**Minimum Design Criteria (MDC) Team  
1/26/2015  
Triangle J COG, Durham**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Attendees** | | | | | |  |
| ***Team Members*** | |  | | |  | ***Others*** |  |
| Eban Bean  Bradley Bennett  Jonathan Bivens Tim Clinkscales Tracy Davis Boyd Devane Hunter Freeman Mike Gallant Joe Hinton  Marc Houle Ron Horvath Bill Hunt  Linda Lewis |  | | Brian Lipscomb Annette Lucas  Mike MacIntyre Todd Miller  Cameron Moore Tom Murray Robert Patterson Derek Pielech Peter Raabe Larry Ragland  JD Solomon Virginia Spillman Toby Vinson Rob Weintraub |  | | Julie Ventaloro, NC DEMLR  Ben Brown, City of Raleigh  Sally Hoyt, UNC-CH Fred Adams, Adams Paving Company |

**Green Roof (follow-up of items tabled at previous meeting)  
Media specification**  
Annette – MDC reworded to say “Maximum organic fraction of the media shall be 10% by volume.” Sally Hoyt suggested we specify by volume instead of weight because lightweight aggregate has density that varies based on water content. Also, density specific to moisture content can be used to convert volume to weight or mixing with dry materials could be required.Jonathan – Only aggregate that will be dry is lightweight aggregate. Organics -- except for peat moss in bags -- it won’t be dry. Still think it would be easier to have it by weight, but this is okay.  
Bill H – If opt not to go lightweight, then can’t really do it by weight. That’s what Sally was saying there.  
Jonathan –Organics will vary wildly based on moisture. Will require some labwork, but that’s not unreasonable if you’re doing this kind of roof anyway.   
Annette – Is group okay with the above recommended language?  
Group agreed.

🌢

**TREATMENT VOLUME**  
Annette – Media depth: “Green roof depth shall be calculated as the design storm depth in inches divided by the plant available water (PAW) for the specified media. The maximum design storm depth is 1.5 inches.” Would capture the whole design storm for coastal counties. Any comments?  
Hunter – Media depth is what’s installed. Is this minimum required? Even if supposed to control for 1.5”, if you design for 1” – I’m confused.  
Jonathan – We’re making a rule. I think we need to boil this down to what the requirements are as opposed to the opinions and theories.  
Annette – Yes, notes are going away. They’re not going into the MDC.  
Hunter – You could make it bigger if you wanted to get more credit, right?  
Sally Hoyt – This language allows for a range of manufactured products.  
Hunter – If you size a green roof on coast for 1” of rainfall --   
Sally Hoyt – Whatever you’re sizing it for, you put that into your calculation to get your depth.  
Annette – We’ve talked about using term “treatment volume.” Treatment volume might be less than, for example, the design volume if someone used a treatment train. A green roof could be a partial credit device.  
Sally Hoyt - So it’s not in MDC to say how much treatment is being provided by your practice?  
Annette - Correct. Folks can undersize their practice if they want to.  
Sally Hoyt – You don’t pond on top of green roof. This is figuring out where your treatment volume is. Question of how to relate that. Maybe you say treatment volume is equal to green roof depth times your plant available water.  
Hunter – It’s not a required element of the green roof, but it’s a calculation required to figure out how much credit you get.  
Todd – What’s the exact volume reduction? Of water falling off roof --   
Sally Hoyt – I’ve labeled it design storm depth, but you can also call it runoff reduction depth. There can be some drainage, but that’s the storage volume in the media.  
Todd – For bigger design storm, ability to go bigger?  
Sally Hoyt – Max runoff reduction is 1.5” -- is technical limit of how much can be evapotranspirated. So you can say “maximum runoff reduction depth.”  
Annette – Maximum depth that can be treated by a green roof --  
Brian L – Is plant available water equal to void space in the material?  
Sally Hoyt – More complicated in lightweight aggregate. Not like gravel because there’s pore space within the lightweight aggregate.   
Brian L – From design perspective, can we standardize what PAWs are for various materials, or do we have to have a sample of what’s going to go in construction?  
Bill H – Supplier of material would have to provide that information.  
Sally Hoyt – You could specify that would have 25% PAW.  
Todd – Is there a timeframe on 1.5”? 24-hour period? Should we say 24-hour rather than just 1.5”?  
Hunter – We’d have to look at all other MDCs. I would want to be consistent. Worth looking at.  
Annette – If we put that in there, it wouldnt’ be consistent. Time isn’t part of calculation here.  
Mike G - You have a green roof collecting this water with drain. Going thru media, there’s velocity reduction of some sort. Would we be concerned more with how fast that would be coming out of that drain?  
Sally Hoyt – Bioretention or sand filter -- we don’t do rate-based sizing. This is similar. It’s volume based, not rate based.  
Annette – There will be little to no drainage off roof most of the time.  
Sally Hoyt – That’s what research shows.  
Mike G – A way to make sizing easier on someone who has larger design storm. I think this is a great practice that we should promote. You want somebody to take that leap. There has to be a carrot.  
Sally Hoyt – Carrot is, regardless of where you are in NC, you can do you wq design storm with this. We’re stretching a bit from research to say 1.5” design storm. You can control your small storms and have little runoff. But if you have 3” of rain, you’ll have runoff.  
Mike G – Are we not considering filtration thru the media?  
Sally Hoyt – Runoff from green roof, you sometimes get high nutrient materials. Real benefit of this practice is runoff reduction.  
Bill H – Curve number will go from 98 to 89 if you do green roof in NC.  
Sally Hoyt – Downstream practice can also be made smaller.  
Bill H – Curve number assignment doesn’t go here; it goes into the design chapter proper.  
Annette – I think Storm EZ does it differently for runoff reduction.  
Hunter – On annual basis, it normalizes to curve number of 89. But on individual storm basis, your curve number can be zero based on small storm.   
Sally Hoyt – Back to wording in MDC – I think maximum rainfall depth sentence needs to stay in here.   
Annette – How about: “The treatment volume shall equal the green roof media depth times the plant available water (PAW). The maximum rainfall depth that can be treated by a green roof is 1.5 inches.  
Group agreed.  
Peter – Would group mind adding one word: “completely” treated? So to emphasize if you have more than 1.5 inches in design, you’re going to have to do something else.  
Jonathan – By saying it’s “completely” treated, is that implying that remainder is getting some form of treatment? In reality, it’s not – it’s running off.  
Peter – It’s completely treating 1.5.”  
Rob W – How about “fully credited”?  
Sally Hoyt – I disagree. I think treated links back to physical properties. Not about regulatory credit.  
Peter – I withdraw my change.

🌢

**MINIMUM MEDIA DEPTH**  
Annette – “The minimum media depth shall be 4.” Lesser depths may be approved on a case-by-case basis.”  
Rob W – I don’t see having a hard-and-fast rule if it’s such an expensive process anyway. A designer will figure out what they need. Will they walk away if they feel they can’t meet this?  
Sally Hoyt – 4” is a pretty standard depth for these things. It can work at a shallower depth, but it requires a lot more operation and maintenance from the owner. It would require buy-in from owner to pay more attention.  
Annette – What do you think of Rob’s suggestion of sliding scale of roof depths and maintenance requirements?   
Hunter – I’m not wild about saying minimum 4,” then in the next sentence, saying you can go less than that. That’s not a minimum design criteria.  
Rob W – To encourage this, maybe it’s not as simple as you can take an inch off it there’s an irrigation system.  
Bill H – 4” if no irrigation; 3” if you are; then we’re done with it.  
Annette – What do you all think of that? It’s simple.  
Bill H – Sedum takes with 4” without irrigation. I think you’re going to have to use sedum anyway.  
Sally Hoyt – Roofs we have with 4” are 100% planted with sedum.  
Bill H – If they don’t irrigate, the plants will die, the owners will get ticked off.  
Peter – Question about proprietary green roofs. Are proprietary designs less than 4”? Is there way to get an MDC certification for a proprietary system, a way to have technology move forward? There are companies that specialize in green roofs.   
Bill H – There aren’t proprietary systems less than 4” here, but there are elsewhere.  
Sally Hoyt – 4” is very standard for proprietary systems.  
Boyd – Can say other systems can be approved on a case-by-case basis.  
Annette – We’ll cover that overall for all MDCs. Group okay with Bill Hunt’s recommended language (4” w/o irrigation; 3” w/ irrigation)?  
Group agreed.

🌢

**VEGETATION SPECIFICATION**  
Sally Hoyt – Recommend we eliminate reference to ASTM standard. It’s good guidance, but it’s not prescriptive enough for MDC.  
Annette – This would be consistent with how we approach bioretention.  
Sally Hoyt – Because part of treatment is evapotranspiration, if you’re not vegetated, you’re missing that.  
Todd – Is track record positive on this?  
Sally Hoyt – At UNC, we have been able to maintain that amount of coverage or more in 2 years, even when planted in drought.  
Bill H – There are people who put a few plugs in and hope it’s going to spread. In NC, the climate is not conducive to that. Plant manufacturer has to tell you what the spacing should be. The roofs that are not all vegetated will not get ET loss.  
Todd – Should there be a number of how much coverage initially?  
Sally Hoyt – Recommend put that in the guidance, not MDC itself.  
Todd – My worry is if you’re 2 years in, you don’t have coverage. It could be a decade before we get this thing in compliance because of lack of oversight.  
Sally Hoyt – Like anything, it’s dependent on maintenance. If you have somebody providing maintenance, they can achieve this.  
Todd – Problem moving initial planting specifications into MDC?  
Bill H – Main reason is there’s a lot of ways to plant these things to establish. Used to be just plugs. Now you can get green roof sod. They also have cuttings, almost like tossing cuttings into the winds. Lots of ways to achieve that. That would be main reason not to put in a planting plan.  
Sally Hoyt – There’s more ways. This would apply to both intensive and extensive green roof.  
Todd – Could there be an interim standard after one year so you’re not waiting two years?  
Ben Brown - How does designer certify that it’s correct?  
Bill H – Designer would have to find green roof plant supplier and give them a warranty that you’ll get 75% growth after two years. I’ve observed suppliers to NC are really sharp.  
Sally Hoyt – We’ve made it two years to give project more flexibility. I would recommend that we put in design section – that it be one year with warranty.  
Mike G – Do suppliers offer warranties now?  
Bill H – I know my colleague in Maryland does. Most green roofs go in without irrigation. This guy will look at design. He is on site for big projects when it goes onto the roof. He has ability to void warranty if he feels it’s been constructed poorly.   
Joe – Same way we’ve having with filter medium. Guidance doesn’t work. Why don’t we put it on the plant provider to tell them how to plant it rather than us saying if you follow this, you’ll meet it in two years.  
Annette – I think that’s the intent, Joe. That we provide requirement as far as outcome and provide suggestions as to how to meet the outcome. We can easily change technical guidance down the road if our guidance wasn’t great. Not so easy to change the MDC.  
Annette - How about “The green roof shall achieve a 75 percent vegetative cover within 2 years”?   
Group agreed.

🌢

**DRAINAGE AREA**  
“If the design storm is 1.5,” no additional area shall be drained to the green roof. For areas with 1” design storms, an additional area up to 50% of the green roof area may be treated with the green roof. If additional drainage area is added, the runoff shall be discharged to the green roof in a manner that distributes the flow throughout the green roof area.”  
Sally Hoyt – At our last meeting, we talked about whether we should allow additional drainage area to be diverted to green roof? Gets back to physical limitation of green roof. If you’re trying to treat 1” design storm, you could add half an inch; if in coastal area, already have to meet 1.5” so can’t add more.  
Annette – This goes back to MDC #2 about crediting and maximum depth.  
Mike G – When you say “treatment,” are we talking about volume, N and P?   
Annette – This device will be credited for whatever treatment volume they handle for nutrients --  
Mike G – How do you get credit for SA waters? Have half a mile setback. If use a green roof, is there appetite for saying that setback is changed to less than half a mile for SA waters? I’m just thinking of a way to make this more palatable on the coast.  
Annette – I don’t know. It might get complicated.  
Bradley – I’m not sure – seems like it’s not an MDC. Seems like an alternative design that someone could come to us to pursue.  
Mike G – If I tell someone they can do a green roof, but they’ll still need a pond, they’ll choose to just do the pond.  
Annette – If your client has permeable pavement to handle 3.7” storm off parking lot, but less from what is coming off of green roof --  
Sally Hoyt – At UNC, we have green roofs because they meet stormwater objective and aesthetic interest.  
Todd – On question of treatment area, I’d be in favor of limiting it to green roof. We’re already stretching it at 1.5” anyway.  
Bill H – I think simpler is better now. If we had more experience with it in the state, I can see us finding alternative designs. I think it’s safer to restrict it now.  
Annette – MDC #2 doesn’t say you can’t do this. Says maximum depth that can be treated by green roof is 1.5”. If we decide in future it’s good practice to have conventional area drain to green roof, we can write guidance for that. Right now we don’t need to have MDC#5 inviting people to do it.  
Sally Hoyt – I agree that simpler is better and that our MDC doesn’t close the door on a designer proposing something different.  
Annette – Group okay scratching MDC #5?  
Group agreed.

🌢

**SLOPE**  
Bill H – I’ve seen some innovative designs where you can put it on a 24% slope. It’s more expensive but doable. Basically, they sell green roof shingles.   
Sally Hoyt – Limitation is in geometry.  
Bill H – Shingle itself stores water and slowly releases it.  
Rob W – Those are proprietary products?  
Bill H – Would be a proprietary product or a really fancy design.  
Sally Hoyt – Even at 15%, you would probably want a different product. If your slope is more than a traditional roof --   
Bill H – Data that all of this is based on is for roofs up to 8%.  
Sally Hoyt – So we could say green roof shall have a slope of no greater than 8% unless --   
Bill H - Then go to Weintraub clause, alternative geometry, container --   
Sally Hoyt – Container based on a wider slope.  
Bill H – I think we can say “container system.”  
Annette – Container system is a gray area. Intensive for us to call something a totally proprietary system – monitoring – over a year-long process. We want to be careful what we call “proprietary.”  
Annette – Group okay making this an MDC: SLOPE. The green roof should have a slope (or pitch) of no greater than 8 percent unless a container system designed for a greater slope is used?  
Group agreed.

🌢

**PROTECTION OF ROOF DRAINAGE**Annette – Make this a requirement rather than a recommendation? Plants will get flooded, die, cause possible structural issues on roof.  
Bradley – Consistent with other BMPs, we have O&M requirements, but have we put specific O&Ms in for other practices?  
Sally Hoyt – I think Elizabeth said this isn’t about O&M, but it’s about putting features in.  
Bill H – We have requirement to put a trash rack. It’s the same thing.  
Sally Hoyt – Could we say green roof system should include elements that waterproof the structure and protect the roof elements from roof intrusion? Emphasize to include rather than say protect: green roof system shall include elements that waterproof the structure and protect roof drainage features from root intrusion.  
Jonathan – I think we’re crossing over into architecture and design. We talked about this last time and put this in recommendations. I think you design it to prevent intrusion of plants into the normal drainage.  
Sally Hoyt – What if we just said protect from root intrusion? On one hand, I don’t think anyone would just throw plants up on roof without worrying about root intrusion, but you have to do something special for that.  
Rob W – Folks doing this already worry about building code. I’d be willing to pass on this.  
Bill H – I think what Jonathan said is what we need.   
Jonathan – Put recommendation to design it to prevent intrusion of roots and plants into roof.  
Bill H – Recommendation or a requirement?   
Jonathan – To me, that’s a recommendation. All roofs don’t even have drainage systems. All I’m saying is when they’re designing drainage for the roof, they’re reducing drainage from what the roof’s going to take in. Roots are going to run eventually and plug up downspouts.  
Sally Hoyt – I would argue for this staying a recommendation because we’re talking about protecting a building. It’s a different situation than a trash rack that will prevent storm drain from getting clogged. If people don’t protect their building, stormwater stuff will still function.  
Annette – I see difference between waterproofing of roof structure, but things in between inlet structure. You put a lip around it so media and roots don’t get into the inlet.  
Bill H – I would not let a roof go by that I was not convinced designer hadn’t taken steps to reduce root intrusion into drainage structure. But if there’s no drainage system, that’s only time – but if there’s a gutter, they need to take measures to prevent root intrusion.  
Annette – A green roof that clogs and won’t drain won’t be successful in the long term.  
Sally Hoyt – I think the sweet spot is – I’m concerned about having root barrier between media and roof, and I’m concerned about having access to address clogging as routine maintenance item.  
Mike G – Are most of these on a concrete and steel deck roof base?   
Sally Hoyt – I think it varies. You have insulation layer, waterproofing layer, root area layer, drainage area layer, moisture retention -- a lot of layers.  
Peter – I’ve also seen it on wood.  
Jonathan – A lot of these have flat metal roofs, not concrete.  
Annette – I think we’ve heard arguments to make it a recommendation and a requirement. Majority of group voted to keep this as a recommendation.

🌢

**Permeable Pavement**Annette – Fred Adams is here today. He knows a lot about permeable pavement. We have quite a few potential MDC for this topic.   
  
**SITING**  
SITING. Permeable pavement shall not be installed in the portions of hotspot areas where toxic pollutants are stored or handled (some examples of hotspots are listed in Section 18.3).  
Annette – Permeable pavement is a relatively new chapter. We have a requirement to avoid hotspots because pp is an infiltration system. We don’t want to infiltration bad pollutants into the ground (e.g, fueling facilities, car washes, etc.) Should we keep this as MDC?  
Tim – If they meet criteria, I don’t see how use should matter.   
Annette – If we were to think about being filters as being an MDC: function in perpetuity, removal of TSS, protection of wq standards. This might fit under protection of water quality standards.  
Todd – Is that unique to permeable pavement as opposed to other infiltration systems?  
Annette – It could be a general standard for other devices that have infiltration components.  
Tim – But then a person in SA waters couldn’t build a car wash.  
Hunter – What Tim’s saying is that by putting this in a rule it would limit allowable land uses in SA waters.  
Sally Hoyt – This is different because of where it’s located. In a hotspot area, how do you clean it up between the pavement and the surface waters? No opportunity to put in control measures.  
Tim – Who makes determination about what’s a hotspot?  
Hunter – How many hotspots are already covered by NPDES Industrial or other stormwater program?  
Sally Hoyt – My concern is a disconnect. At UNC, designed infiltration at a storage facility. In terms of defining areas, there are ways to do this in accordance with SIC codes. I agree there are problems with this, but it’s important for protection of waters.  
Hunter – May not be an MDC.  
Sally Hoyt – We’re not saying you can’t use permeable pavement at the facility, just not in area where have high likelihood of spills.  
Hunter – Table this one and get feedback from RRC. Let’s talk about design specifications.  
Rob W – If we have list of hotspots – matters what use is. Can it be a recommendation that they’re not placed where there’s a danger of chemical runoff?  
Boyd – Shall not be placed in areas where toxic chemicals may be introduced in toxic amounts or something.  
Rob W – Also not allowed in 100 feet of wells -- that’s already in the rules.  
Sally Hoyt- Might be good to table this until we talk about design.  
Robert P – I agree better as a recommendation. It would be picked up in facilities’ spill prevention plan.   
Annette – Okay to make this a recommendation? Permeable pavement should not be installed in areas where toxic materials are stored or handled.  
Group agreed.

🌢

**SEPARATION FROM THE SHWT**  
The bottom of permeable pavement designed for infiltration shall be a minimum of two feet above the SHWT. However, the separation can be relaxed to one foot when the applicant can prove that the water table will subside to its pre-storm elevation in five days or less.  
Jonathan – We’re shooting for 2 feet below bottom of stone?  
Annette – We talk about bottom of aggregate base and subgrade surface.  
Mike G – I would say bottom of aggregate base.  
Jonathan – Or just subgrade.  
Mike G – Either one.  
Annette - The surface of the subgrade for permeable pavement designed for infiltration shall be a minimum of two feet above the SHWT. However, the separation can be relaxed to one foot when the applicant can prove that the water table will subside to its pre-storm elevation in five days or less.  
Hunter – That could be construed to be the top surface of the subgrade.  
Jonathan – That is the top surface of the subgrade. #3 says soil subgrade surface. Why not say that?  
Annette - The soil subgrade surface for permeable pavement designed for infiltration shall be a minimum of two feet above the SHWT. However, the separation can be relaxed to one foot when the applicant can prove that the water table will subside to its pre-storm elevation in five days or less.  
Jonathan – So this is for infiltration only? Detention only?  
Eban – If have detention system that’s lined, water table shouldn’t rise above that. It’s going to go back to pre-storm elevation in five days. If it’s for detention only, it’s not infiltrating.  
Annette - We don’t require that every detention system be lined. Lining long-term isn’t always successful at keeping water out. Perhaps we could relax it to one foot for detention systems?  
Mike G – For detention systems, why couldn’t have it right up to bottom of aggregate?  
Annette – It would have an underdrain on it.  
Cameron - What do we do for wet ponds?  
Annette – [Diagram on whiteboard – SHWT, aggregate base] Detention system does not have to be lined.  
Bill H – SHWT determination needs to be spot on. My biggest concern is I get the SHWT, and they’re wrong by about a foot. Then my practice is exporting N and P into storm drain network because I’m dewatering it. We’re adding pollutants. If you don’t nail SHWT – it’s often off by about a foot – which is why I suspect you wanted to go to a foot with that design.  
Sally Hoyt – My concern is making it different than other infiltration devices.  
Annette – We’re talking about when it’s a detention device.  
Boyd – For wet ponds, we say 6” plus or minus SHWT. We like SHWT to be up there. Why don’t we like that here?  
Joe – If you have it down in SHWT and you don’t get a lot of rain, you’ll get infiltration if it’s not lined. If it is lined, there’s a possibility – I’ve seen it in swimming pools -- that it will push in sides of swimming pool because water tension in SHWT can do that. Streams move cars. It doesn’t take much. You want SHWT at top of pavers for detention. If it’s infiltration device, water has to have some place to go. If water table is at bottom of detention pond and you don’t have liner, it won’t be detention. It will infiltrate sidewalls.  
Mike G - So you want your SHWT at your outlet for detention device?  
Joe – Yes.  
Annette – So Item 3 in general MDC says SCM shall not include an outlet structure that is set more than 6” below the SHWT unless it can be demonstrated that the device will not dewater waters . . . .  
Robert P – Why would you spend extra money to build permeable pavement down further?  
Mike G – You wouldn’t really want SHWT up into it --  
Brian – You might if you were focusing on temperature though.  
Annette – What’s going to happen is if you have SHWT up here [diagram] --  
Mike G – You have to make thicker aggregate – you’d store above that, outlet structure would let anything out. You would be giving up aggregate you put below that.   
Annette – For design to make sense, we want SHWT -- the highest place on detention system on soil subgrade surface.  
Jonathan – Doesn’t alleviate Bill’s concern that people aren’t getting SHWT correct, but that’s a concern with anything.  
Annette – So one MDC for infiltrating pavement, and add an MDC for detention?  
Mike G – If you missed your call on SHWT, and it’s higher than upturned elbow – permeable pavement coarse won’t be more than 6, 12” –  
Bill H – Issue is if gravel layer is a foot; pond is depth of 8 feet – you have a lot of wiggle room in a pond. Permeable pavement all you’ve got is 12” of gravel.  
Annette – Philosophical issue – do we want to include a factor of safety because of how sensitive it is to getting the SHWT right? Device won’t work, will be bypassing treatment volume and structure will be weaker.  
Bill H – Minimum of one foot above SHWT.  
Annette – Issue of mounding could happen over time.  
Joe – It does happen. When we put in large subsurface systems, you have to look at mounding. After 20-30 houses, water table changes. Equation accounts for build up with all houses. A single family residence will not affect SHWT, but multiple will. Small permeable pavement, it won’t be necessary. But a Wal-mart will affect, mounding will be an issue.  
Eban – Limited by lateral flow. Won’t drawdown within 72 hours because of mound. Smaller devices, ratio of volume to lateral area is much greater.  
Annette – We have to put pen to paper. How does group feel about the following:

#2 SHWT REQUIREMENTS FOR INFILTRATING PAVEMENT SYSTEMS. The soil subgrade surface for permeable pavement designed for infiltration shall be a minimum of two feet above the SHWT. However, the separation can be relaxed to one foot when the applicant can prove that the water table will subside to its pre-storm elevation in five days or less.  
# 3 SHWT REQUIREMENTS FOR DETENTION PAVEMENT SYSTEMS. The soil subgrade surface for permeable pavement designed for detention shall not be set below the SHWT.  
Group agreed to both Item #2 and #3.

🌢

**SOIL SUBGRADE SURFACE**  
The surface of the soil subgrade shall have a slope of less than or equal to two percent (level). Terraces and baffles may be installed to achieve a level subgrade.  
Eban – We have a permeable pavement lot on a 1% grade over 450 feet, no baffles. We have half inch of rainfall for storage. Storms above that, we see water coming out at surface. Problem is that it’s not the slope, but it’s the slope and the length, the fall. If fall is greater than pavement thickness, you have chance to have discharge at surface at low end. This should be a requirement on the fall for that pavement compared to thickness of pavement system whether or not you have baffles. Volume should be whatever is at lip, bottom of pavement surface, about half that volume.  
Sally Hoyt – We have systems that have different cells that are graded, slope of bottom of cells, underdrains. Wouldn’t want it sloped too much. Maybe it needs to be an “and” requirement?  
Annette – I can see both points. You can’t construct .5%. But if you have that long of a run, 450 feet, at 2%, that’s a big difference.  
Rob w – Doesn’t matter if it’s 4% or 5% -- it will infiltrate. If you make people flatten them out, people won’t use them. Or am I missing something? Are baffles easy to do?  
Sally Hoyt – Baffles are easy to do.  
Joe – Kind of like little terraces there. If you have 200-foot line, you’re using a third of your rock, so we put in baffles. Maybe a foot or less baffle. It holds water so we get that first gravel – all gravel is used -- all volume of storage is used.   
Eban – In ECU example, if baffles were included it would be able to retain 2” of rainfall. Now it only gets half a little under that. It’s maximizing system itself if you have the fall you need to include the baffles.  
Jonathan – In parking lot, what do you use for baffles?  
Sally Hoyt – Graded earthen berms in ours.  
Joe – Hard enough so you can go over them with a machine. These are packed.  
Bill H – We’ve used concrete walls in tighter lots.  
Jonathan – Concrete curbs that will break it into cells. You could even leave them on slope.  
Joe – Some device that makes water back up to use all storage above it.  
Sally Hoyt- On our system, there’s nothing above ground.  
Fred Adams – Berms can be made of anything. Want construction to go quick as possible.  
Sally Hoyt – [Diagram] Water infiltrating through pavement section ending up in deeper cells  
Bill H – 1) design has to be able to store water and 2) infiltrating footprint – expose water to footprint in which it can infiltrate. If you can do those two things, you can leave out fall and slope. It’s embedded in that. Challenge is tying those two things together. Does design store all water it’s supposed to without overtopping and is “x” amount of bottom of infiltrating system exposed and working during wq event. It allows those fractions to be sloped. In between berms, allowed to have some sloping. Complicated, so we went with slope, but I hate slope. It’s all about storing water and making sure you can infiltrate.  
Jonathan – If slope is too steep, water will just runoff, not infiltrate.  
Bill H – In the end, that is taking care of by forcing volumes to be stored and have infiltrating footprint.  
Jonathan – If have 10% slope, won’t have water going through pavement because of runoff. Need a cap.  
Eban – Limited by slope of pavement surface, whether that’s the durability, what’s feasible.  
Bill H – We should all something to capture all the design volume without overtopping.  
Eban – Define design volume as water behind the berm.  
Bill H – A design volume has to be able to be stored.  
Annette – We may need some verbiage in chapter that explains how all these pieces fit together (run, high/low point, baffles, berms).  
Eban – Terraces and baffles may be used to retain water, increase storage, prevent later flow in subgrade.  
Joe – It’s not used to achieve a level subgrade.  
Rob W – Do we need to change this may to should or shall if needed?  
Jonathan – But they wouldn’t be needed in flat parking lot. Twist is slightly. May be installed to increase the volume that’s held.  
Fred Adams – When it’s above surface, you have to have baffle.  
Annette – Protective enough?  
Eban – Still up to designer. If they have additional storage downslope, they wouldn’t have to.  
Bill H – We’re looking at minimum design criteria. If it dewaters 72 hours, captures all water supposed to, we don’t need all this baffle stuff. Put that in guidance.  
Annette – Group okay with scratching second sentence about baffles?  
Group agreed.  
[Bill H requested that we revisit putting in language about not overtopping.]

🌢

**AGGREGATE**  
Washed aggregate base materials shall be used.  
Jonathan – Fine with idea, not language. Should title be “Stone Base”? Is this for what we’re putting in concrete, asphalt? This is requirement for what is stone base, not hard surface on top.  
Fred Adams – Trying to define angularity? Use open-graded?  
Jonathan – You can’t buy washed stone here unless it’s uniform size.  
Fred Adams – We are having to blend sands in order to meet manufacturer criteria with washed aggregate.  
Jonathan – That’s what’s going in paver fill?  
Fred Adams – No, that’s stone base.  
Jonathan – Some 2S sand isn’t washed. Depends on natural fines that are in it. Open graded implies mixture of stones. It could be more stable.  
Fred Adams – Won’t matter on rigid pavements. Will matter on flexible pavements.  
Annette – Maybe note this in technical guidance?  
Fred Adams – I haven’t seen this is a real problem. Probably wouldn’t want to have limestones as much.  
Annette – Okay if we let folks decide what they need?  
Todd – So outcome we’re seeking is to keep it porous in the future? Instead of getting into technicalities, we focus on outcome that it has to remain porous.  
Jonathan – Look for spec that limits fines.   
Sally Hoyt – Concerned about being too prescriptive because there’s other ways people do storage. Key is it’s washed, not clogging.  
Jonathan - That’s what 200 sieve is.  
Joe – If you put 5 stands in there, you’ll clog it up. We say above 40 sieve is what we’re finding behind areas that aren’t draining properly after a couple rain events. We lose vertical distance height and permeability in some cases of 50%.  
Annette – How about STONE BASE. Washed aggregate base materials shall be used.  
Group agreed.

🌢

**PAVEMENT SURFACE**  
Designers who propose pavement surfaces other than Permeable Interlocking Concrete Pavers (PICP), Pervious Concrete (PC) and Porous Asphalt (PA) shall demonstrate that the proposed design functions adequately hydraulically and structurally in the long term.  
Robert P – Do grass systems have open grade aggregate beneath them?  
Fred Adams – They do, but have sand. You’re filling void space, so you don’t have the storage.  
Bill H – Studies on turf grass systems. Those work the worse in terms of infiltrative ability, amount of runoff during storms. Not bad, but they’re like grass.   
Annette – Two issues: Does this pavement device treat water like SCM, or is this a way to make a surface like a field actually pervious?  
Bill H – For water that falls on it, they’ll handle 1, 2 or 3 inches per hour without producing runoff. Astroturf can handle really high rainfall rates. But if it’s a soil-grass system, it’ll behave like the soil underneath it more or less.  
Annette – Idea of MDC is to open the door if someone has another type of pavement surface. Whole rest of the system would be designed in accordance with the other requirements.  
Sally Hoyt – Reasonable because other systems are proprietary that manufacturer would have information about infiltration rate.  
Annette – So do we not need this MDC? I don’t think we have a performance spec anywhere for the pavement surface.  
Mike M – Maybe it’s not an MDC.  
Tim – So if there’s not a spec, how do you know if other ones can ever be approved?  
Annette – I get calls from local governments looking for guidance on astroturf. Would be nice if MDC gave that guidance.  
Sally Hoyt – Surface materials has to have infiltration rate greater than design storm intensity? Maybe have a factor of safety on that since performance declines over time.   
Annette – You don’t want it to be designed for 2 inches for hour – would want it much higher at beginning.  
Tim – What is design storm for this?  
Annette – Same as other devices, depends where you are. Good point – not always a rate, just a depth.  
Tim – For infiltration, there’s a rate, but not for detention.  
Annette – Maybe it’s good to spec a rate that would go in at inception of design. Not sure what the rate would be.  
Sally Hoyt – Rate has to be fast enough so water goes through and not run off.  
Tim – What are rates of those other ones?   
Annette – NC State measures PICPs in Boone. It was like up to 1,000 inches per hour, initially when installed.  
Bill H – Eban looked at 48 of them up and down coast. If clogged, 400-500 inches an hour. Usually, the surface from a rainfall perspective is not what cause the thing to function wrong.  
Annette – It’s all about maintenance.  
Tim – If it’s only .52 below, it doesn’t matter.  
Bill H – Usually so much gravel that systems can handle lower infiltration rates.  
Mike M – If it’s not PICP, PC or PA, if it’s not MDC, maybe we do PEP?  
Bill H – Turf stone filled with sand – that’s more or less passé in industry.   
Mike M – Should some of those be considered for PEP?  
Annette – I’d rather not put every surface into PEP.  
Mike M – Use determines what you’ll allow. We allow turf for football fields. Everyone in county wants them – putting in enough storage underneath, and that’s okay. Can’t drive on them.  
Annette – MDC says it shall function adequately in the long term. We don’t have staff time to put every conceivable surface through PEP.  
Tim – We agree with the structural part, but what does stormwater have to do with that? If they make a mistake, they have to fix it. We should take that out of MDC.  
Sally Hoyt – In long run, would be helpful to have a rate to use to evaluate other products. But that needs to be developed separately.  
Annette – I would like this in here because it gives local government reviewers some freedom to make judgements without having to call me every time. Hoping this device will catch on also.  
Tim – But who determines what’s adequately? Who determines hydraulically?  
Hunter – So there has to be a performance specification.  
Annette – We can recommend a performance spec in the chapter.  
Tim – It’s fine having those three, but who made those three the gospel of what needs to be done here? Nothing wrong with those, but there could be others out there.  
Mike M – Chapter 13 says you have to safely pass --  
Bill H – At least demonstrated infiltration rate of 100 inches per hour would be a good starting point, using normal head, not driving head. It’s a clean number; people get it.  
Fred Adams – Is this test at the end of construction?  
Mike G – No, it’s a manufacturer spec.  
Bill H – Idea is not to test it in the field.  
Fred Adams – Test of brick pavers at NC State were at 50 inches an hour. It was open-graded stone. 100 inches seems a little high to me.  
Bill H – When we did our study of 48 systems, those that were not clogged were 400 and up. We didn’t look at bricks though. Other thing is if you direct water to it, run-on, I think it’s more important then. If you have no run-on, 4-6 inches an hour is fine. Everything is going to clog to some extent. 50’s probably not a bad number to use as well. That’s only one order to number higher than New Jersey’s numbers of 4-6, which are bogus numbers.  
Hunter – Federal highway numbers for hardened concrete: 2 gallons per SF per minute; 384 feet [Editor’s note: Not sure if I heard this number correctly] per day. Not a requirement for federal highways.  
Brian L - That’s 184 inches [Editor’s note: Not sure if I heard this number correctly] per hour.  
Bill H – That puts my 100 inches per hour back in the running.  
Mike M – I like 100.  
Tim – How did those other guys – who’s provided specs on that?   
Mike M – I agree with Tim. I think 100 inches per hour should be standard for anything.  
Annette – How about: The proposed pavement surface shall have a demonstrated infiltration rate of at least 100 in/hr using a head less than or equal to 4 inches?   
Boyd – I like 50. We want to encourage people to use this.  
Group agreed to: The proposed pavement surface shall have a demonstrated infiltration rate of at least 50 in/hr using a head less than or equal to 4 inches.

🌢

PERMEABLE ASPHALT  
For permeable asphalt, a modified asphalt binder as specified by the Carolina Asphalt Pavement Association (CAPA) shall be used to ensure long-term durability and permeability.  
Brian L – Is there any other certification organization?  
Annette – NAPA. This is a specific spec for our state.  
Sally Hoyt – Combine this with PERMEABLE CONCRETE?  
Boyd – I don’t mind it here, but should this be a recommendation?  
Annette – As a part of guidance for pavement surface.  
Fred Adams – We want to make sure as an industry that we’re not failing.  
Sally Hoyt – As an institution that has some excellent-performing installations and some that are failing, it’s not just about initial installation rate. But it’s about over time. I see a value for long-term maintenance for having this.  
Boyd – I do have some mixed feelings about it. Not sure Rules Review Commission would allow us to do this.  
Annette – If we specify national standard, then I think we’re probably okay. I know they’re okay with us specifying an ASTM standard.   
Group agreed to make this a recommendation: Permeable concrete and asphalt specification: For permeable concrete, the mix design. . . . For PA, the mix design shall be . . . .

🌢

RUNOFF FROM ADJACENT BUA  
Runoff from adjacent pervious areas shall be prevented from reaching the permeable pavement. Exceptions such as site restrictions on redevelopment projects shall be reviewed on a case-by-case basis.  
Rob W – If you have a parking lot or playground, and you have permeable asphalt that’s lower than it, what is a well-designed system to convey the runoff? Is that positive drainage? Piping?  
Sally Hoyt – Could be rewritten to be more concise. “. . . .from adjacent BUA’s at ratio of up to 1:1 BUA: pavement area.” Get rid of “provided” to end of sentence.  
Bill H – Water that runs on to permeable pavement needs to do so in dispersed manner.  
Sally Hoyt – By limiting it to 1,000 SF of area per point?  
Bill H – That one’s about roof leaders specifically.  
Tim – How is 1:1 proven to mean anything?  
Bill H – That was done to be conservative. It used to be zero. Lately, we’ve looked at different loading ratios from a clogging standpoint. We pushed it 2.6:1; 3:1; 5:1; 8:1 – all but one clogged pretty bad. When water comes off impermeable asphalt, it does so at specific points; it’s not true sheet flow. Using simplification by restricting footprint multiplier- it’s a way of dealing with too much load to specific points. One that didn’t clog was 8:1. That’s because it was rooftop.  
Fred Adams – Rooftops should not be limited.  
Sally Hoyt- I disagree. Rooftops often have things in them. Factor of safety, rate at which water will flow through pores. Other thing is with traditional pavement joining with permeable pavement, it settles things out, clogs. Varies based on what roof is like. Botanical gardens have had tons of issues with leaves, organic matter in drains system.  
Boyd – Say “prescreened” rooftop.  
Bill H – Okay to say higher than 1:1 loading ratio for roofs?  
Sally Hoyt – Yes, but not sure how much higher.  
Annette – Adjacent pavement area at ratio of 1:1?  
Fred Adams – I don’t know where it came from, but 5:1 has been standard.  
Bill H – I’d love to be able to pull off 5:1, but it’s been too many failures.  
Boyd – Soils have to be designed to infiltrate in 72 hours -- that’s in there.  
Annette – We get into that later.  
Bill H – As long as screening – I’d like to be able to send as much water to it as we could. That makes it a more attractive practice.  
Brian L – We ought to send more to it than we do to disconnected impervious surfaces.  
Annette – 7:1. But this is getting more credit than DIS.  
Rob W – Will be set by volume. Keep wording short, then engineer will figure out what max is.  
Sally Hoyt – Goes back to rate at which water goes through pavement.  
Annette – That’s in Item 12.  
Tim – Can mathematics make the answer work?  
Bradley – If math can determine rate it will clog --  
Bill H – If want to process 1.5 inch storm and have 3:1 loading ratio, you’ve got 4 inches, void ratio at .33. That’s a foot, assuming entire foot of gravel being used. Know it’s on a slope, lose a third of it. In the end, can use math, you realize that most of time you won’t have more than 18” gravel. So we have a 1:1 -- or perhaps 2:1 is what gravel construction, what people willing to spend -- is where it will top out most of time.  
Boyd – I wish we didn’t have to have a number. Can’t we just say screened rooftop runoff can be put off at a rate that can infiltrate 72 hours? We do that on septic tanks, infiltration systems. I’d be more liberal with it.  
Hunter – Don’t see 10-year storm requirement from BMP manual?  
Annette – I’m thinking that general MDC covers that.  
Hunter – Engineers fight 10-year requirement more; don’t like having to put all that gravel in to meet it. Want to be sure we don’t duplicate gravel depths. Designers push back at how expensive it is to make gravel deeper.  
Annette – Item 6 under general MDC.  
Hunter – [Put placeholder in under Item 22 for 10-year storm.]  
Annette – Bill was saying that when run on is from pavement, it clogs the permeable pavement. We don’t want to spec a design standard that will result in failure.  
Bill H – Gets to what Boyd said about rooftop. Requiring to capture volume without overtopping, dewater in 72 hours. I think in the end we can drop rooftop bit. There will come to a point when it will break, get close to water table, can’t use all the gravel . . . will get unwieldly. Restrict it to pavement with one caveat: clean or treat or screen rooftop runoff.  
Rob W – Is there a way – say you’ve got concrete parking pad for bus pullout – couldn’t a designer run that water through a curb, through grass and back onto pervious concrete? It just has to be clean.  
Robert P – Can you go higher than 1:1 if you pretreat?  
Sally Hoyt – Yes. That’s the way it’s written.  
Rob W – So that wording change to say screened to receive runoff from rooftop and other sources --  
Bill H – Not a huge fan of pervious surfaces running onto permeable pavement.  
Annette – What are “other sources”?  
Bill H – So we’re in the piedmont. You get proprietary system to treat runoff from a large area, then you can discharge it into permeable pavement. That would handle your peak flow mitigation.  
Mike M – But if you treat that, they’ll release it.  
Bill H - Filtered runoff from any impermeable surface can have a higher --  
Sally Hoyt – I’m okay with restricting it to rooftop since I don’t think other situations will come up much.   
Mike M – 1,000 SF to a single point – I understand it if you’re working on injection well. But large rooftops only have like 4--  
Sally Hoyt – We’re saying that you can put a small area onto the surface.  
Peter – Do we need to clarify about running it directly into a subsurface?  
Sally Hoyt – That’s in design guidance, but --  
Brian L – If it’s already been screened, why does 1,000 SF matter?  
Sally Hoyt – Because it’s getting to hydraulic properties – becomes physically problematic at higher amounts.  
Rob W – We’re talking about a lid for the infiltration device which is permeable pavement. Does all this belong in infiltration section?   
Sally Hoyt – Right. Permeable pavement is a big inlet.  
Annette – I think we might serve community better to keep this in a different chapter.  
Rob W – If you’re coming off roof with 10,000 gallons, you want it to go directly into holding tank.  
Sally Hoyt – We do address that in design guidance in chapter.  
Annette – Why would someone want to put roof runoff into permeable pavement and not directly into subsurface?  
Rob W – That’s what this does. Forces people to put it into subsurface.  
Sally Hoyt – Depends on layout of site.  
Boyd – A 20,000 SF footprint, you’ll have to have 20 leaders going to a permeable pavement.  
Rob W – Do we need to say you can use a manifold system as long as any one inlet is no more than 1,000 SF?  
Robert P – Infiltration basins we limit per inlet. We’re trying to get too prescriptive here too.   
Sally Hoyt – As long as water’s getting into system beneath it, doesn’t matter. I’m okay moving this to recommendation.  
Cameron – How long does water from leader flow across pavement until it infiltrates into system?  
Bill H – Depends on clogged condition.  
Annette – We’re saying if it’s above 1,000 SF, deposit it below surface.RUNOFF FROM ADJACENT BUA. Permeable pavement may be designed to receive runoff from adjacent conventional pavement at a ratio of 1:1 of additional conventional pavement to permeable pavement area. Screened rooftop runoff shall not be subject to the 1:1 loading limitation. RECOMMENDATION: Downspout outlets or ground level impervious surfaces should not drain more than 1,000 SF to a single point onto the permeable pavement.   
Group agreed.

🌢

RUNOFF FROM ADJACENT PERVIOUS AREA  
Runoff from adjacent pervious areas shall be prevented from reaching the permeable pavement. Exceptions such as site restrictions on redevelopment projects shall be reviewed on a case-by-case basis.  
Sally Hoyt – Get rid of second sentence. Major factor in clogging.  
Peter – Would like to see permeable pavement for sidewalks in residential areas.  
Bill H – Not saying that.  
Sally Hoyt – If have sidewalk with grassed area draining to it, it will get clogged.  
Brian L – Why would you spend money to use permeable pavement on sidewalks?  
Boyd – To get below low-density threshold or something in water supply.  
Bill H – Thin narrow strip getting sheet flow from pervious area is recipe for clogging.   
Sally Hoyt – I would be more restrictive than this. Limit it in installations smaller than 6 parking spaces because we can’t get street sweeper in.  
Rob W – If I’m doing a townhome neighborhood and want to use permeable pavement for street, I can’t do it if I’m using sidewalk because homeowners hate permeable pavement sidewalk because kids fall on it, can’t skateboard, etc.  
Bill H – In Ohio, pervious sidewalks, they were migrating, elevated above surrounding landscape, and they were doing fine.  
Sally Hoyt – Other thing we can do is set limit – no more than 5% of permeable pavement or something.  
Tim – It’s a flow length problem, isn’t it?  
Brian L – Parallel parking stalls you want to make permeable pavement -- if there’s grass strip along it, that strip cannot flow onto parking stall?  
Tim – You might as well just leave. Nobody will do permeable pavement in NC – physically impossible.  
Bill H – Incidental runoff – 2 feet of grass across 18 feet of permeable pavement is incidental.  
Sally Hoyt – Can we say less than 10% of drainage area? If lot is clogging, 10% can clog and it will still function. Best applications for permeable pavement are big parking lots.  
Bill H – That’s my experience too.  
Robert P – Landscape islands are going to be required locally.  
Hunter – I can pull up some plans we’ve done to see in parking lot installation and typical road --  
Bill H – Pavement needs to be sufficiently wide as well. If you have 4 foot vegetated strip that looks like crap, then you’ve got a 4 foot strip of permeable pavement -- that is a recipe for failure. Pavement needs to be – we’ve looked at clogging encroachment – it can be 3 or 4 feet easily.  
Sally Hoyt – NC State proposed infiltration levels – maintain at certain level to retain capacity. Not binary, but can lead to complete clogging.  
Todd – Is it recoverable?  
Bill H – Depends. Pervious concrete is not recoverable unless you cut it out. PICP is recoverable with right type of suction. No doubt we need an allowance for incidental run on. I would propose 15-20%.  
Annette – I’d like to see a width and a percentage. Just because lot is big doesn’t mean we want a big vegetated area to go to it. Hunter and I will talk about these numbers.  
Tim – I’ll look at plans also.  
Mike M – Consider we have a tree ordinance in Charlotte. Landscaped areas have to be at least 274 SF and be within 40 feet of a parking lot.   
Marc - Charlotte requires 10% internal landscaped area within parking lots.  
Annette - Runoff from adjacent pervious areas shall be prevented from reaching the permeable pavement except for incidental runoff from a small, stable vegetated area. [Need to work further on language.]

🌢

**CONSTRUCTION SEQUENCE**  
Permeable pavement shall not be installed until the upslope and adjoining areas are stabilized. After installations, barriers shall be installed to prevent construction traffic from driving on the pavement.  
Rob W – You have to have driveway in before you can get building permit and start construction.  
Annette – If all your access is supposed to be permeable pavement, you might clog your pavement.  
Rob W – We end up covering it.  
Fred Adams – Area has to be stabilized, I agree with that. Fear is compaction of subgrade. Put in permeable pavement first, then clean it afterwards. Probably got to be tested, I agree with that. Chicken-or-egg concept. I think you have permeable pavement built, and construction equipment will go on it.  
Boyd – Add “or pavement protected” after “adjoining areas are stabilized.”  
Sally Hoyt – Construction vehicles have muddy tires. I’m suggesting that the best way to protect is put it in last, but that’s not always feasible. But have testing requirement to address that.  
Fred Adams – I want things to work when I leave. Require infiltration test.  
Annette – How about: After installation, permeable pavement shall be protected from sediment deposition until site is completed and stabilized. An in-situ infiltration permeability test shall be conducted on the pavement after site stabilization.  
Group agreed.   
Fred Adams – Who’s accepting the results of this test?  
Sally Hoyt – Engineer reviews results before as-built certification. Either engineer does test or observe it being done or get official results.  
Brian L – Any issues if not at full build out? What if a lot will be opened back up in a year or two? Retesting?  
Sally Hoyt – Simple infiltration test, 2x2 box with putty, pour 5 gallons of water.  
Tim – If you have 500 lots, do you do all the driveways?  
Rob W – Real question is the construction sequence can be years after stormwater device is built and operated.  
Tim – This is good for commercial use but --  
Brian L – Is engineer that designed it responsible for clogging after 10 years?  
Tim – And then you’re on someone’s private property, not HOA stuff.  
Rob W – Infiltration/permeability test shall be conducted as part of as built.  
Tim - Most won’t do as-built for little driveway.  
Cameron – If each lot has pervious driveway, developer won’t care. Up to homebuilder to make sure driveway put in right. Different entities responsible for different things.  
Annette – This is an important issue. We are scheduled to discuss this later. Does group like the idea of having an in situ permeability test after stabilization? Is it okay if we let that go for now?  
Tim – I don’t have a problem with it. But this one has to be subject to change based on the other.  
Sally Hoyt – This is open ended. Doesn’t say who would have to do the testing.  
Tim – Not just homebuilders. It could be Joe Smith that buys the lot that has to do it.  
Brian L – I’m okay with test as long as it’s clear as to when that happens.   
Cameron – For subdivisions, it would work itself out. Municipalities aren’t allowing permeable pavement in public rights-of-way anyway. Last thing that gets put in with house is driveway.  
Joe – If it’s an individual subdivision, if that individual has a well on his lot, that well has to be permitted by the county. Maybe this is something the county would have to do. The builder would be required to test their driveway.  
Annette – This could be anybody’s infiltration system, other SCM. Can we table this acceptance issue and move on to other design elements?  
Group agreed to construction sequence okay for now, but we’ll continue to work on second sentence.  
Retitle it “Inspections and Certification.”

🌢

DRAW DOWN TIME AND SOIL INVESTIGATION  
Infiltrating pavement systems shall be designed to completely dewater the treatment volume to the bottom of the infiltration device within 72 hours. A site-specific soil investigation shall be performed to establish the hydraulic properties and characteristics of the area in which the infiltration device will be sited.  
Rob W – If every house has permeable pavement, does every lot have to be tested?  
Joe – Yes. It’s a relatively easy thing to test. Like you do for septic systems. You can make some general assumptions looking at lot upfront without doing big test. Long-term acceptance rates. You do that on lots. When they come back and they want to move driveway from right to left side, then you do more expensive test.  
Sally Hoyt – If you assume infiltration rate based on preliminary test, then you do in situ test, you can adjust your aggregate storage so you can still use the site.  
Tim – Hand auger test is between $500 to $1,000.  
Hunter – I don’t want to get hung up on cost. Someone’s getting a benefit somewhere else.   
Joe – People will spend $10,000 on something for the house that lasts maybe 10 years. This will work for the life of the house.  
Sally Hoyt – If I was doing plan review, I would see that plan called for this test being performed.  
Tim – Who do we produce this test to? This second test?  
Annette – That’s another part of what we’re talking about this spring.  
Annette - How about: DRAW DOWN TIME AND SOIL INVESTIGATION FOR INFILTRATING PAVEMENT SYSTEMS. Infiltrating pavement systems shall be designed to completely dewater the treatment volume to the bottom of the infiltration device within 72 hours. A site-specific subsoil investigation shall be performed prior to placement of the stone base to establish the hydraulic properties and characteristics of the subsoil.  
Group agreed.

🌢

**CONTRACTORS**  
For PICP, PA and PC, the use of certified and qualified contractors in accordance with industry standard documents shall be required and noted on both project plans and specifications.  
Group agreed to move to Recommendations.

🌢

**SOIL PREPARATION**  
In HSG B, C and D, the surface of the soil subgrade under infiltrating permeable pavement should be scarified, ripped or trenched immediately prior to aggregate base placement to maintain the pre-construction subgrade infiltration rate.  
Brian L – So can we get rid of the second test we just talked about?  
Tim – If they meet the requirements, it should just be you have to maintain integrity of system. You shouldn’t have to do anything.  
Joe – Can eliminate this because previous item takes care of it.  
Tim - What is considered prior to placement of stone base? A day, a week, a month?  
Joe – Testing of individual site is to make sure something hasn’t been screwed up.   
Sally Hoyt – We had word “immediately” in there.   
Tim – I don’t want “immediately” in there. If they test if then, might be too late to do anything about it. You can’t get building permit without showing report in some municipalities. In reality, the state is trying to say this is immediately or whatever – what is that time?  
Mike M – Would you be okay with 24 hours?  
Tim – Can’t be 24 hours because you can’t get building permit --  
Sally Hoyt – Setting aside permitting, intention is to do testing with in situ soils before stone is placed. Intent is not to specify what sort of investigation needs during design phase in order to get approvals.  
Joe – If I’m investigating this in preliminary phase, you’ll have report on Lot A that there is an area this will work in. You use that report just like a septic or well permit to go get your building permit. Once they put it in, ready to put driveway in, they come back before it’s installed, the test will be run that day, the stone will be installed the next day. That report will be more specific that it still meets requirement. Won’t hold up building permit.  
Tim – Difference between state and local building code.  
Rob W – Joe’s talking about minimum design criteria should be able to be done at preliminary stage. That should give you everything. This rule is more of a recommendation.  
Joe – I don’t care if it’s recommendation or a rule. It needs to be done.  
Tim – Where does report have to go to?  
Fred Adams – I like something like this because it helps educate folks that we’re trying to use something that allows infiltration.

🌢

**PLACEMENT OF INFILTRATION MEDIA**  
In-situ soils may be removed and replaced with infiltration media or infiltration media may be placed on top of in-situ soils if the applicant can demonstrate that the modified soil profile allows for drainage of the treatment volume within 72 hours.  
Rob W – Make it a recommendation?  
Annette – It’s an MDC in infiltration chapter.  
Brian L – I think it’s fine to leave it in.  
Group agreed to keep it as MDC.

🌢

**OBSERVATION WELL**  
For infiltrating pavement surfaces located under the ground surface, a minimum of one inspection port shall be provided at the low point in the system unless the subgrade is terraced; in that case, there shall be one well for each terrace.  
Bill H – We’ve used two inches in the past for our observation well.  
Fred Adams – I think four is in the BMP Manual somewhere.   
Todd – If you have acres of parking lot, is there a ratio of wells to size?  
Annette – How about: Permeable pavement shall be equipped with a minimum of one inspection port at the low point in the system. If the subgrade is terraced, then there shall be one observation well for each terrace. [Note for design guidance – suggest size of the observation should be minimum 2”.]  
Group agreed.

🌢

DETENTION SYSTEMS  
Pavement systems may be designed to detain stormwater in the aggregate for a period of two to five days.  
Group agreed.

🌢

**GRADING WHEN DRY**  
The soil subgrade for the permeable pavement shall be graded when dry. The aggregate base and permeable surface course should be completed as quickly as possible to reduce the risk of soil subgrade compaction.  
Bill H – This is important for infiltrating systems.  
Joe – What’s “dry”?  
Annette – Idea is when it’s not raining.  
Joe – Make this a recommendation.  
Annette – Change “dry” to “there is no precipitation.” And make it a recommendation.  
Group agreed.

🌢

**EDGE RESTRAINTS**  
Edge restraints shall be provided around the perimeter of permeable interlocking concrete pavers (PICP) and grid pavers as well as anywhere permeable pavement (of any type) is adjacent to conventional asphalt.  
Fred Adams – This should be required. Crucial to function of pavement surface.  
Group agreed.

🌢

**PERMEABLE PAVEMENT SIGNAGE**  
Permeable pavement signage shall be clearly and permanently posted to prevent use by inappropriate vehicles, and the deposition and storage of particulate matter (except for single family residences, where signage is optional).  
Fred Adams – Loading capacity is important.  
Sally Hoyt – Move this to recommendation. If you want to protect pavement, there are other things you can do.  
Bill H – I think we should just eliminate it. I don’t think people that we care about will read it.   
Group agreed to either eliminate it or make it a recommendation. Hunter will provide more about this.

🌢

Annette - We didn’t get to the plan for the spring, so I’m assigning homework. I’ll send Team document. Please review and think of ideas ahead of next meeting.

**Action Items**Annette –Send Team additional homework in 2 weeks.  
Team – Review chapters and additional homework as assigned.

**Next Meeting – February 23, 2015 – 9:30 to 3:00, Fast-track Permitting**