

DATE: July 25, 2003

MEMORANDUM

TO: Kevin McKyton, Bonita Bay Group
Eric Livingston, FLDEP, Bureau of Watershed Management

FROM: Charlie Miller

SUBJECT: Shadow Wood Preserve
Green Roof

On July 5, 2002 Roofscapes, Inc. provided a complete design package to the Bonita Bay Group and FLDEP, including:

1. Details
2. Product Data
3. Specifications for the Type II, Type III and Type IV green roof systems
4. Sample of the media formulations

In addition, a monitoring plan was submitted to the Bonita Bay Group and FLDEP on September 15, 2002.

System As-Built

The demonstration green roof was installed during the week of July 21, 2003. The installation conforms in most details to the specifications (July 5, 2002). However, the as-built project differs from the proposal in the following details:

1. The roof areas, as built, are divided into three approximately equal areas, each including about 800 square feet. The plan called for two areas with approximately 900 square feet and one with about 600 square feet. The relative position of the three green roof types also varies from the original layout (see as-built plan).

2. The final profiles are as follows:

Type II:	Basal drainage layer (sheet drain)	0.79 inches (20 mm)
	Growth media layer	3.5 inches
	Total root depth	3.5 inches

Type III:	Basal drainage layer (granular)	4 inches
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Growth media layer	1.5 inches
Total root depth	5.5 inches

Type IV: Basal drainage layer (granular)	4 inches
Growth media layer	1.5 inches
Total root depth	5.5 inches

The somewhat thinner profiles are the result of two factors: 1) the shipment of growth, i.e., top media was short by 2.5 cubic yards, and 2) the changed geometry of the green roof resulted in the Type II green roof zone being 50% larger than designed. The result is that an additional 4.0 cubic yards would have been required to finish the vegetated cover as designed¹. These changes will result in the systems being slightly shallower and lighter than originally planned. We do not believe that the revised profiles constitute a problem.

- The Type II media was amended from the original specification, by increasing the quantity of lightweight aggregate in the mixture. The properties of the final mixture are:

Coarse Stalite® (5/16)	44%	(vol)
Stalite fines®	21%	(vol)
Perlite	17.5 %	(vol)
Vermiculite	7%	(vol)
Peat Moss	10.5%	(vol)
Osmacote (14-14-14)	0.6 lb/CY	
Granulated Gypsum	0.6 lb/CY	

- A wider range of plants were added to the roof plantings that originally proposed. A complete plant list is attached. Except as noted, plants of each variety were distributed in groups of 10 or 15 across each of the areas. The objective is to determine if there are differences in plant health among the three green roof types.

Maintenance

Prior to installing the plugs and bare-root plants, the media was thoroughly soaked. No further irrigation should be required to support the plants. Our goal is learn which plants are best adapted to thin un-irrigated green roof systems in South Florida.

Maintenance should be limited to periodic weeding. Plant varieties that do not survive should be replaced using plants that have proven successful. In particular, cutting can be taken from plants to propagate successful species.

¹ Roofscapes, Inc. will return a credit to the Bonita Bay Group for the 2 cubic yards that were not delivered as ordered.

Ground Trays

Three ground trays have been prepared. Two of these (i.e., Trays 1 and 2) are identical and have drains in the side which, discharge water when the level reaches about 1 inch. The third (i.e., Tray 3, which currently has no drains) should be outfitted with drains installed in the bottom of the tray to promote complete drainage. We recommend that Trays 1 and 2 be mounted horizontally (i.e., with no slope toward the drain). After mounting the tray, these trays should be filled with water to make certain that the water stands to a uniform level across the bottom of the tray. Tray 3 should also be mounted horizontally.

Two types of irrigation should be installed:

- a) Trays 1 and 2, with side drains: a simple deliver tube can feed water to the gravel zone in the bottom of the profile. When the tray's storage capacity is filled (about 6 gallons) the water will overflow at the drains.
- b) Tray 3, with bottom drain: an eight-foot length of drip line (e.g., Netafim®) shall be installed in the base (see sketch). The drip line will furnish water to a heavy felt fabric layer at the bottom of the profile.

The trays can be irrigated manually, or via a timer. In either case an accurate record of the times and durations of the watering episodes should be noted.

The profiles shall be as follows:

Trays 1 & 2, should be built the same as green roof zones III and IV on the facility roof. That is:

- Protection layer
- 4 inches of drainage gravel
- 4 oz/yd² filter fabric
- 2 inches of growth media
- Wind blanket

Tray 3 will have the following profile:

- Sheet drain 4 layers of 5 oz/yd² filter fabric (or equivalent)
- 4 inches of growth media
- Wind blanket

Tray 1 should replicate, to the plant mixture used on the roof. Tray 3 is best suited for plants with tuberous roots that cannot easily infiltrate through the separation fabric. Bonita Bay Group should consult with Al O'Donnell to finalize the plant lists for Trays 2 and 3, which are experimental in nature.

Roofscapes, Inc. has ordered additional growth media to fill these trays. It will be shipped as soon as it is prepared. The formula will be the same as that presented in the

July 2002 specification. Other materials necessary for the tray installations are already available in Estero.

Monitoring

All water that discharges from the green roof is collected by the gutter. At present, the gutter is undivided. However, there are four downspouts. If one of these is blocked up, then there will be one spout to serve each green roof zone. To prevent co-mingling of runoff, two small 'dams' must be installed in the gutter.

Plant List (As-Built)

Plants were installed in groups of 10 to 15 plants and distributed uniformly over each zone. All three zones contain the following plants in these approximate quantities:

<i>Sedum oaxacanthum</i> *	36
<i>Sedum album murale</i> *	86
<i>Sedum sexangulare</i> *	82
<i>Sedum rubrotintum</i> 'Dwarf'*	67
<i>Sedum lineare variegatum</i> *	4
<i>Delosperma</i> 'Tequila Sunrise' *	96
<i>Delosperma cooperii</i> *	96
<i>Delosperma herbeau</i> *	4
<i>Delosperma nubigenum</i> *	91
<i>Euphorbia millii</i> 'Rosey'	100
<i>Euphorbia millii</i> 'Short & Sweet' (bare root)	100
<i>Zephyranthes</i> 'Rain Lily' (bulb)	50
<i>Aloe vera</i> (bare root)	33
<i>Spartina</i> 'Spartini'	100
<i>Portulaca</i> spp. (see O'Donnell Nursery)	150
<i>Portulaca pilosa</i>	200
<i>Tradescantia</i> 'Wandering Jew'	75
Total	1,342

Type III Zone, only:

<i>Sedum tetractinum</i> *	12
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<i>Sedum bohmeri (Orostachys) *</i>	12
<i>Sedum pachyphyllum *</i>	12
<i>S. muscoideum *</i>	1
<i>Sedum album micranthum</i>	12
<i>Delosperma floribundem *</i>	12

Type II Zone, only:

Agapanthus spp. (bare root)	30
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* plants furnished by Emory Knoll Nursery