Soil Specifications Roundtable Meeting

DRAFT Agenda

Wednesday, April 14, 2010
2:00 – 4:30 PM

Room 10, 2nd Floor
1515 Clay Street, Oakland

2:00 Welcome, Introductions, Purpose of Meeting................................. Jill Bicknell, BASMAA Development Committee Chair

2:10 Contra Costa Countywide Soil Specifications ......................... Megan Stromberg, WRA

2:30 Alameda Countywide Soil Specifications .................................................. Ed Boscacci, BKF

2:50 Facilitated Discussion............................................................. Sandi Potter, Water Board Staff, Facilitator

   Discussion Topics (refer to Discussion Questions included in meeting packet)
   ▪ Contents of soil mix “recipes” (Discussion Questions 6, 7, 8, 11)
   ▪ Soil installation and testing (Discussion Questions 9, 10, 12)
   ▪ Data required for the MRP submittal (Discussion Questions 2 - 5)
   ▪ Other technical issues (Discussion Question 1, issues identified by attendees)

4:20 Closing Summary/Next Steps................................................................. Jill Bicknell
Discussion Topic: Contents of Soil Mix “Recipes”

Refer to Discussion Questions:

6. How to enhance fertility and moisture retention?

7. Performance-based specification vs. “recipe”?

8. Significance of differences in compost specs?

11. Dealing with variations in source material?
Discussion Topic: 
Soil Installation and Testing

Refer to Discussion Questions:

9. Role for on-site testing methods in specs?

10. How to meet MRP requirement for testing to verify long-term infiltration rate?

12. Recommendations for installation of soil?
Discussion Topic:
Data Required for MRP Submittal

Literature Review Discussion Questions:

2. Applicability of literature to Bay Area?
3. Supports feasibility/pollutant removal of specs?
4. Contributed to differences in the specifications?

Field and/or Analytic Testing Discussion Question

5. Supports feasibility/pollutant removal of specs?
Discussion Topic: Other Technical Issues

Discussion Question:

1. Lessons learned in the field?

Any other issues raised by attendees?
Next Steps
1.0 Summary of Key Points from the Roundtable Discussion

- **Sand and compost mix is recommended:** Based on concerns with the variability of topsoil, roundtable participants seemed to agree that a specification based on sand and compost, with no topsoil, would be the most reliable approach to biotreatment soil specifications.
- **Provide separate gradations for soil mix components:** The specification should indicate separate gradations (percent passing through various sieve sizes) for the sand component and for the compost component.
- **Specify coarse compost:** Coarse compost is recommended, to help achieve the desired infiltration rate, however a small percentage of fines (perhaps 5 percent) is needed for stormwater treatment.
- **Laboratory testing recommended:** Due to highly variable results of onsite testing, meeting participants supported an approach that would include laboratory testing, rather than field testing, on a regionwide basis, rather than a project-by-project basis. Water Board staff stated that they would consider a combination of tight specifications for the soil mix, specified installation practices, and visual observations that the unit is functioning properly, in lieu of onsite soil testing.
- **Specify infiltration rates for long-term success:** Water Board staff recognizes that infiltration rates will degrade over time and, for this reason, they are open to expanding the upper range of infiltration rates for bioretention soils.

2.0 Detailed Meeting Notes

2.1 Welcome, Introductions, Purpose of Meeting (Jill Bicknell)

- **Introductions:** Attendees introduced themselves (list at end of meeting summary).
- **Purpose:** The purpose of the meeting is to better understand the significance of differences between the Contra Costa and Alameda countywide biotreatment soil specifications, and how these specifications relate to new Municipal Regional Stormwater Permit (MRP) soil specifications requirements. Discussions are intended to focus on clarifying technical issues, and will not consider policy issues.

2.2 Contra Costa Countywide Soil Specifications (Megan Stromberg)

- **Infiltration rate:** To achieve a long-term infiltration rate of 5 inches per hour, a safety factor was used, so that an initial infiltration rate of 8 to 12 inches per hour was sought. The specifications are intended to balance plant health and the infiltration rate.
- **Topsoil versus sand:** Two mixes are specified: Mix A (topsoil, sand and compost) and Mix B (sand and compost). Local providers were consulted to develop specifications.
Topsoil is expected to be better for plant health, but topsoil mixes tend to be inconsistent since they are not defined texturally.

- **Compost:** Coarse compost is specified, with fines screened out. Green waste compost is not very good to use, since it includes trash and may have high level of inert particles. There is a risk of slumping when a lot of compost is used.

- **Testing:** Lab tests were conducted to verify texture. A sample is required for visual verification. Certification is requested from the supplier or lab that the soil meets the specification. Two suppliers have a mix that meets the specifications.

- **Tips:** Choose appropriate plants. Protect soil from sedimentation.

- **Mulch:** Compost is recommended for mulching, since it floats less than wood chips.

- **Source documents:** A bibliography was handed out. Sources are primarily from Seattle.

### 2.3 Alameda Countywide Soil Specifications (Ed Boscacci)

- **Swales versus bioretention:** Two soil mixes are specified: a dewatering mix for vegetated swales (infiltration rate of 2.5 to 10 inches per hour) and a treatment mix for bioretention areas (infiltration rate of 5 to 10 inches per hour). The purpose of the dewatering mix is to avoid excessive ponding in the base of swales. The purpose of bioretention mix is to treat stormwater runoff by filtering it through the soil.

- **Loamy sand** is specified for both mixes. It has worked well in swales.

- **Filter fabric:** Initially filter fabric was specified to prevent soil from clogging underdrains. Water Board staff recommended removing this, based on experience on the East Coast, where filter fabric clogged and led to early failure of bioretention areas.

- **Compaction:** It's important to avoid over compaction of soil. Jetting with water and installing the soil in 6-12” lifts has been effective.

- **Compost** is needed for plant nutrients but there is concern with decomposition. The specification for 10% compost was an estimate.

- **Field testing:** The specifications left open the possibility of using in situ soils with an admixture. A field testing protocol was provided to confirm the infiltration rate.

- **Bioinoculation** helps with plant health and with pollutant removal. Some providers have included worm castings in bioretention mixes for bio-inoculation.

- **Water retention:** Some providers have recommended vermiculite or perlite to help sandy soils retain water, and to help reduce irrigation requirements.

### 2.4 Discussion (facilitated by Sandi Potter)

The discussion focused on four discussion topics (shown below). Each discussion topic related to discussion questions that were provided to meeting attendees in advance.

**Discussion regarding Contents of Soil Mix “Recipes”**

- **Whether to include compost:** Dale Bowyer commented that North Carolina has a mix with 85 percent sand and 10 to 12 percent fines (including clay), and apparently no compost. This seems to be because nutrients are a concern in receiving waters. Phosphate in the sand is measured. The mix is pre-mixed at a plant before it is brought to the site.

- **Flow control:** There was a comment that drain flow control may be preferable to relying on the soil column for water retention. Limiting outflow with an orifice on the underdrain is difficult, since the orifice needs to be small and is therefore vulnerable to clogging. Dale mentioned a product called Smart Drain, which is a PVC plastic strip with micro-channels. The plastic strip allows flows to “weep” out of the soil media into the underdrain. More information is at [www.smartdrain.com](http://www.smartdrain.com).

- **Contra Costa soil mixes:** Someone asked whether Contra Costa’s soil mixes A (top soil) and B (sand) were designed so that if suitable topsoil was not available, sand could be
used. Megan answered that the mixes are intended to be completely interchangeable, although it was thought that mix B (sand) would be more commonly used.

- **Using compost to create topsoil?** Dale asked whether someone might try creating topsoil by mixing sand and clay into compost. Dan Cloak responded that this had been tried and the result resembled concrete.

- **Horse racing track example:** Jim West commented that mixing compost with sand and clay is very difficult, due to the tendency of clay to clump together. Horse racing tracks specify 10 to 15 percent silt and clay, but they add the clay as a baked powder and pre-mix with sand. To make it work, you need to start with dry, pulverized material.

- **Defining “topsoil”:** Jim West commented that the name “topsoil” is so generic that it does not define a product. For suppliers, “topsoil” is simply an import that can be spread out. It may be any number of things, including mined sand mixed with fertilizer.

- **What should be added to sand?** Jim West commented that a sandy material is needed to get the required biotreatment infiltration rate, but sand from a dune has no microbial action. The important role of compost is to provide microbial inoculation and water retention. Jim added that soils that are sandy do not have good structure, and compost adds structure. Although slumping occurs with compost, and it does need to keep being replenished, the compost does not go away. It breaks down and changes in form.

- **How well does Contra Costa’s Mix B (sand) work?** Tom Dalziel noted that Mix B has been used since October 2008. The plants in bioretention areas constructed over a year ago appear to be doing well, although he did not have information on how frequently they need to be watered.

- **Roof deck planter example:** Jim West remarked that there is a good track record with soils in podium planters such as those on top of Moscone Center. Organic matter such as peat moss, coconut husk and compost have been used. He recommends that podium soils have less than 8 percent silt and clay, as there are problems when too much silt and clay are used.

- **Seattle’s bioretention soil specifications:** Megan explained that Seattle’s first soil specification was developed around 2001, and then updated in 2008. It is very similar to the WSU specification. Megan talked to the engineer who did long-term infiltration testing. Seattle’s reports say that the plants have done really well. The current Seattle specification is an aggregate and compost mix.

- **Soil variability:** Scott Wikstrom commented that soils are inherently variable, and that, when specifying an infiltration rate, it makes most sense to specify orders of magnitude, such as 5 to 50 inches per hour, or 2 to 20. Attempting a narrower range is likely to get inconsistent results. Dale added that Water Board staff are relaxing their view of the upper range of infiltration rates for bioretention soils, as they realize rates will degrade over time.

- **Installation issues:** Paul Niemuth remarked that installation is as important as using the right recipe. TMT’s Terra Vida soil failed to work in a project in Fremont, and this seemed to have been at least partly due to improper installation. The compost component of the Terra Vida mix may have also been a problem.

- **Avoiding Fines:** David Swartz commented that fines should be eliminated from the soil mix. A few projects used material that met the Contra Costa specification, but then failed. The problem seemed to have been a failure to wash the sand. If this had been done the fines would have been removed. Kelly Carroll concurred that to conduct the sieve analysis properly, the sand needs to be washed. Scott Wikstrom agreed that washing was part of the ASTM specification for sand.

- **Standardization.** Dale commented that a sand specification is very important, as it makes up the majority of the mix. He also suggested that a recipe that uses standard terminology will make it relatively “goof proof.” Kelly noted that a standard regional specification may require more input from landscape architects, due to climate variations throughout the Bay region.

- **Golf course example:** Jim West gave the example of golf courses, which need to be well drained for golfers, but need nutrients and to retain water for plant health. Calcine clay is
sometimes added to golf course soils. It consists of hard particles and works like kitty litter to enhance moisture retention. Perlite has also been used to help with moisture retention.

- **Starting with soil versus sand.** Jim West commented that TMT’s Terra Vida mix started with soil that had less sand content than was needed to achieve the 5 to 10 inches per hour infiltration rate, and then added a coarse additive. This did not work too well. To make soil like this achieve the desired infiltration rate, you would have to overwhelm the soil matrix with the porous material.

- **Percentages of silt and clay:** Jim West noted that he has tested a variety of very sandy soils, with about a 2 to 10 inches per hour infiltration rate. He gets better results using a hydrometer. He said one might find 6 to 14 percent clay and silt in a soil like this.

- **Nutrients in compost:** Jim West observed that outside of California, compost is fairly nitrogen-neutral. It’s different in California, because most compost in California is from green waste. Compost here is also high in potassium, moderately high in phosphorus, and has good microbial action.

- **Percentage of compost:** Jim West recommended that the compost not be included at the full 18-inch depth of treatment soils. Including compost at the bottom will tend to create anaerobic conditions and increase potential for settling. He suggested that if you want one mix for the whole depth of the treatment measure, include less compost in the overall mix, and then add compost to the top 6 inches.

- **Compost particle size.** It was noted that the biotreatment specifications do not specify compost particle size. Megan responded that the Contra Costa specification does specify screened compost. Jim West observed that some providers routinely measure fines in compost. Megan added that the Contra Costa specification could be revised to either specify the percent fines for the mix after the sand and compost are mixed together, or it could specify the percent fines for compost only. Jim West advised specifying each component separately. Dale urged the group to nail down a specification for coarse compost. Megan suggested calling providers and asking what screen is used for coarse compost. It was noted that there is a tradeoff: finer compost offers more fertility, while coarser compost is better for the infiltration rate.

- **Inerts in compost:** It was noted that the compost component in the Alameda soil specifications specifies that inerts shall be less than 0.1 percent by weight or volume, whereas, the compost component in the Contra Costa soil specifications specifies that inerts shall be less than 1 percent by weight or volume. Tom Dalziel stated that the Contra Costa compost specification is based on the US Composting Council’s Seal of Testing Assurance Program. Laura Prickett noted that the Alameda compost specification is from the Bay Friendly Landscaping program. More information is needed about this parameter.

- **Concluding comments on the best mix** Scott suggested that a bioretention soil specification based on topsoil opens the door to including fines. He added that the Contra Costa soil mix B (sand) had been used successfully in Contra Costa since fall 2008. Dale commented that some fines are needed for plant health and for structure, but not too much to maintain permeability. Jim West observed that there are sandy loams and loamy sands that can meet the infiltration specification, although this varies by geography. He recommended specifying the proper sand, and then determining how much silt and clay you want in the mix for performance.

**Discussion Regarding Installation and Testing**

- **Soil compaction.** Paul described a swale project that used Terra Vida soil (which was sold by TMT as a biotreatment soil but does not meet the Alameda specifications) above a subdrain, which was located in a layer of Class 2 perm drain rock, with no filter fabric. There was 18 inches of soil, topped by 3 inches of compost top dressing. It clogged, and they discovered that fines from the compost had gone all the way down and clogged the Class 2 perm. The subdrain was also not working. Someone had used at tamper to...
compact the soil. Scott commented that compost and sand do not compact, but other materials do.

- **Plant health in a sand-compost mix.** David Swartz reported that he has visited bioretention areas that used Contra Costa Mix B (sand and compost). The plants seemed to be in good health, and during storms water was observed going out the underdrain.

- **Mulch:** Laura asked if participants had information or opinions about using pea gravel as a non-floating mulch material, as it is often used in Portland, OR. Megan commented that finer compost does not float, and that pea gravel would inhibit weeds but would not do much for water retention. Jim West added that, in the Bay Area climate, pea gravel would get really hot, which may be less of a concern in the Pacific Northwest.

- **Onsite testing.** David explained that before the Contra Costa program developed its soil specifications, he attempted to verify the 5 to 10 inches per hour infiltration rate with field testing. He showed the group the PVC tube he used to fill with soil, then add water, and time it to see how long it would take for the water to infiltrate. He conducted this test many times on the same batch of soil and found that the variability of the results was incredible. He would recommend against relying on onsite testing. Scott commented that if you use an on-site test, it may be problematic knowing how to proceed if the material fails the test after it is already installed. Scott recommends conducting all testing before the material gets to the site. It was suggested that the MRP testing requirement be conducted on a regionwide basis, rather than a project-by-project basis. Dale commented that he is leaning toward tight specifications for the soil mix and for installation practices, and visual observations that the unit is functioning properly, in lieu of onsite soil testing.

- **Verifying proper installation.** David said that to verify proper installation, he conducts a visual inspection, adding that it is helpful to go after a rain event to see if it is draining adequately. Dale responded that visual inspection should be adequate to satisfy the long term infiltration rate verification, and the inspection should be done during or after a storm event. Scott suggested that, to observe the water draining from the underdrain, the catch basin should not be placed in the middle of the bioretention area. If you put it at one end, it is more accessible. Then you can open it up and see water coming out from the underdrain.

### Discussion of Data Required for the MRP Submittal

- **Demonstrating pollutant removal.** MRP Provision C.3.c.iii.(3) requires submittal of relevant literature, field, and analytic data showing adequate pollutant removal. Someone asked what should go in this submittal to demonstrate pollutant removal. Dale responded that it can be assumed that the basic biotreatment soils approach will address total suspended solids (TSS), and if there are enough compost and fines, hydrocarbons will be addressed. In the next permit cycle, however, we may need to consider phosphate and nitrogen. This will depend on whether there are issues with nutrients in local streams, and what the limiting nutrient is.

- **Information on pollutant removal studies.** Shannan Young stated that Fremont will have some data from a soil mix study the city is conducting, but results are not expected in time for the December 1, 2010, MRP soil specifications submittal. Cynthia Havstad commented that there information on pollutant removal from studies on the West Coast regarding the use of compost in filter socks. Megan added that Curtis Hinman of Washington State University Extension has done studies of the WSU soil mix and has data on pollutant removal rates. Dan Cloak commented that there are studies demonstrating the pollutant removal efficacy of sand filters, adding that a water quality benefit can be assumed when the volume of stormwater runoff is reduced. Laura mentioned that the San Francisco Estuary Institute is conducting a water quality study of the bioretention areas at Daly City’s Serramonte Library/Gellert Park parking lot and offered to get more information on soil specifications used in that project.
- **Cation exchange.** Megan mentioned that the WSU studies investigated a cation exchange process for nitrogen removal. Dale commented that if clay is reduced to nothing, the cation exchange capacity is lost.

- **Plants’ role in pollutant removal.** Ed Boscacci commented that plants have been shown to make a difference in pollutant removal, including the tendency of roots to help with infiltration. Dale commented that bunch grasses and shrubs have deeper roots. Scott noted that bunch grasses are doing OK in bioretention areas installed in Contra Costa County. Paul suggested that adding bark to the soil mix would help with porosity and production of beneficial fungus.

2.5 Next Steps (Jill Bicknell)

- **Soil specifications policy discussion.** Jill thanked attendees for their contributions to this discussion of technical issues and announced that the next BASMAA Development Committee meeting will be held on Thursday, May 6, from 1:00 to 4:00 PM. The meeting will include, among other agenda items, a debrief on the soil specifications roundtable meeting, and a discussion of related policy issues, such as how to proceed with developing a soil specifications submittal for the Water Board, by the MRP deadline of December 1, 2010. Jill asked meeting attendees who are not on BASMAA’s Development Committee to let her know if they would like to attend the May 6 committee meeting.

- **Further opportunities to participate.** As BASMAA proceeds with developing a soil specification submittal for the Water Board, the roundtable meeting participants will have an opportunity to review draft materials for the submittal.
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<td>Cynthia Havstad</td>
<td>Bay Friendly Landscaping Program</td>
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<td>Dale Bowyer</td>
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<td>David Swartz</td>
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<td>Ed Boscacci</td>
<td>BKF Engineers (presenter)</td>
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<td>Jill Bicknell</td>
<td>Santa Clara Valley Urban Runoff Pollution Prevention Program</td>
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