% less water than the water-use baseline for the building. The low-flow plumbing fixtures at One and Two Potomac Yard adequately reduce the building occupants’ water use to qualify for the additional point.

**Energy & Atmosphere (EA)**

**EA Prerequisite 1 – Fundamental Building Systems Commissioning (Required)**

According to the U.S. Department of Energy, commissioning is the process of ensuring that energy-using systems of a building are designed, installed, functionally tested, and capable of operation and maintenance according to the owner’s needs. The intent of EA Prerequisite 1 is to verify the use of best practices in commissioning buildings. It requires implementing a commissioning plan using an independent commissioning team (one that does not include individuals who are directly responsible for the project’s design or construction management). The commissioning team verifies that the installation, operation, and performance of building systems are as designed, that building personnel are trained adequately to operate the systems, and that adequate maintenance
documentation is provided to the building owner. To satisfy this prerequisite, Crescent Resources engaged an independent commissioning agent, Advanced Building Performance, to oversee the commissioning of One and Two Potomac Yard.

**EA Prerequisite 2 – Minimum Energy Performance (Required)**

This prerequisite establishes compliance with ASHRAE/IESNA Standard 90.1-1999, *Energy Standard for Buildings Except Low-Rise Residential Buildings* or the local energy code, whichever is more stringent, as the minimum level of energy efficiency required for base buildings and systems. The designs for One and Two Potomac Yard comply with the ASHRAE/IESNA Standard. The photographs in Figure 25 show commissioning professionals testing the myriad components of the buildings’ environmental systems for performance and reliability. The commissioning process will continue for several months after the building is complete to ensure the proper performance of all environmental systems under all kinds of atmospheric conditions.

**EA Prerequisite 3 – CFC Reduction in HVAC&R Equipment (Required)**

This prerequisite strives to reduce ozone depletion by disallowing the use of chlorofluorocarbon (CFC) refrigerants in HVAC systems and refrigeration systems of new buildings (the credit allows a phase-out of CFC refrigerants for rehabilitated buildings). To satisfy this prerequisite, One and Two Potomac Yard’s HVAC and refrigeration systems are CFC free.

**EA Credit 1 – Optimize Energy Performance (1-10 Points)**

This credit encourages developers to reduce the negative environmental impacts of buildings associated with their energy use. The points earned for the credit vary based on the amount by which the energy costs for a building’s HVAC, service hot-water, and interior-lighting systems fall below baseline costs established by the energy code required by EA Prerequisite 2 (the more stringent of ASHRAE/IESNA Standard 90.1-1999 or the local energy code). A whole-building simulation according to the ASHRAE standard establishes the energy costs for the systems.
Energy savings between 17.5% and 22.5% earns two points, and energy savings between 22.5% and 27.5% earns three points. One Potomac Yard’s energy savings are 23.5% over baseline, earning three points for this credit. Two Potomac Yard’s energy savings are 20.7% over baseline, earning two points for this credit. To earn points for this credit and achieve energy cost savings of 20% over baseline costs as required in the EPA-lease Solicitation for Offers (SFO), the designs of One and Two Potomac Yard incorporate the following:

- Lighting-power densities that fall between 0.74 and 0.9 watts per square foot
- High-performance window and entry systems that maximize thermal performance, reduce solar gain, and minimize air leaks and uncontrolled water infiltration
- Light-colored materials that maximize the affect of daylight and reduce energy use and heat gain from artificial light sources
- Building-management control systems that monitor carbon dioxide, humidity, and temperature and that control air-movement and temperature
- High-efficiency HVAC systems

**EA Credit 3 – Additional Commissioning (1 Point)**

This credit encourages developers to provide assurance in addition to fundamental building commissioning that the building and systems are designed, constructed, and calibrated to operate as intended. The credit requires completion of the following additional commissioning tasks:

- Additional reviews of the building’s design by an independent commissioning agent, including a review before, during, and at the completion of the construction documents phase of the building design
- Review of the construction contractor’s documentation for relevant systems (commonly called contractor submittals) by the independent commissioning agent to confirm the products and systems incorporated into the building
- Compilation of a single commissioning manual for the building owner that contains the information required for re-commissioning building systems
- Engaging entities to review the operation of building systems with the owner’s operation and maintenance staff and developing a plan for resolving outstanding commissioning-related issues within one year after the date of construction completion

To earn the point for this credit for each building, the independent commissioning agent will complete these additional tasks as part its oversight of the commissioning of One and Two Potomac Yard.
EA Credit 4 – Ozone Protection
(1 Point)

To promote early compliance with the Montreal Protocol on Substances that Deplete the Ozone Layer, an international agreement signed in 1987, this credit encourages developers to employ strategies that reduce ozone depletion. The Montreal Protocol stipulates requirements for phasing out production and consumption of substances that deplete the earth’s ozone layer. The credit requires the installation of base-building HVAC equipment, refrigeration equipment, and fire-suppression systems that do not contain hydrochlorofluorocarbons (HCFCs) or Halons, both ozone-depleting substances. To earn the point for this credit, the HVAC and refrigeration equipment at One and Two Potomac Yard are HCFC free and the fire-suppression systems are Halon free.

EA Credit 5 – Measurement & Verification
(1 Point)

This credit promotes the ongoing accountability for and the optimization of building energy and water consumption performance. It requires the installation of continuous metering equipment for various end-uses including lighting systems and controls, motor loads, HVAC-system loads and operations, building-related process energy systems and equipment, and water-service systems. The EPA SFO included requirements for measurement and verification because it is a high priority of the Agency. Advanced Building Performance developed a plan for One Potomac Yard (only) to meet EPA requirements, as well as to earn the point for this credit for One Potomac Yard. The photograph in Figure 26 shows wall-mounted, continuous-metering equipment that keep building personnel apprised of the performance of building systems at One Potomac Yard.

EA Credit 6 – Green Power
(1 Point)

This credit encourages developers to use grid-source (instead of on-site), renewable energy technologies that do not pollute the environment. Early in the project’s design process, EPA agreed to purchase grid-source green power for both buildings. To earn the point for each building, EPA is securing a contract for the kilowatts per hour that each building will use and EPA will pay the cost for one full year of green power for the buildings, or for 50% of the green-power costs for two years.

Figure 26: Wall-Mounted, Continuous-Metering Devices
**Mr Prerequisite 1 – Storage & Collection of Recyclables (Required)**

This prerequisite attempts to reduce the waste generated by building occupants that is disposed of in landfills. It requires providing an easily accessible, dedicated area for the entire building for the collection, separation, and storage of recyclable materials. Paper, corrugated cardboard, glass, plastics, and metals must be recycled. To earn the point for this credit, a dedicated area close to the loading dock is reserved for the collection and management of recyclable materials at One and Two Potomac Yard. In keeping with EPA-lease requirements, Crescent will recycle paper products, cardboard, and glass, plastic, and aluminum beverage containers. The photograph in Figure 27 shows the sign at the entrance to the recycling room in One Potomac Yard.

**Mr Credit 2 – Construction-Waste Management**

Mr Credit 2 includes two subordinate credits that encourage developers to divert construction, demolition, and land-clearing debris from disposal in landfills by redirecting recyclable materials back to manufacturing processes and redirecting reusable materials to appropriate sites. The subordinate credits are cumulative; a project must satisfy the requirements for Mr Credit 2.1 to qualify for Mr Credit 2.2. Davis Construction is assisting Crescent Resources in pursuing both subordinate credits for One and Two Potomac Yard.

Davis Construction did an exceptional job of tracking and maintaining the records for these credits. Diverting 75% of construction waste is extremely difficult for a project the size of One and Two Potomac Yard.

**Mr Credit 2.1 – Construction-Waste Management: Divert 50% from Landfill (1 Point)**

This credit requires developing and implementing a construction-waste management plan that quantifies the amount of construction-activity debris diverted from disposal in landfills. It also requires recycling or salvaging 50% of construction, demolition, and land-clearing debris. Calculations are by weight or volume, but the method of calculation must be consistent throughout the project. The construction-waste management program implemented at One and Two Potomac Yard aggressively recycles and salvages materials, earning the point for this credit for each building. The photographs in Figure 28 show containers used for on-site recycling during construction.
MR Credit 2.2 – Construction-Waste Management: Divert 75% from Landfill
(1 Point in addition to MR Credit 2.1)

To earn a point in addition to the point for MR Credit 2.1 requires recycling or salvaging 75% of construction, demolition, and land-clearing debris. The aggressive construction-waste management program implemented at One and Two Potomac Yard should earn the additional point for each building.

Figure 28: Containers Used for Recycling During Construction

MR Credit 4 – Recycled Content

MR Credit 4 includes two subordinate credits that encourage developers to incorporate recycled-content material into projects, which increases the demand for building products containing recycled materials. The resulting decrease in demand for products that contain only virgin materials reduces the negative impacts of extracting and processing virgin materials. The subordinate credits are cumulative; a project must satisfy the requirements for MR Credit 4.1 to qualify for MR Credit 4.2. Crescent Resources is pursuing both subordinate credits for One and Two Potomac Yard.

The EPA SFO specified that the CPG guide product selection and establish the requirements for proportion of recycled content. To earn MR Credit 4.1 and MR Credit 4.2, Sustainable Design Consulting, Davis Carter Scott, and Davis Construction worked together to ensure that the buildings incorporate the correct products.

MR Credit 4.1 – Recycled Content: 5% (post-consumer + 1/2 post-industrial)
(1 Point)

This credit requires using construction materials with recycled content as defined by the Federal Trade Commission in its document Guides for the Use of Environmental Marketing Claims, 16 CFR 260.7 (e). To satisfy the credit, the sum of the value of post-consumer recycled content plus one-half the value of the post-industrial recycled content must make up least five percent of the total value of the materials used in the project. Post-consumer recycled materials are waste materials generated by the end user of a product or material. Post-industrial recycled materials are waste materials generated
in manufacturing processes. The value of the recycled content of a material is the ratio of the weight of recycled content in the item to the total weight of the item multiplied by the total value of the item. Mechanical and electrical components are not included in this calculation. The materials used in the construction of One and Two Potomac Yard meet the requirements to earn the point for each building. The photographs in Figure 29 show the steel used to reinforce concrete (rebar) at One Potomac Yard, which has 85% post-consumer and 15% post-industrial recycled content.

**MR Credit 4.2 – Recycled Content: 10% (post-consumer + 1/2 post-industrial)**

*(1 Point in addition to MR Credit 4.1)*

To satisfy the requirements for this credit, the value of the recycled materials required by MR Credit 4.1 increases from five to ten percent. The materials used in the construction of One and Two Potomac Yard meet the requirements to earn the additional point for each building. The photographs in Figure 30 show various products that contain recycled materials used in the construction of One Potomac Yard.

**Figure 29:** Rebar with Post-Consumer and Post-Industrial Recycled Content

**Figure 30:** Products with Recycled Content

Products Listed Clockwise from Top Right:
- Ceiling Tile (78% Post Industrial, 4% Post Consumer)
- Safing Insulation (85% Post Industrial)
- Gypsum Board (99% Post Industrial)
- Ceramic Tile (50% Post Industrial)
MR Credit 5 – Regional Materials

To support regional economies and reduce the negative environmental impacts of transporting materials and products, MR Credit 5 includes two subordinate credits, each intended to increase the demand for building materials and products that are extracted and manufactured within the project’s region. The subordinate credits are cumulative; a project must satisfy the requirements for MR Credit 5.1 to qualify for MR Credit 5.2. Crescent Resources is pursuing both subordinate credits for One and Two Potomac Yard.

Through months of dedicated research, Davis Construction and other consultants found materials that originated from within a 500-mile radius of Potomac Yard to earn the points for the two subordinate credits.

**MR Credit 5.1 – Regional Materials: 20% Manufactured Regionally**
(1 Point)

This credit requires that a minimum of 20% of building materials and products incorporated into a project originate from within a 500-mile radius of the project site. Assembly of manufactured products must occur within this prescribed area; however, component parts and products can originate from outside of the area. The materials used in the construction of One and Two Potomac Yard satisfy the credit to earn the point for each building.

**MR Credit 5.2 – Regional Materials: 50% Extracted Regionally**
(1 Point in addition to MR Credit 5.1)

This credit requires that at least 50% of the building materials used to qualify for MR Credit 5.1, or 10% of all building materials, be extracted, harvested or recovered (as well as manufactured) within a 500-mile radius of the project site. The materials used in the construction of One and Two Potomac Yard satisfy the credit to earn the additional point for each building.

MR Credit 7 – Certified Wood
(1 Point)

This credit encourages developers to use products that incorporate wood originating from sustainable forests certified by the Forest Stewardship Council (FSC). A minimum of 50% of the wood-base building materials and products used in a project must use FSC-certified wood. Wood-base building components include, but are not limited to, structural and general dimensional framing, flooring, finishes, furnishings, and nonrented temporary construction applications such as bracing, concrete formwork, and pedestrian barriers. To earn the point for this credit, the project team conscientiously selected wood products—more than 50% of wood materials used at One and Two Potomac Yard were grown in FSC-certified, sustainable forests. The photographs in Figure 31 show wood from certified sustainable forests used in One Potomac Yard.
Indoor Environmental Quality (EQ)

**EQ Prerequisite 1 – Minimum IAQ Performance (Required)**

This prerequisite establishes minimum IAQ performance to prevent the development of indoor air quality problems in buildings and to contribute to the comfort and well-being of the occupants. It requires that a project’s ventilation systems meet the minimum requirements of ASHRAE 62-1999, *Ventilation for Acceptable Indoor Air Quality*. The ventilation systems at One and Two Potomac Yard comply with the ASHRAE requirements, satisfying the prerequisite.

**EQ Prerequisite 2 – Environmental Tobacco Smoke (ETS) Control (Required)**

This prerequisite prevents the exposure of building systems and occupants to ETS. It requires that building designs ensure zero exposure of non-smokers to ETS by one of the following methods:

- Prohibiting smoking in the building and locating exterior designated smoking areas away from entries and operable windows; or

- Providing a designated smoking room designed to contain, capture, and remove all ETS from the building. Minimally, the smoking room must directly exhaust to the outdoors with no recirculation of ETS-containing air to non-smoking areas of the building. Tracer gas testing methods described in ASHRAE Standard 129-1997 verify the performance of the smoking rooms. The building construction contract must include smoking-room testing and either the commissioning report or a separate document must report testing results.

Satisfying the requirements of the prerequisite, smoking is not allowed inside One and Two Potomac Yard, and exterior designated smoking areas are located away from entries and operable windows. Further, smoking was not allowed within the buildings while they were under construction.

Figure 31: Wood from Certified Sustainable Forests
**EQ Credit 1 – Carbon Dioxide (CO₂) Monitoring (1 Point)**

This credit encourages developers to integrate IAQ monitoring into projects, which helps sustain long-term occupant comfort and well-being. It requires installing a permanent carbon dioxide monitoring system that provides feedback on space-ventilation performance in a way that allows operational adjustments. To earn the point for this credit, One and Two Potomac Yard have building-management control systems that meet this requirement. The photograph in Figure 32 shows a carbon dioxide monitor installed at One Potomac Yard.

**Figure 32: Carbon Dioxide Monitor**

**EQ Credit 3 – Construction IAQ Management Plan**

EQ Credit 3 includes two subordinate credits that encourage developers to prevent IAQ problems resulting from construction processes. The intent of the subordinate credits is to help sustain the comfort and well-being of construction workers and building occupants. The subordinate credits are not cumulative; a project does not have to satisfy the requirements for EQ Credit 3.1 to qualify for EQ Credit 3.2. Crescent Resources is pursuing both subordinate credits for One and Two Potomac Yard.

**EQ Credit 3.1 – Construction IAQ Management Plan: During Construction (1 Point)**

This credit requires developing and implementing an IAQ Management Plan for the construction and pre-occupancy periods of a building that include the following measures:

- Implementing IAQ procedures during construction that meet or exceed the recommended Design Approaches of the Sheet Metal and Air Conditioning Contractors’ National Association (SMACNA) IAQ Guideline for Occupied Buildings;
- Protecting absorptive materials that are stored on-site or installed in the building from moisture damage;
• If air handlers are used during construction, installing filtration media (air filters) with a Minimum Efficiency Reporting Value (MERV) of 8 according to ASHRAE 52.2-1999 at each return air grill; and

• Replacing air filters at the end of construction and immediately before the occupation of building areas. The replacement air filters must be more efficient than those used during construction—they must have a MERV of 13.

EPA, GSA, and Davis Construction worked with Crescent Resources in developing the Construction IAQ Plan. EPA-SFO and LEED-credit requirements were part of the plan implemented by Davis Construction, earning the point for this credit for each building. The photograph in Figure 33 shows a vacuum sander used to finish gypsum board, controlling dust at its source in keeping with the SMACNA IAQ Guideline and the Construction IAQ Management Plan.

**EQ Credit 3.2 – Construction IAQ Management Plan: Before Occupancy (1 Point)**

This credit requires developing and implementing an IAQ Management Plan for the pre-occupancy period of the building that ensures the quality of air for building occupants by flushing out the building or by passing baseline IAQ testing.

• Flushing out the building requires installing new MERV 13 air filters and circulating 100% outside air through the building interior for a period of at least two weeks after construction ends and before the occupation of building areas. After the flush out, air filters that processed inside air during the flush out must be replaced with new MERV 13 air filters (filters that only processed outside air do not need to be replaced).

• Passing baseline IAQ testing requires conducting testing according to EPA’s current *Protocol for Environmental Requirements, Baseline IAQ and Materials, for the Research Triangle Park Campus, Section 01445.*

Although the EPA SFO emphasized the need for a two-week building flush out, this approach was infeasible for the project because using 100% outside air would have negatively affected the construction schedule. EPA and Crescent Resources cooperated to modify the EPA-lease requirements to reflect the realities of the project. To satisfy the intent of the SFO, Crescent Resources substituted baseline IAQ testing for a building flush out. The testing plan for One and Two Potomac Yard, developed by EPA, GSA, and Healthy Buildings International, follows the protocol detailed in the USGBC LEED Credit Ruling to earn a point for each building.
To ensure the air quality for tenants and their employees, Healthy Buildings International conducted baseline IAQ tests before the spaces were occupied. It tested for five contaminants – carbon dioxide (CO₂); formaldehyde; particulates; total volatile organic compounds (TVOC); 4-phenylcyclohexene (4-PCH), which is often associated with new-carpet odor; and carbon monoxide (CO). Before tenants occupied a floor, the IAQ on the floor exceeded the established requirements. The photograph in Figure 34 shows IAQ-testing equipment in use.

**EQ Credit 4 – Low-Emitting Materials**

EQ Credit 4 includes four subordinate credits that encourage developers to reduce the quantity of indoor air contaminants that emit odors and that are potentially irritating or harmful to the comfort and well-being of material installers and building occupants. The subordinate credits are not cumulative; a project does not have to satisfy the requirements of one to qualify another.

Crescent Resources is pursuing all four of the subordinate credits for One and Two Potomac Yard. The base building and tenant specifications were written to achieve these credits and, in some cases, to exceed them by following EPA-SFO requirements. Davis Construction delivered submittals to Davis Carter Scott and Sustainable Design Consulting for review to ensure all materials were LEED compliant.

**EQ Credit 4.1 – Low-Emitting Materials: Adhesives & Sealants (1 Point)**

This credit requires limiting the VOC content of adhesives and sealants used in construction to less than the March 2002 VOC-content limits of the South Coast Air Quality Management District (SCAQMD) Rule #1168. Also, sealants used as joint fillers (commonly called caulk) must meet or exceed the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51. To earn the point for this credit, the adhesives and sealants used at One and Two Potomac Yard comply with these requirements. The photographs in Figure 35 show low-emitting adhesives and sealants used at One and Two Potomac Yard.
EQ Credit 4.2 – Low-Emitting Materials: Paints & Coatings (1 Point)

This credit requires limiting the VOC emissions and chemical components of paints and coatings used on a project to the limits established by Green Seal’s Standard GS-11. To earn the point for this credit, the paints and coatings used at One and Two Potomac Yard comply with these requirements. The photographs in Figure 36 show low-emitting paints and coatings used at One and Two Potomac Yard.

EQ Credit 4.3 – Low-Emitting Materials: Carpet (1 Point)

This credit requires that carpet systems used on a project meet or exceed the requirements of the Carpet and Rug Institute’s Green Label Indoor Air Quality Test Program. To earn the point for this credit, the carpet systems used at One and Two Potomac Yard comply with these requirements. The photograph in Figure 37 shows low-emitting carpet squares installed in One Potomac Yard.

EQ Credit 4.4 – Low-Emitting Materials: Composite Wood (1 Point)

This credit requires that composite wood and agrifiber products (e.g., particleboard) used on a project contain no added urea-formaldehyde resins (commonly used as binders). To earn the point for this credit, the composite wood products used at One and Two Potomac Yard do not contain added
urea-formaldehyde resins. The photograph in Figure 38 shows composite-wood wall panels installed in One Potomac Yard.

**EQ Credit 5 – Indoor Chemical & Pollutant Source Control**

(1 Point)

This credit encourages developers to avoid exposing building occupants to potentially hazardous chemicals that adversely affect air quality. It requires the building design to minimize the cross-contamination of regularly occupied areas with pollutants using the following strategies:

- Employing permanent entryway systems (e.g., grills and grates) to capture dirt, particulates, etc. at all high-volume building entrances;

- Where chemical use occurs in buildings (including housekeeping areas and copying or printing rooms), segregating the areas with floor-to-floor partitions, providing separate outside air exhaust at a rate of at least 0.50 cubic feet per minute per square foot, prohibiting air re-circulation, and maintaining a negative air pressure of at least 7 PA (0.03 inches of water gauge); and

- Where water and chemical-concentrate mixing occurs in buildings, providing drains plumbed appropriately for disposing of the resultant liquid waste.

To earn the point for this credit, the project team incorporated detailed requirements in the base-building and tenant-work specifications for One and Two Potomac Yard. Permanent entryway systems were installed at all high-volume entrances, housekeeping and copy areas are appropriately ventilated, and water and chemical concentrate mixing will not occur at One and Two Potomac Yard. The photograph in Figure 39 shows the entry vestibule of One Potomac Yard and its permanent entryway system that catches dirt.

**EQ Credit 7 – Thermal Comfort**

EQ Credit 7 includes two subordinate credits that encourage developers to provide thermally comfortable environments that support the productivity and well-being of building occupants. The two subordinate credits are cumulative; a project must satisfy the requirements for EQ Credit 7.1 to qualify for EQ Credit 7.2. Crescent Resources is pursuing both subordinate credits for One and Two Potomac Yard.
EQ Credit 7.1 – Thermal Comfort: Compliance with ASHRAE 55-1992 (1 Point)

This credit requires the building design to comply with ASHRAE Standard 55-1992 for thermal comfort standards, including humidity control. For naturally ventilated buildings, it requires maintaining 90% of the acceptability limits defined in the Collaborative for High Performance Schools (CHPS) Best Practices Manual. The advanced building-management control and high-efficiency HVAC systems incorporated into One and Two Potomac Yard satisfy these requirements to earn the point for this credit. The photograph in Figure 40 shows a humidity control installed at One Potomac Yard. Appendix One includes diagrams of the environmental-control systems.

EQ Credit 7.2 – Thermal Comfort: Permanent Monitoring System (1 Point in addition to EQ Credit 7.1)

This credit requires installing permanent systems to monitor temperature and humidity and provide operator control over the humidification, dehumidification, and thermal-comfort systems in the building. Because EPA specifically wanted the buildings to comply with the requirements of this credit, the advanced building-management control systems at One and Two Potomac Yard meet the requirements to earn the point. The photograph in Figure 41 shows a humidity monitor and vapor-injection system at One Potomac Yard. Appendix One includes a diagram showing locations of continuous monitor controls for self-contained units on a typical floor.

EQ Credit 8 – Daylight & Views

EQ Credit 8 includes two subordinate credits that encourage developers to provide connections between indoor spaces and the outdoors for building occupants by introducing daylight and views into regularly occupied areas of the
building. The subordinate credits are not cumulative; a project does not have to satisfy the requirements for EQ Credit 8.1 to qualify for EQ Credit 8.2. Crescent Resources is pursuing only EQ Credit 8.2 for One and Two Potomac Yard.

**EQ Credit 8.2 – Daylight & Views: Views for 90% of Spaces (1 Point)**

This credit requires that building designs achieve a direct line of sight to vision glazing for building occupants in 90% of all regularly occupied spaces. Examples of spaces excluded from this requirement include copy rooms, storage areas, mechanical rooms, laundry rooms, and other low-occupancy support areas. USGBC considers other exceptions on their merits. To earn the point for this credit, the designs for One and Two Potomac Yard include open floor plans and windows that are nine feet tall, allowing views to the outside from 90% of the regularly occupied interior spaces. The photographs in Figure 42 show the nine-foot tall windows and typical views to the outdoors at One Potomac Yard.

**Innovation & Design Process (ID)**

**ID Credit 1 – Innovation in Design**

ID Credit 1 includes four subordinate credits that offer design teams and projects opportunities to earn points for exceptional performance above the requirements set by the LEED Green Building Rating System and/or for innovative performance in green building categories not specifically addressed by the LEED Green Building Rating System. The subordinate credits are not cumulative; a project does not have to satisfy the requirements of one to qualify for another. Crescent Resources is pursuing all four subordinate credits for One and Two Potomac Yard.

**ID Credit 1.1 – Innovation in Design (1 Point)**

This credit requires the LEED applicant to identify, in writing, the intent of the proposed innovation credit, the proposed requirement for compliance, the proposed submittals to demonstrate compliance, and the design approach (strategies) used to meet the requirements. To earn the point for this credit, Crescent Resources is documenting that 40% of materials and products used at One and Two Potomac Yard originate from within a 500-mile radius of the project site. This proportion of regional materials is twice the amount
required by MR Credit 5.1, representing exceptional green-building performance.

**ID Credit 1.2 – Innovation in Design (1 Point)**

This credit requires that the LEED application include the same information required for ID Credit 1.1. To earn the point for this credit, Crescent Resources and Woodmark developed a Green Housekeeping program for One and Two Potomac Yard in keeping with guidelines established by USGBC—maintenance personnel will use low-toxicity cleaners to maintain a healthy indoor environment, which qualifies as innovative IAQ performance. The photograph in Figure 43 is of Woodmark’s Ed Beanblossom holding the Green Housekeeping Manual for One and Two Potomac Yard.

**ID Credit 1.3 – Innovation in Design (1 Point)**

This credit requires that the LEED application include the same information required for ID Credit 1.1. To earn the point for this credit, Crescent Resources established a User Education Plan at One and Two Potomac Yard—signage, literature, and policies are in place to educate occupants about the design strategies and materials used to create a green building, representing innovative performance. The diagrams in Figure 44 illustrate the green-building feature signs displayed throughout the buildings.

**Figure 43:** Ed Beanblossom Holding the Green Housekeeping Manual

**Figure 44:** Green-Building Feature Signs
ID Credit 1.4 – Innovation in Design
(1 Point)

This credit requires that the LEED application include the same information required for ID Credit 1.1. To earn the point for this credit, the water efficiency at One and Two Potomac Yard was increased to 40% (33% greater than the efficiency required by WE Credit 1.2), representing exceptional water-efficiency performance. The photographs in Figure 45 show water-efficient faucets installed in One and Two Potomac Yard.

Figure 45: Water-Efficient Faucets

ID Credit 2 – LEED-Accredited Professional
(1 Point)

This credit supports and encourages the design integration necessary for a successful LEED Green Building project and streamlines the application and certification process. It requires having at least one principal participant of the project team that has successfully completed the LEED-Accredited Professional exam. To earn the credit for this point, the Potomac Yard Team included at least eight LEED-Accredited Professionals. The photographs in Figure 46 are of some of the LEED-Accredited Professionals who worked on the greening of One and Two Potomac Yard.

Figure 46: LEED-Accredited Professionals at One and Two Potomac Yard
Challenges and Lessons Learned

In overcoming complicated challenges inherent in the LEED-certification process for One and Two Potomac Yard, the project team learned valuable lessons that will allow each member to pursue certification of future projects more effectively. The challenges and corresponding lessons included the following:

- **LEED certification requires teamwork.** Crescent Resources learned that managing interactions among project participants and being forthcoming with information avoided creating “us” versus “them” mentalities within the project team. For example, by readily disclosing information, a relationship of cooperation evolved between Crescent Resources and EPA, as evidenced by EPA agreeing to pay costs associated with EA Credit 5 – Measurement & Verification and EA Credit 6 – Green Power, which Crescent Resources could not pursue otherwise.

- **Various stakeholders in the project have conflicting requirements.** At One and Two Potomac Yard, concurrently meeting the requirements of USGBC, EPA, Federal Protective Services, and Arlington County meant compromising preferences of one entity to satisfy the requirements of another. Also, some requirements for LEED credits, if literally interpreted, extend beyond the limits of the developer’s control. For example, where right-of-way easements exist on the site, the developer cannot control whether street lighting prescribed by the local jurisdiction and installed on these easements meets the requirements of applicable LEED credits. The Potomac Yard team learned to assess the extent to which stakeholders can impose requirements on the developer realistically and to address requirements accordingly. At the beginning of the development process, EPA agreed that when SFO requirements conflicted with LEED requirements, LEED requirements would prevail.

- **Various credits have conflicting requirements.** Sometimes, a reasonable strategy for pursuing one credit is at odds with the requirements of another. For example, using recycled, consolidated latex paint to meet the requirements of MR Credit 4 – Recycled Content conflicts with the requirements of EQ Credit 4.2 – Low-Emitting Materials: Paints & Coatings. Recycled, consolidated latex paint is produced by mixing the remainders of batches of various latex formulations that otherwise would be wasted. But, mixing formulations precludes the ability to measure the VOCs in the recycled product. The Potomac Yard team learned the importance of coordinating the requirements of various credits to maximize point totals.

- **Fulfilling credit requirements can lead to seemingly illogical decisions.** For example, one of USGBC’s stated goals for MR Credit 5 is to support regional economies, but pursuing points for this credit led the Potomac Yard team to import goods from Canada (because of its proximity to the project) instead of using U.S.-manufactured materials. The project team learned that requirements for credits are imperfect methods for achieving the credit’s goal.

- **Pursuing LEED certification adds time to the construction process.** It makes material specification more complicated than for a typical project because it necessitates more research. It also requires taking the time to educate
subcontractors to the importance of LEED material and installation requirements. For example, IAQ requirements for carpet aging might seem arbitrary to a carpet installer; however, carpet aging affects IAQ and passing IAQ testing drove GSA’s acceptance of the buildings. Crescent Resources learned that selecting design-team members and subcontractors with LEED experience is essential to minimize the extra time required to achieve LEED certification.

- **Enforcing the implementation of LEED requirements during construction is difficult.** Subcontractors might be lax with requirements because they do not understand the complexities of LEED requirements. Crescent Resources learned that a quality control program, including frequent field inspections, is critical to successfully implementing LEED requirements.

- **Efficient construction practices are at odds with recycling requirements.** Efficient construction operations depend on keeping a site free of debris and waste, but recycling requires maintaining and sorting piles of waste materials. The Potomac Yard team learned to use “dumpster management” to meet recycling goals and to minimize the disruption of operations caused by waste handling.

- **The design and engineering for LEED improvements is costly.** While design costs are usually around 3% to 4% of building construction costs, LEED-related design costs were about 33% of the corresponding LEED-related construction costs at One and Two Potomac Yard. During the course of the project, Crescent Resources learned to appreciate the complexity of the design and engineering required for LEED certification—especially as it relates to building commissioning.

- **Building commissioning is expensive, complicated, and time consuming.** Crescent paid more than $750,000 in commissioning fees for One and Two Potomac Yard. The commissioning process involves more than 2800 control points in the energy-management system, with each point tested (up to eight different ways) for accuracy, functionality, and reliability. Tests of each control point occur every 48 hours to compile trend-logging reports to compare to future performance tests. Building-commissioning procedures occurred throughout the construction period (24 months) and will continue for at least 12 months after construction is finished. However, building commissioning ensures a high-performing building from first occupancy and provides the building management with a base-line performance standard to evaluate the on-going building systems for efficiency.

- **Pursuing LEED certification requires careful planning.** The project team conceived of and gained Arlington County approval for One and Two Potomac Yard before establishing the goal of earning at least a Silver Rating for each building. Retrofitting the project to incorporate LEED requirements after obtaining zoning approval unnecessarily complicated the project’s design. To facilitate certification, the Potomac Yard team learned that the goal of certification should be set at project inception, the team should have frequent LEED coordination meetings starting early in the process, and the team should begin documenting credit and point strategies right away.
• **Credit requirements are often obscure.** Because LEED certification is an evolving program, the Potomac Yard team sometimes perceived UGBC policies as moving targets that were developing as they were implemented. Also, USGBC information is loosely written and USGBC clarifications were often confusing. Through their experience at One and Two Potomac Yard, the project team learned that USGBC responses are often qualitative rather than quantitative, complicating project decision making. The project team also learned to clearly define questions posed to USGBC to avoid getting responses based on what USGBC would “like to see” instead of on what is required for certification.

• **The LEED certification process is filled with uncertainty.** Because the evaluation of the project occurs at completion, “point management” is essential. Crescent Resources learned that it is important to evaluate the points that a project is expected to earn early in the process, and to re-evaluate the expected point totals often. Other point-management strategies Crescent Resources learned include “going for the low-lying fruit,” pursuing points that add to costs without complicating the process, and banking “insurance points” by pursuing more points than necessary to achieve the minimum certification level desired for the project.

• **"Spill-over" effects caused by real estate development are hard to measure.** Private markets usually ignore externalities of development, so public entities attempt to minimize the adverse effects of real estate development on local communities through government regulations and municipal proffers. The LEED scorecard is a quantitative measure of negative external effects: the higher the LEED score, the lower the negative external effects. It is not surprising that municipalities encourage compliance with LEED credits through both incentives and legislative mandates.

• **Pursuing LEED certification alters a developer’s perspective.** Traditionally, developers focused on relationships among land, labor, and capital, using financial statements as measures of the efficiency of these relationships. Seeking LEED certification forces developers to look at the relationships among land, buildings, people, and nature. These relationships are more complex than the traditional ones, and not as easily defined or measured by financial statements. The LEED scorecard is a tool that measures the extent of these relationships and its numeric score can be certified by a third party and represented to the general public.

• **Achieving LEED certification is a beginning and not an end.** The development process of a LEED-certified building is not over when its construction is finished. The end of the construction phase marks the beginning of the process of operating an energy-efficient, healthy, and sustainable work place, which is part of the greater social community and natural environment. Another LEED program, LEED for Existing Buildings (LEED–EB) measures ongoing building performance. LEED–EB guides the operations of economically profitable, environmentally responsible, healthy, productive places to live and work.

Crescent Resources agrees with the majority of LEED participants who, according to USGBC, characterize LEED as a wonderful tool that is starting to transform the building industry but that is also too time consuming and costly. In response to
feedback from LEED-program participants, USGBC announced yet another series of enhancements to the LEED Green Building Rating System and certification process in November 2005 at its Greenbuild Conference and Expo in Atlanta, GA. The changes to the program are designed to further reduce the LEED documentation-process time, paperwork, and cost. USGBC hopes program enhancements will encourage wider participation and transform the marketplace to one where sustainability is the norm.

Although LEED certification adds complexity and cost to a project, it is in keeping with Crescent Resources’ commitment to sustainable development. The following words of one team member sum up the value of pursuing at least a LEED Silver Rating:

_I’m glad Crescent decided to make LEED a priority on this project. While I think the LEED points system is [a] long way from perfect, it is definitely a step in the right direction. Building green is fairly easy to accomplish and it significantly improves our world. I wish more clients were willing to endure a little headache to bring their buildings to the next level in intelligent and high-performance design._—Kathy Barcus, Davis Carter Scott
About the Authors

Daniel B. Kohlhepp, Ph.D.
Regional Vice President
Crescent Resources, LLC

As regional vice president for the Mid-Atlantic Region, Dan Kohlhepp is responsible for the acquisition, development and leasing of commercial real estate in Virginia, Maryland, Pennsylvania, and the District of Columbia for Crescent Resources, LLC. He is currently completing the development of Potomac Yard, a 300-acre, mixed-use, urban in-fill project in Northern Virginia. During the development of Potomac Yard, Dan and his team have been awarded the Northern Virginia NAIOP Best Transaction of the Year (2001), Trenchless Technology’s Project of the Year (2003), Arlington Chamber of Commerce Chairman’s Award (2003), Washington Business Journal’s Best GSA Lease Award (2004), and Arlington Chamber of Commerce ABBIES “Green” Award (2005).

Dan earned his B.S. and M.B.A. degrees from Penn State University and earned his Ph.D. with a major in Real Estate and Urban Analysis, at the Ohio State University.

He currently serves on the advisory board of the Edward St. John Real Estate Department of Johns Hopkins University. He also serves on the Four Mile Run Joint Task Force, a special committee established to advise Arlington, Alexandria, the U.S. Army Corps of Engineers, and the Northern Virginia Regional Commission on the remediation and re-development of the Four Mile Run stream. He is a past director of the Alexandria Economic Development Partnership and the American Real Estate and Urban Economic Association.

In 1997, the Weimer School of Advanced Real Estate and Land Economics recognized Dan with its Leadership Award, and in 2003, Penn State University presented him the Alumni Fellow Award.

Elizabeth W. Adams, LEED AP
Development Coordinator, Mid-Atlantic Region
Crescent Resources, LLC

Elizabeth Adams serves as the Development Coordinator for Crescent Resources’ Mid-Atlantic Office in Arlington, VA.

Elizabeth assists in the marketing, leasing, land sales, development and construction of all Crescent’s Mid-Atlantic projects. She is responsible for maintaining relationships with County Staff, community leaders and other real estate professionals to establish Crescent as a developer and good neighbor in the community and region.

Elizabeth received a bachelor of arts in Journalism and Mass Communication from the University of North Carolina at Chapel Hill.

Elizabeth is the member of several organizations: Northern Virginia National Association of Industrial Office Parks (NAIOP), USGBC, Urban Land Institute (ULI), and is a lifetime member of Leadership Arlington—Alexandria Chamber of Commerce and the Arlington Chamber of Commerce. She has participated in numerous community events and served on several committees.

Elizabeth received her ULI Certificate and is a LEED-Accredited Professional.
Elena M. S. Garrison, R.A.
Graduate Student, The Edward St. John Real Estate Department
Johns Hopkins University

Elena Garrison is a graduate student at the Edward St. John Real Estate Department at Johns Hopkins University. A licensed architect, she has 12 years of experience practicing architecture and 10 years of subsequent experience developing intellectual properties related to construction technology for The American Institute of Architects.


Elena is an emeritus member of ASTM International, and served as a participating member for 10 years, during which she served as Chair for Subcommittee F06.80, Resilient Floor Coverings Specifications. She also actively participated in F06 investigations of slip resistance, failures of floor coverings installed on concrete slabs, and substrate preparation guidelines.

During her graduate studies at Hopkins, Elena shifted her career focus from architecture and technical issues of construction to development, deal structure, and finance. Currently, she works in acquisitions, overseeing the analysis and underwriting of residential and mixed-use deals.

Elena received her Bachelor of Architecture, summa cum laude, from the University of Maryland in 1981, and became a licensed architect in Maryland and Virginia in 1985 and 1987, respectively. She will receive a Master of Science in Real Estate with a focus in Real Estate Development from Johns Hopkins University in May 2006.
Appendix One: Environmental-Control Diagrams

Figure 47: Condenser-Water System Monitors

The diagram in Figure 47 illustrates the monitoring system for the open-loop condenser-water return and supply (CWR and CWS) systems for SCUs on the seventh floor of One Potomac Yard and the closed-loop computer-room condenser-water return and supply (CCWR and CCWS) systems for the computer-room cooling units.
The diagram in Figure 48 shows the locations on a typical floor of continuous-monitor controls, including carbon dioxide sensors (shown as blue rectangles with white numbers in them) and room-temperature thermostats (shown as numbers not in boxes).

The diagram in Figure 49 shows locations of carbon monoxide sensors (blue boxes), exhaust fans, supply fans, and stir fans on a typical parking level.
Figure 50: Digital Electric Monitor Schedule

The tables in Figure 50 list energy-consumption criteria for equipment that is checked and verified by digital electric monitors. The equipment includes SCUs, humidifiers, lighting panels, receptacle panels, computer-room air-conditioning units (CRACs), and penthouse equipment.
Appendix Two: Green-Roof Photographs

Figure 51: Green-Roof Areas