State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION

JON S. CORZINE
Governor

MARK N. MAURIELLO
Acting Commissioner

Bureau of Nonpoint Pollution Control
Division of Water Quality
Post Office Box 029
Trenton, New Jersey 08625-029
609-633-7021 Fax: 609-984-2147
http://www.state.nj.us/dep/dwq/bnpc_home.htm

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Dear Interested Parties,

The Stormwater Management rules at N.J.A.C. 7:8 and provides stormwater management standards for new development and redevelopment in the State of New Jersey that is defined as "major development." The standards include requirements for the use of nonstructural stormwater management strategies, groundwater recharge, runoff quantity and runoff quality control that focuses on the control of total suspended solids (TSS.) Currently, adopted as part of the Stormwater Management rules, are standard stormwater best management practices (BMPs) that can be utilized to comply with the TSS requirements. In addition to the adopted list of BMPs, proprietary manufactured treatment devices may be evaluated for a TSS removal rate through verification by NJCAT and certification by the NJDEP. (MTDs are proprietary water quality treatment devices that, if evaluated in accordance with NJDEP protocols, may be utilized for compliance with the 80% Total Suspended Solids requirements at N.J.A.C. 7:8-5.5.) The receipt of these two reviews and approvals is the recognition of a device's approval for use in NJ for compliance with the TSS requirements.

In the past few years, many issues have been raised to the Department regarding the use and misuse of existing protocols, both in relaxation and inequality of the testing performed, the project review and the approvals. Comments were also provided expressing concerns regarding the interpretation of the existing protocols and the necessity for more stringent application and detailed guidance for the testing of devices. NJDEP had two meetings with the vendors to discuss issues with protocols, one on March 4, 2008 and another on October 27, 2008. In the past two years, vendors also provided input to the Department on various issues associated with testing through questions and comments on their's and/or competitors' product reviews.

As a result of vendor comments and reviews of MTD data, NJDEP developed three draft protocols. The Hydrodynamic and the Filter Protocols will supersede the existing laboratory testing protocols for the evaluation of manufactured treatment devices (MTDs). The Field protocol is a series of additions and revisions to the existing Technology Acceptance Reciprocity Protocol Tier II that is currently in place.

NJDEP posted these protocols for comment on April 28, 2009 and accepted comments until May 15, 2009. Comments were received from the following: Craig Beatty, KriStar Enterprises, Inc.; Craig Beatty and Gene LaManna, Stormwater Equipment Manufacturers Association; Derek Berg, CONTECH Stormwater Solutions; Graham Bryant, Hydroworks; Stuart Ellis, AquaShield, Inc. ; Joel Garbon, Imbrium Systems Corp.; John S. Gulliver, Department of Civil Engineering, University of Minnesota;

Qizhong (George) Guo, Civil and Environmental Engineering, Rutgers University; Gene LaManna, Terre Hill Stormwater Systems; John S. MacKinnon, Hydro International; James T. Mailloux, Alden Research Laboratory; Jon McDonald, Kristar Enterprises, Inc.; Omid Mohseni, Barr Engineering Company and St. Anthony Falls Laboratory, University of Minnesota; Tom Pank, BaySaver Technologies, Inc.; Robert Pitt, Dept. of Civil, Construction and Environmental Engineering, University of Alabama; Robert Roseen et al., University of New Hampshire Stormwater Center; and Daniel P. Smith, Applied Environmental Technology.

The attached document is a compilation of the comments received and their responses. Please note that comments have been edited for consistency in language and for brevity. Comments submitted that are not specific to the protocol are not part of this response document.

Thank you for you input into these protocols.

Sincerely,

Sandra Blick, Supervisor
Stormwater Management Unit

Comments and Responses on Laboratory Protocols for Manufactured Treatment Devices

Many comments were repeated for both filter and hydrodynamic protocols. Where a comment only applies only to the filter or to the hydrodynamic protocol, the word “filter” or “hydrodynamic” precedes the comment.

<u>General Comments</u>

1. There is no correlation between the flow rates in the lab and those in field applications.

   The removal rates of a manufactured treatment device (MTD) is associated with its design parameters, including the maximum treatment flow rate (MTFR) established in the lab. The design flow rate for field applications is the runoff from the New Jersey Water Quality Design (NJWQD) storm for the inflow area to the MTD. The MTD utilized at that location must be rated for a flow equal to or greater than the NJWQD flow. The allowable flow rate for each MTD must be required to be at or below the MTFR.

2. Filter: Some filters may not have cartridges; therefore, the term filter cartridges should be removed.

   The filter protocol has been revised as recommended.

3. Filter: Page 1, paragraph 4: “Hydrodynamic Sedimentation” should be replaced with “Filtration.”

   The protocol has been revised as recommended.

4. Hydrodynamic: Many devices were tested on different particle sizes than that in the NJDEP protocol, such as F95 sand. The approved flow rates of previously verified and certified devices should be normalized based on their tested particle.

   The intent of this new protocol is not to revisit existing approvals but to ensure consistent application in future. All devices approved prior to the adoption of the revised stormwater management rules are due to expire on May 15, 2011 with the exception of devices that have received final certification. Any future testing must be in accordance with the new protocols and the required particle sizes. Devices that do not comply with the particle size requirements of these protocols will not be recognized in New Jersey.

5. The use of TSS in the title of the protocol creates confusion regarding the intent of the methodology since many discussions refer to total sediments suspended in water as opposed to the TSS analytical testing methodology.

   The use of TSS in the title is consistent to the requirements in the New Jersey Stormwater Management rules that allow manufactured treatment devices to be utilized to comply with *the 80% Total Suspended Solids requirement under NJAC 7:8-5. See also Response to Comments 49 through 104.*

6. Metric units should also be required in order to simplify comparisons with published papers.

While metric units may be valuable, NJDEP does not believe it is necessary to mandate their use since they are not the standard units used in New Jersey stormwater management design.

<u>Maximum Conveyance and Treatment Flow Rates (MCFR and MTFRs)</u>

7. The paragraph should be deleted revised to indicate that the MTFR will be determined during lab testing as a function of the capacity to remove TSS instead of by the device characteristics prior to testing.

The lab protocols have been revised to allow MTFR to be determined both prior to or during lab testing.

8. The definition of MCFR should be more specific. MCFR appears to mean flows controlled by an internal bypass. For offline systems, the MTFR should be used to design the external/diversion bypass structure instead of the MCFR unless it is demonstrate that no significant scour occurs under MCFR.

The definition of MCFR is based not only on bypass but on the maximum flow that will pass through all of the treatment components. Many manufacturers claim a MTFR that is significantly lower than the MCFR in order to achieve a target TSS removal rate. As the commenter indicated, the MTFR should also be used to design bypass for offline structures.

9. The MCFR should refer to the maximum flow passing through the device, not the maximum flow being treated by the device.

The MCFR is the maximum flow that passes through all of the treatment components of the device. The MTFR is the maximum flow that meets the claims of the manufacturer.

10. The protocol indicates that the maximum conveyance flow rate is the highest flow rate that can be fully treated by the device and gives the impression that the MTD will meet the treatment standard at the MCFR.

As part of the review process, the verification agency must ensure that the treatment standard is met at the MTFR and not the MCFR.

11. The term maximum conveyance flow rate is misleading and indicates no more flow can be conveyed through the unit. The limiting factor should be resuspension and loss of captured material instead of MCFR. Consider a change to Maximum Allowable Flow rate based on scour potential or allowance of upstream surcharge.

Response to Comments 11 through 12.
The maximum conveyance flow rate is the maximum flow that can be conveyed through all of the components of the device, which includes all of the treatment components. The surcharge

limitation may be one of the necessary variables that allow the MCFR and MTFR to be determined for a particular MTD. A scour test has been incorporated to address resuspension of sediments for larger storm events.

12. The Maximum Conveyance Flow Rate should be clarified as the maximum flow passing through the device and not the maximum flow being treated by the device.

13. The reasoning behind the use of water level would be used to establish MTFR is unclear. It seems that MTFR should be determined by documenting the flow/operating rate at which performance criteria are met.

    The water level does not define the MTFR; the MTFR defines the water level and establishes the relationship between the MTFR and MCFR within a device that can be utilized for scaling of untested devices.

14. Hydraulics depends on the structure as well as the inlet and outlet pipes (e.g., material, size, and slope). The MCFR/MTFR as tested will only be valid for the exact configuration tested. The hydraulics need to be analyzed to allow designers to ensure that the head loss due to the MTD functions with the storm sewer system. Analysis to establish the appropriate equations and associated coefficients should be required. Testing for MCFR and MTFR does not provide enough hydraulic information that will be useful for actual drainage designs that may vary from the setup that is tested.

    The configuration and the setup in any laboratory configuration must be the same as the field installation in order to receive the NJDEP confirmed removal rate, unless written approval prior to testing is provided by the verification agency who in turn received written confirmation from NJDEP regarding configuration adjustments. Therefore, the hydraulics of the structures in the laboratory should be the same as that installed in the field.

15. Flow equations and various coefficients used to scale between devices are discussed. This seems to overcomplicate the process. Since NJDEP intends to prohibit scaling methodologies other than the aerial (hydraulic loading rate- Q/A) method unless 3 distinct model sizes are tested to prove scaling methodology, why not use the relationship between flow and treatment area for the purpose of scaling? Scaling should be based on unit area of flow per unit area of treatment surface area. MFTR should be defined as cfs or gpm/ ft2 of treatment surface area. MTFR for other model sizes is established by holding this relationship constant.

    Response to Comments 15 through 17
    Applying the tested removal rate to similar devices will be based on the tested Q/A as indicated by the commenters. The transfer of the removal rate to the similar devices will not only require the surface area but also the MTFR for the untested devices. The MTFR of the untested devices will be defined using the equations for the tested device and the relationship established between the MTFR and the MTCR, which must remain the same. (See also Response to Comment 13.)

16. Extrapolation of flow rate for different separator sizes based on the MTFR and separator hydraulics alone would be inappropriate to achieve the same level of TSS removal for the

scaled separator. Flow rates should be scaled based on flow rate per separator surface area (gpm/sqft) as mentioned in the protocol, or flow rate per separator volume (gpm/cuft), whichever is smaller based on the tested MTFR.

17. The reference to MCFR should be removed since it is not needed/used in the protocol. The storms that can be used for testing are defined by the storm characteristics and do not depend on the MCFR. The requirement for storm flow rate is based on the MTFR and as such MCFR is not required nor should be a parameter for either lab or field testing.

18. The 2nd and 4th paragraphs on page 2 should be combined since the both address sizing.

Paragraph 4 was moved below paragraph 2 since both address sizing. Portions of the recommended language were utilized to clarify the protocol.

19. The lab protocol requires testing up to 125% of the MTFR. As such testing occurs up to 125% of the maximum treated flow rate without by-pass or overflow or 1.25 x MCFR. The 100% flow rate should be defined as the MTFR and the term MCFR should be discarded.

The MCFR is the highest flow that can pass through a device without bypassing a filter (filtration) or that can pass through all of the treatment components without bypass. Many manufacturers utilize a flow rate (MTFR) which is less than the MCFR to achieve a particular TSS removal rate, which indicates the necessity for both terms. In cases where the MTFR is the same as the MTCR, the removal rate tested must include flows from the bypass to assess the effluent at 125% of the MTFR.

20. MCFR is quite confusing, and in most cases is actually the MTFR. Most systems have an MTR (MTFR) and an MHR maximum hydraulic rate which includes bypass. This becomes particularly biased against systems that have been designed to store the resuspendable pollutants offline. I believe what is important is that the MCFR is not the; "… highest flow that can be conveyed through all of the device's treatment components or measures without overflow, bypass or surcharging", but instead the; "… highest flow rate that can be conveyed through the device, and achieve the required removal rates." These would of course be based on the weighted value in Table 2. Every technology is different and has its function. Why limit this unnecessarily, when the goal is to make certain that systems are sized and applied correctly, it is unreasonable to put them all in the same box, when clear limitations exist with some and not others.

Response to Comments 20 through 21.
Many manufacturers utilize a maximum treatment flow rate (MTFR) which is less than the MCFR to achieve a particular pollutant removal rate. Therefore, it is appropriate to include both MTFR and MCFR. The MTFR is the flow rate that would achieve the approved removal rates, not the MCFR. In order to utilize the removal efficiency of the tested MTD, the relationship for the MTFR and MCFR for smaller or larger versions of the tested MTD must remain consistent with the tested device.

21. The MCFR should be independent of MTFR. The MCFR is a hydraulic concern while the MTFR is a treatment concern. There should be no defined relationship between the two.

22. The sentence that states that the MTFR is the highest flow rate that "ensures the performance and maintenance interval" claimed by the manufacturer gives the impression that the MTFR dictates performance and maintenance interval rather than being a function of the performance and maintenance interval.

NJDEP does believe that the MTFR dictates the performance; however, many manufacturers adjust the MTFR based on the performance they are seeking to demonstrate to the review agencies.

23. MTFR should be the maximum rate that the unit can operate at while meeting the required TSS removal efficiencies, based upon the weighted pollutant load factors (table 2).

The protocol currently indicates that MTFR is associated with the performance of the MTD.

24. Hydrodynamic: There are no criteria in place to ensure the MCFR does not washout previously captured pollutants. Testing must be conducted to ensure no washout occurs at the MCFR.

Any material that is settled then resuspended will be part of the tested effluent and addressed in the removal efficiency.

25. Hydrodynamic: NJDEP should reestablish a re-suspension / scour testing protocol for hydrodynamic separators**.** Separators should be tested at greater than or equal to 125% of the MCFR with clean water, and the treatment chamber pre-loaded with NJDEP test sediment (mean particle size 67 microns) at 100% of the manufacturer's recommended sediment maintenance depths. Acceptable level of re-suspension is indicated by effluent TSS concentration of less than or equal to 10 mg/L. Devices that can demonstrate effective internal bypass mechanisms through such testing should be permitted to be installed without external bypass.

Response to Comments 25 through 29.
NJDEP has developed a scour requirement at 600 percent of the MTFR, which approximates the 25-year storm event for which storm sewer systems are typically designed. The particle sizes for this scour test is the portion of the NJPSD 40 microns and greater to account for the particles anticipated to be settled by a hydrodynamic device, with an acceptable increase in influent concentration of 10 mg/l.

26. Hydrodynamic: For an online system, an additional "scour" flow rate should be defined and measured. This flow rate will be for the total volume that passes through all the components, not just the treatment components of MCFR and MTFR. Under the scour flow rate, no significant scour should occur.

27. Hydrodynamic: Is the intent of the sampling requirement to be one residence time apart a scour test? How is the material lost during this period assessed?

28. Hydrodynamic: There is no mention of washout testing in the protocol. This is a critical element of HDS testing and must be included. Without washout testing many of the other measures of this standard are meaningless.

29. Hydrodynamic: Scour testing with a sediment bed comprised of the NJPSD is inappropriate since the NJPSD is finer particles captured by the hydrodynamic separators, which are particles below 15-20 um. A larger gradation should be used that is representative of what separators can remove.

30. The wording "that ensures the performance and maintenance interval claimed by the manufacturer" under maximum treatment flow rate should be replaced with "that can be treated to meet the TSS removal efficiency performance claim; provided that the device is maintained according to the Maintenance Plan of the manufacturer.

    The first portion of the sentence was revised as recommended. The second portion was clarified to indicate that the removal rate is related to the approved maintenance plan and interval.

Maximum Sediment Storage Depth and Volume

31. What are the criteria for the maximum storage depth and volume?

    The maximum storage depth is the maximum depth at which sediment can be stored and not interfere with other components of a system and not cause resuspension when half-full at 125% of the MTFR.

32. Filter: What is the filter area? This should be defined.

    The filter area is the area of the filter media perpendicular to flow through media and was previously defined in page 2.

33. Filter: What is the effective settling area? This should be defined.

    The effective settling area was previously defined on page 2.

34. Filter: Effective Settling Area should be modified to remove the second sentence and modify the first sentence "The effective settling area sis the area where settling of particulates occurs in the device, and is typically the water surface area in the forebay (or equivalent settling chamber) and/or the chamber containing the filtration media.

    The protocol has been revised as recommended.

35. Filter: The effective filter area only addresses surface filtration.

    The removal rates as demonstrated in the testing addresses the effectiveness of not only filtration at the surface but through the entire depth of media.

Laboratory Qualifications

36. This section should be split into two parts. One part should address qualification for test laboratories eligible to perform testing and the other part should address qualifications of analytical laboratories eligible to perform analysis of samples collected.

The protocol has been clarified as recommended.

37. New Jersey Laboratory Certification/Accreditation unduly restricts laboratory analysis to New Jersey laboratories. National or State certification or accreditation should be sufficient.

Response to Comments 37 and 38.
The requirement for NJ Laboratory Certification is consistent with existing NJ requirements and does not restrict accreditation to New Jersey laboratories. NJDEP believes that all analysis of TSS must go to an independent laboratory, instead of a portion. There are currently 63 laboratories in 21 states that have this certification. Laboratories not currently accredited can seek accreditation. Additional information on certified laboratories are available under the selection "Laboratories Certified by Parameter," residue-nonfilterable (TSS) at http://datamine2.state.nj.us/DEP_OPRA/OpraMain/categories?category=Certified+Laboratories,

38. The requirement of independent laboratory analysis for TSS/SSC should be limited to 25% of the test samples.

39. There is no procedure in the New Jersey accreditation for SSC analysis.

NJDEP recognizes that SSC analyses will not be performed under NJ accreditation. There is no requirement for SSC analysis to be performed under the protocol to receive verification. However, any SSC analyses performed by manufacturers must be submitted along with any accreditation associated with the analysis, if available.

40. Indicate whether qualified observer negates need for lab certification. If not, then this would rule out use of in-house lab.

The use of a qualified observer does not negate the need for lab certification. If a laboratory is currently not certified, certification can be achieved through NJDEP, Office of Quality Assurance.

41. The appropriate discipline for laboratory observers should be further defined, such as a PE in the state of testing. Many qualified professionals could be excluded due to lack of professional license.

Qualified professionals include stormwater management engineers and/or scientist in a university that perform extensive stormwater management removal rate research. A resume of the professional should be submitted to the verification agency prior to testing to ensure that the qualifications demonstrated are sufficient.

42. NJDEP should qualify observer(s) who must be hired by manufacturers to observe and certify the test or at least certain parts of the test. If the results from the data taken with the observer correlate to the test claims, the results are accepted. This would probably only cost a few thousand dollars and be NJDEP's insurance policy that this testing is conducted properly. NJDEP could appoint 3 as acceptable and each vendor could choose 1 of the 3. In all cases, the independent observer should be named and approved prior to the testing.

NJDEP does not have a specific licensing program for observers and does not anticipate developing such a program. Instead, the verification entity is responsible for ensuring that the qualifications of the independent observer are met.

43. NJDEP should designate approved testing facilities and require independent testing be performed at an approved facility. The use of such a facility would provide consistency and quality control regarding the accuracy of the report and the treatment of data inconsistencies. An independent observer does not write the testing report and can only verify what they observed.

At this time, the use of designated testing facilities is not required. NJDEP may evaluate this in future amendments and as additional stormwater testing facilities are available.

44. The cost of independent observer is very high. Consider reducing the requirement for independent observers to 20% of the trial or a minimum of one test at each target flow.

Response to Comments 44 through 46.
The need for an independent observer during the duration of the laboratory test is critical to ensuring the defensibility of the data. (See Responses to Field Protocol Comments regarding independent observer time frame during field evaluation.)

45. The cost of independent observer is very high. Consider reducing the requirement for independent observers to 25% of the trial.

46. Independent third parties used by the manufacturer must be present for the full duration.

47. If the manufacturer is paying an independent party for oversight/observation, there is a built-in "financial conflict." Deleting the word "financial" on page 2 would be more consistent with the intent.

The protocol has been revised as recommended.

48. "Conflict of interest" should be defined. The consequences for discovery of a non-disclosed "conflict of interest" should be provided.

A "conflict of interest" for the purposes of these protocols, is when an individual or an organization designs and/or sells a manufactured treatment device and also performs the evaluation of the device effectiveness without third party oversight. The third party overseer would have a "conflict of interest" if such a person invented and/or has financial interest in the results of the evaluation of a manufactured treatment device.

49. Should a notarized Non Collusion Affidavit be required from both the manufacturer and all "third parties", observers, Technical Advisors, laboratories, etc?

A notarized affidavit is not required. However, the manufacturer and all observers and technical staff may submit such an affidavit if they choose. Such an affidavit would fulfill the requirement in Category IV and V of the MTD process that requires "A document signed by the testing entity and the manufacturer indicating compliance with the 2009 NJDEP Testing Protocols, as amended and supplemented (Hydrodynamic, Filter, or Field requirements in accordance with NJ Amendments of TARP) is be submitted to NJCAT."

50. The test configuration and its applicability to sizing should be approved prior to beginning the testing or it will be subject to NJDEP interpretation of acceptable sizing if done after the testing.

The test configuration must reflect a full, scale commercially available device. Where deviations are necessary due to constraints outside of the manufacturer's control, an amended test configuration must receive approval from the verification agency. The verification agency can only approved the amended configuration through a prior written agreement with NJDEP. Requests after testing has occurred will not be considered.

Temperature

51. The following recommendations for temperature have been provided: 64-68 F; A maximum at 79 F; below 80 F; between 60 and 80 F; and a maximum of 70 degrees F.

Response to Comments 51 through 53.
The temperature limit has been revised to 60-80 degrees.

52. Testing can be performed over a wider range of temperatures than proposed. The limited effects of temperature can be compensated by a temperature normalization procedure if necessary.

53. The cost of temperature restrictions may be expensive.

54. The maximum background level of 5 mg/l is very low and may be unattainable. The issue is not so much the background but the particle size of the background. A background concentration of 10 mg/l is moot if the particles are 5 microns. As long as the particle is smaller than what is captured in the unit, it will not affect the data. If a closed loop is used to control the temperature, then the background concentrations will continuously rise. Properly monitoring and accounting for background in the calculations is not difficult and has been shown to produce very good results.

55. The background limit of 10 mg/l should be acceptable provided the background contains less than 2 mg/l of particles greater than 25 um. As long as the background is properly accounted for this should not significantly affect the results as compared to the cost increases in the testing.

NJDEP disagrees that the background concentration does not factor into the removal rate. Past submissions have resulted in inconsistent recommendations on how to account for large background concentrations to adjust the TSS removal rate if the device is unable to capture the particle size. These protocol is intended to reduce such inconsistencies. NJDEP has revised the protocol to allow for a background limit of 10% of the influent concentration and provides another option to address situations where the 10% limit is exceeded. If laboratory testing cannot be performed on this device due to background concentrations and the increased background due to a closed loop situation, the manufacturer has the option of doing all of the removal efficiency testing in the field.

56. Testing a single cartridge is more conservative than testing a full scale device since there is less area of settling. Appropriate conditions for testing single cartridge should be more fully defined.

Previous testing has resulted in configurations which, when scaled, are not the same as what is commercially available. Therefore, this protocol does not specifically provide for single cartridge testing. However, the NJDEP recognizes that there may be circumstances when testing a commercially available is not viable. Therefore, the protocol has been revised to indicate that in certain limited circumstances based on the unique circumstances associated with a particular device, the verification entity may allow a non-commercially available device and configuration. The verification agency can only allow the testing of a non-commercially available device through a prior written agreement with NJDEP.

57. Please explain what is meant by "attenuation time" in the full scale device testing requirements.

Attenuation time is a period of time that a volume of water is held or delayed and which that may contribute to the effectiveness or the maintenance interval of an MTD.

Removal Efficiency Test Runs

Comments regarding bypass are addressed in the Responses to the Field Protocol.

58. Filter: Revise the requirement for the tested concentration to 200 mg/l. This revision will ensure consistency in influent TSS removal rate the maintenance interval testing.

It is appropriate to use different concentration for the maintenance and clogging testing since it is based on the mass that results in a loss of performance. The use of a higher concentration will allow the reduction in flow to occur in a shorter period of time, thus reducing the time needed to perform the test; therefore, the concentration to determine the weight of material before loss of 10% MTFR has been increased to 400 mg/l in the protocol.

59. The number of influent/effluent samples should be reduced to a reasonable number. Currently, 30 influent/effluent sample pairs at three replicates each results in 90 sample pairs.

Response to Comments 59 through 62.

The protocol has been revised to clarify three paired sample for each test run, resulting in a total of thirty paired samples (30 data sets).

60. The protocol does not provide any guidance on the appropriate number of samples to be taken during each test run. We recommend a minimum of 5 paired samples per test run.

61. The requirements for 30 runs will generate some unnecessary data. Because performance is expected to follow a smooth curve, each set of 5 runs will provide enough data to do an error analysis to give statistically valid data. However, it should be noted in the protocol that samples should be taken in triplicate so that even 10 runs will generate 30 data points.

62. The need to repeat point to account for outliers is understood, especially when sampling is involved. However, the requirement to repeat ever test three times at the same concentration seems a little redundant. The location of the points with respect to the generated curve will clearly show if a point is an outlier and should be repeated. The generation of data Standard Deviations and COVs is also a very useful tool when evaluating the accuracy of the test data

63. The protocol does not specify a minimum duration for each test run. We recommend a minimum of 5X the device resident time after system stabilization to allow for the collection of the sample pairs.

Response to Comments 63 through 64.
The influent and effluent sample pairs cannot be taken until the inflow and outflow rates in the device have equalized. Following this initial time period, collection of the influent and effluent samples in a sample pair must be separated by one residence time through the filter device. In addition, the collection of sample pairs must be separated by either a 10 minute interval or 10 times the residence time of the device at the selected flow rate, whichever is greater. This sampling must be completed before the device's MTFR is reduced by greater than 10. These requirements will dictate the minimum duration for each test run associated with each device.

64. Duration of test runs was not addressed except with clear water. I believe that the minimum required test run should be 20 volume cycles of the system or 10 minutes at the test flow rate.

65. Hydrodynamic: The concentration levels of 50 mg/L to 100mg/L are not realistic or useful for application to real world field installations for hydrodynamic separators. The typical concentrations experienced in actual installations is 100mg/L and higher. Thus, it is recommended that the concentration levels for the laboratory test protocol be set at 50mg/L; 100mg/L & 150mg/L.

Based on NJDEP evaluation of runoff concentrations, the use of a 100 mg/l maximum is more reflective of commercial sites than 150 mg/l. It is anticipated that these devices will be placed in with mostly impervious inflow areas more similar to commercial site loading than other types of sites.

66. The lowered testing concentrations of 50 to 100 mg/l propose will increase the sensitivity of the TSS results to sampling and analytical errors. A 10mg/l difference from the true value of

TSS concentration due to sampling errors is easy. Errors increase as a percentage of the concentrations decrease.

Response to Comments 66 and 67.
While there may be additional errors with the use of an influent concentration of 50 mg/l, this concentration is representative of stormwater runoff. Therefore, the use of 50 mg/l is appropriate.

67. Although 50 mg/l may be representative of stormwater, such a concentration will result in decreased confidence in the ensuing TSS removal results. Alden Research Laboratory has indicated that the TSS removal curves for 100 mg/l, 200 mg/l, and 300 mg/l are typically parallel and there is not a significant difference between the 100 mg/l and 200 mg/l results. Therefore, testing should be at 200 mg/l and the test results can be transformed if required based on existing testing result comparisons derived by Alden Research Laboratories.

68. Hydrodynamic sedimentation devices will normally be used for pre-treatment and/or as the first device in a treatment train. Therefore, they would typically receive raw stormwater and would treat higher TSS concentrations than devices located downstream of hydrodynamic devices. Therefore, hydrodynamic devices should only be tested at a concentration of 100 mg/l.

There has been a misconception in the manufactured treatment device community regarding NJ requirements for pretreatment and the differences in application for hydrodynamic devices versus filter devices. Hydrodynamic devices are not exclusively used as pretreatment and often used alone on sites that receive commercial or highway runoff where the TSS removal rate requirement is 50%. Filters are often used downstream of a detention basin but are also be used as pretreatment for a subsurface infiltration basin. Both hydrodynamic devices and filters have the opportunity to be placed as an only treatment or as a pretreatment. Therefore, they should be tested based on the same runoff.

69. Hydro: The preloading requirements are great for a scour/loss test but requires the use of sampling (with associated error). It may not provide as much information as a combination of removal efficiency test empty plus clean water scour test with a partial mass balance.

The regulations stipulate the use of TSS. Therefore, the use of mass balance would not be consistent with the requirements for TSS removal rates.

70. Hydro: The rationale or passing 10X the maximum particulate storage volume through the device is unclear since any loss would have to be replaced to the initial 50% volume.

The protocol has been revised to demonstrate the scour potential of 125% of the MTFR.

71. Hydro: In the “Preloading” provision, the first sentence should be modified to read “The device shall be pre-loaded to 50% of the manufacturer’s recommended sediment maintenance depth for the tested device with material consistent with the New Jersey Particle Size Distribution (NJPSD) described in Table 1.”

The protocol has been revised to indicate that the pre-loading is based on the manufacturer's recommendation.

72. Filter: This section specifies that the system must be stable before sampling but does not specify that a clean filter should be used nor does it set limits on the stabilization time. Since filter removal rates improve as it clogs, the results can be skewed by running it for a long time before sampling. There should be a maximum as well as a minimum time. Typical stabilization times are 1 to 3 times the detention time, so a reasonable maximum is 5 to 6 times the detention time.

    The manufacturer has the option to utilize a filter that has been in place for a long period of time; however, significant flow limitations or limitation to upstream drainage area may result which will be part of the design criteria for future uses of the filter. The maximum time period is not defined; however, at the end of the test period, the MTFR must be at least 90% of the initial MTFR.

TSS Removal Rate

73. How are representative influent and effluent samples determined?

    The word "representative" was in error and has been removed.

74. How and where are samples to be taken? What methods are acceptable? A detailed procedure should be provided with acceptable error limits if sampling is to be done in a repeatable manner?

    Response to Comments 74 through 76.
    Sampling procedures provided in the TARP Tier II protocol, as amended, should be followed in laboratory sampling as applicable.

75. How does one sample the entire flow cross-section at a relatively high flow rate?

76. A note should be added indicated that Annual TSS Removal Rate be applied as a fraction (rather than percentage).

    The TSS removal rate is shown as a percentage to provide consistency.

77. "Residence time" should be defined.

    Residence time is the time it takes a drop of water to go from the inlet to the outlet of the system.

78. A standardized commercially available particle size distribution (PSD) from US Silica should be used due to the difficulty of matching the prescribed PSD.

    Response to Comments 78 through 79.
    The development of a NJPSD recipe based on commercially available material will be considered in future updates of the protocols.

79. NJCAT or NJDEP should find a supplier that provides a consistent material for everyone's use to ensure it is equitable or should develop a pre-approved recipe to limit the variability.

80. Where there is a difference between the tested PSD and the NJPSD, the differences in the tested material should be reflected in the approvals.

All future testing must be in accordance with these protocols, as revised or amended. If a vendor utilizes test material that is not consistent with the protocol, then the testing is not in accordance with the protocol and the device will not be acknowledged by NJDEP.

81. Using the same PSD for both filtration devices and hydrodynamic separators is appropriate only if the filtration device is to be tested in its entirety and the tested filtration device will be used as a standalone unit in the field.

Response to Comments 81 through 82.
Filtration devices are allowed to be placed as the first item in a treatment train as are hydrodynamic devices. The manufacturer has the option to test a filtration device downstream of a detention basin or another type of pretreatment and to have the entire system verified. In such cases, all of the design parameters of the upstream facility will be required with every installation of the filter MTD.

82. Filter: Filters should be tested using SCS 106(d50 = 22 microns) for filtration modules even if there is another upstream chamber. The use of particles with d50 equal to 67 should not be used to quantify the overall/system removal efficiency if the filtration device is installed downstream of a hydrodynamic separator or another BMP.

83. Since the NJPSD has been established for over 5 years it should remain as the prescribed particle size distribution.

Response to Comments 83 through 88.
Evaluation of the particle sizes of runoff from different studies throughout the country has indicated that the NJPSD is reflective of the particle sizes of urban runoff.

84. Filter: The use of NJDEP gradation is a relaxation of existing standards which will result in filter failure when installed in the field.

85. Filter: The use of a fine particle size distribution will minimize errors associated with scaling of settling devices upstream of a filter.

86. Filter: Filtration systems that were lab tested with Sil-Co-Sil 106 were only barely able to meet the 80% TSS removal in field testing which makes Sil-Co-Sil 106 the appropriate surrogate sediment since the NJPSD will not achieve 80% in the field.

87. Filter: The particle sizes for filters should be limited to the range 100 microns and under. Including the larger particle sizes limits the ability to perform accurate sampling.

88. Filter: The use of the NJPSD for testing filters will give extra weight to the settling component of the device. It is also hard to keep this material in suspension at the lower flows typical of filters.

89. Filter: Some filters are designed to flow at constant design rate. The protocol only applies to those that claim variable flow rates. Allow constant flow rate filters to be tested within +/- 10% of that flow rate for all of the testing. The flow weighted efficiency computations would not apply. The use of 0 removal rate at 125% punishes filters.

Response to Comments 89 through 90.
The protocol has been clarified regarding adjustments for filters that trigger outflow at a specific rate. The manufacturer is not required to use a 0% removal rate at 125%; instead, the removal rate at 125% of the MTFR should be tested and included in the equation. The use of the weighted removal efficiency for filters provides a consistent comparison with the results of the hydrodynamic tests.

90. Filter: Use of weighted removal efficiency is much less conservative than requiring 80% removal at the MTFR.

91. Concentrations +/- 10 % of target will be difficult to hold. 25% is more realistic particularly for 50 mg/l.

Response to Comments 91 through 93.
The tolerance has been increased to allow a net variation of 10% for the range of particle sizes. The protocol has been revised to allow for a 10 mg/l deviation from the concentration in recognition of the difficulty to maintain +/- 10 % of the 50 mg/l concentration.

92. It will be very difficult to pre-determine what the sediment feed rate should be in order to achieve the influent TSS concentration of 50 to 100 mg/L, especially within 10% margin. Large uncertainties result from using the existing water sampling method as well as the existing TSS laboratory analysis method (Standard Method 2540D).

93. A tolerance of +10% should be applied to the average of the particulate concentrations for the three test runs at each flow rate, not for each test run.

94. We support the use of TSS as a single measure that is know to be a conservative measure for protection of water resources.

Response to Comments 94 through 104.
The regulations stipulate the use of TSS. The NJDEP has not established the correlation between SSC and TSS at this time. The Guo study, while beneficial, is not comprehensive. As more research is performed comparing TSS, SSC analyses for the same samples and associated mass balance with both, the NJDEP may consider a correlation equation in future amendments to the protocol.

95. While TSS is needed for regulatory compliance, SSC is more reliable for small particulate fractions. If TSS is needed, either both analyses should be done or a theoretical correlation used.

96. There is a difference between the definition of TSS (total suspended solids) and the EPA analytical methodology for TSS (total suspended solids). The two are typically confused. State requirements for 80% annual TSS load reduction do not imply that the EPA analytical methodology for TSS analysis has to be used to determine TSS removal. Methodologies such as Suspended Solids Concentration (SSC) testing or mass balance testing are just as valid, if not more accurate, as the EPA analytical methodology to determine TSS removal.

97. SSC should be the primary analytical method for determination of TSS concentrations since mass balance testing with filter systems is not feasible. Recommend against the EPA TSS analytical methodology due to inherent inaccuracies.

98. The testing protocol should require the use of both the SSC method and the TSS method for sample analysis, with the intent of eventually modifying stormwater rules to adopt SSC as the preferred method and to phase out use of TSS.

99. Mass balance should be the preferred method for TSS removal analysis.

100. TSS has been shown to be inaccurate for particle sizes above 60-80 micrometers. Why is NJDEP specifying an inaccurate method to analyze the samples unless the particles as less than 60 micrometers.

101. The use of SSC is more reflective of total sample TSS test. TSS will not include representative samples of particles greater than 250 micron. Since 10% of the NJPSD are greater than 250 microns, it is clear that the correct analysis is the SSC test. SSC results are historically more comparable using the SSC test.

102. SSC test is a total sample TSS test. In order to get the larger particles (typically > 250 um) to be included in the subsample of the TSS test, requires extremely fast extraction of the subsample and usually will not include a representative amount of the greater than 250um particles. Now add the fact that 10% of the NJPSD includes greater than 250um particles and it becomes clear that the correct analysis is the SSC test. I would also point out that historically results are far more accurate, repeatable (and therefore more comparative and meaningful) than TSS results simply because of the problems associated with the sub-sampling.

103. If TSS is the required water sampling method, use of a relationship between TSS and SSC to pre-determine the sediment feed rate could be a way to achieve a balance between the regulatory requirements and the testing consistency. Such a TSS-SSC relationship has been derived through a NJDEP-sponsored study (Guo 2007).

104. The testing should be based on a semi-mass balance method and has been shown to obtain results with an acceptable degree of reliability.

105. It should not be the responsibility of the applicant nor or the testing protocol to provide research material on SSC and TSS analytical methods.

In response to comments about SSC and TSS comparability, NJDEP will utilize information on the results of the sampling of the two methods for the same flows and concentration to evaluate whether future amendments to the method of TSS removal rates are necessary.

106. Particle size can't be determined from a TSS Sample. A separate sample must be taken or the PSD can be collected through a partial mass balance procedure that eliminates sampling.

The manufacturer is responsible to ensure that appropriate samples are taken for the data required.

107. Filter: Filtration studies are well suited to the regression of EMC method. Use of this method allows for the use of parametric statistics in evaluating performance. Use of the regression of EMC method should be considered.

At this time, the use of the EMC regression method is not in the protocol. The NJDEP may consider this in future amendments to the protocol.

108. It is critical that acceptable methods of sampling be clearly defined (grab?, automatic samplers? etc)

Additional information has been provided that allows the use of both grab and automatic samplers, providing the sampling methodology is consistent for all influent and/or all effluent.

109. Filter: The preloaded material is not addressed until page 5. Is this a scour test requirement?

Response to Comments 109 through 110.
NJDEP agrees and the pre-loading requirement was removed.

110. Filter: We feel there is little benefit to preloading sediment onto the floor of a filtration device. Velocities through a filtration system are so low as compared with a flow through HDS device there is virtually no risk of re-suspension.

111. Instead of using a TSS load rate, it is more appropriate to calculate the TSS load by multiplying the TSS concentration by the volume of flow passing through the device during the test.

Response to Comments 111 through 112.
NJDEP believes that the use of load rates is appropriate for the computation of removal efficiency and addresses devices where the inflow may not equal outflow.

112. The use of the TSS load rate compounds sampling errors.

113. A composite of all influent and all effluent samples should done for the three test runs at each flow rate. This would produce a particulate concentration similar to an event mean concentration for each flow rate. The time period between each subsample should be specified as one minute.

The time period between samples is one residence time which takes into consideration differences in MTD designs. (See also Responses to Comments 59 through 62.)

114. Requiring that the net variation of the PSD be zero percent is not achievable due to the known variation of commercially available sediment gradations.

NJDEP has re-evaluated these criteria to allow at 10% net variation.

115. PSD analysis should read “In addition, particle size distribution must be determined and reported for a single influent/effluent sample pair at each flow rate for the 100 mg/L TSS concentration, resulting in a total of 5 influent PSD analyses and 5 corresponding effluent PSD analyses

116. PSD analysis for every sample is excessive. PSD for an influent composite sample and an effluent composite sample from all of the influent and effluent samples collected at each flow rate should instead be required reducing the number to 10 influent and 10 effluent PSD samples.

117. The number of required PSD analyses is not clear. There is no reason PSD should change with concentration, but it may change with flow rate. Therefore, one PSD per flow rate is reasonable.

118. It is not reasonable to require every TSS sample collected during laboratory testing to be analyzed for PSD. Laboratory sediment stock should be of known gradation. Analyzing several samples of the feed stock and several test samples should be sufficient to confirm the PSD for lab testing.

119. A PSD of every sample would be very costly. A PSD an influent composite sample and an effluent composite sample from all of the influent and effluent samples collected at each flow rate should be performed instead. That would reduce the number of samples requiring PSD to 20 samples.

Response to Comments 64 through 67.
NJDEP agrees that the reduction of PSD samples is warranted and has revised the protocol to 20 total (10 paired) samples based on composite influent and effluents.

120. The numerous acceptable test methods for PSD may result in analysis that are not easily comparable; resulting in confusion and ambiguity; number of acceptable test methods should be reduced.

The test methods have been reduce to sieve, Coulter counter, hydrometer and laser diffraction tests. The test method utilized for PSD must address the sizes of the particles being sampled. .

Scaling

121. Define similar devices.

Similar devices are larger or smaller versions of the tested device, and are often differentiated by model numbers. Devices are not considered similar when the configuration, test media, or other treatment and/or draindown mechanism differs from the tested device.

122. Please explain/clarify requirement for ratio of MTFR to Effective Settling Area.

Where there is a settling area in a tested device, that ratio (Inflow/Settling Area) shall be maintained in any device that relies on the tested device for TSS removal rate.

123. Scaling too complicated and should be based on approved rate per filter area should be held constant along with other critical dimensions: sump depth, volume, etc.

Response to Comments 123 through 126.
The scaling of the filter is based on the effective filter area . The scaling of any other treatment in the tested system defines the complexity of the scaling. If the tested system includes items such as sump depth and volume, these must also be scaled and included in all future applications. It is up to the manufacturer to demonstrate that all of the components tested in the laboratory that may impact the function and/or maintenance of the filter system be incorporated in the scaling of non-tested devices.

124. Filter: The MTFR is more of a function of filter area than effective settling area. The size of the structure does not necessarily change with the number of filter cartridges or modules. Therefore, sizing should be based on the ratio of MTFR to effective settling area. It may make sense to establish a minimum ration of effective settling area to filter area based on the tested device to ensure that the relative amount of TSS removed by settling would be translated to similar devices during scaling.

125. Scaling appears very complicated and should be simplified.

126. Filter: The removal rates for filters should scale well. The settling component should be scaled based on flow rate to tank volume to ensure consistent settling time.

127. MTCR should be independent of MTFR. The MTCR is a hydraulic concern while the MTFR is a treatment concern. There should be no defined relationship between the two.

The MTCR establish the hydraulic equations for the tested systems. The MTFR is a subset of the MTCR, and is typically established by an elevation relative to the hydraulic controls in the system. The MTCR allows devices to be scaled based on flow. The MTFR for the scale devices will then be based on the relationship of the tested MTFR to the tested MTCR and maintaining the MTFR/Effective settling area, whichever is more restrictive.

128. Although testing three devices would help to calibrate the scaling equation, it will not be feasible for most manufacturers to perform such a test in their labs. The number of devices should be reduced to two or three different sizes of bench scale equipment.

Three tests are the minimum that NJDEP can consider before allowing a revised scaling equation. The use of bench scale tests will introduce additional uncertainties regarding the applicability of the information to much larger units. Instead of laboratory analyses, the manufacturers have the option to test units in the field to which does not have the flow limitations of a laboratory.

129. Hydro: The limitation of the applicability of the removal rates to MTFRs ranging from 20% to 300% is too restrictive. No limits should be placed on the devices provided the scaling equations are proven according to the protocol.

130. Larger units are very difficult to test. The scaling should be revised to increase the upper limit to 500%.

NJDEP has re-evaluated this criteria and has revised eliminated this requirement.

131. Hydro: The scaling of the hydrodynamic device infers Hazen scaling based on lateral area, derived from Stoke's Law. Surface area scaling neglects any effects which may exist due to non-classical settling or non-linear flow paths.

The scaling provides a consistent and conservative method of scaling. Devices have the option to demonstrate that their project should be scaled in a different manner, through testing of three different size devices.

132. Hydro: The Effective Treatment Area should be further defined as either vertical or horizontal cross-sectional area.

The effective treatment area is defined as, typically, the water surface area.

133. The words "flow equation, device dimension, water levels and coefficients" need further definition.

NJDEP believes that the words "device dimension and water levels" are self-explanatory and that "flow equation and coefficients" are sufficiently discussed on page 2.

134. The words "in accordance with protocol" should be provided after "testing." Thorough testing should be further defined.

The protocol has been clarified that strict adherence to the protocols are required.

MTFR and Maximum Drainage Area

135. Hydrodynamic: Since the 100% flow rate (MTFR) represents 90% of the annual flow volume based on the annual weighting factors (Table 2) this would guarantee that separators are utilized in the same hydrologic conditions as tested and that only 10% of the annual rainfall is by-passed/overflowed. This percentage of by-pass is also acceptable from a scour perspective since some verified technologies did not complete any scour testing.

Specific scour testing has been incorporated at 600% of MTFR which is based on the storm sewer design storms.

136. Filter: The MTFR is based on the highest flow rate through the filter. However, any detention storage volume provided in a filter system is not taken into account in the calculation of maximum inflow drainage area. For example, even though a filter system may have a lower MTFR than another system, it may still process the same annual volume of water if there is storage provided to offset the lower MTFR. The amount of detention storage provided in a filter system needs to be taken into account in the calculation of maximum drainage area served by the system.

The maximum treatment flow rate (MTFR) is the maximum flow rate treated by a filter regardless of whether or not it is downstream of the detention basin. The upstream attenuation can greatly decrease the flow rate downstream of a detention basin which necessitated a second limitation of maximum upstream drainage area. NJDEP recognizes that upstream detention can greatly decrease the flow into a filter MTD, and requires that the maximum allowable impervious area be in the verification in recognition of the flow reduction due to upstream detention.

Maintenance Interval

137. Filter: Filtration calculation requires too many devices to be consistent with the protocol.

Response to Comments 137 through 138.
NJDEP believes that the number of cartridges should be based on the maintenance and clogging. Therefore, the device function dictates the number of filters per acre.

The equation on page 7 is incorrect and has been corrected. The equations on formerly on page 9 were correct; however, in order to minimize misunderstandings, the maximum impervious inflow area is

$$\frac{\textbf{Weight of TSS Before 10\% Loss in MTFR (LBS)}}{\textbf{400 LBS per Acre of Drainage Area Annually*}}$$

Based on the values for comment 138, assuming loss of 10% at 22.5 lbs results in the following:

A = (22.5/400) = 0.056 acres

Therefore, 18 cartridges are required per acre if the data is based on lab data and 9 cartridges if the data is based on field analysis. NJDEP believes that this is a reasonable number of filter devices per acre.

138. Filter: The calculations on pages 7 and 9 are inconsistent. Using a 0.033 cfs cartridge with an allowable load of 22.5 lbs before maintenance, the computations on page 7 results in a requirement of 1292 cartridges per acre and the computations on page 9 results in a requirement of 862 cartridges per acre which is excessive.

139. Page 6, Maintenance Interval, 2nd paragraph. The last sentence: delete "MCFR" and substitute "MTFR."

MCFR is the correct term. If a filter cannot be cleaned so as to restore the MCFR to the entire system as originally designed, then the filter cannot simply be cleaned or re-commissioned but must be replaced.

140. The use of 400 lbs per year per acre of TSS load to estimate the maintenance interval for a filtration device is too conservative. Typically is a sedimentation chamber or another BMP upstream of the filtration module, and a large part of the sediments would have settled out prior to entry into the filtration module. Maybe 200 lbs per year per acre would be more appropriate considering 50% of TSS would likely have been removed prior to sediment entry into the filtration module.

NJDEP believes that the use of 400 lbs per year from runoff is appropriate. The manufacturer has the option to test a filtration device downstream of a detention basin or another type of pretreatment to account for the function of the upstream detention or settlement. In such cases, all of the design parameters of the upstream facility will be required with every installation of the filter MTD.

141. Filter: A pass/fail criterion for the filter maintenance should be used instead of using the TSS ratio as an alternative drainage area to prevent a possible sizing confusion.

The need for maintenance in a filter (clogging) is very different from the sedimentation (volume/depth of sediment.) Therefore, NJDEP has developed limitations and maintenance intervals based on the different removal processes.

142. Hydrodynamic: The value of 0.0.000097162 needs to be corrected in the denominator to 0.000097162.

The hydrodynamic maintenance equations have been amended.

143. Hydrodynamic: Why not simplify this calculation and divide the devices sediment storage capacity by the annual sediment load x removal efficiency /12.

Response to Comments 143 through 150.
The methodology has been revised to account for a 90% of the annual runoff as recommended by a commenter. The use of a bulking factor of 2 and a density of dry sediment at 165 lbs/cf is the same as a wet density of 82.5 lbs/cf. NJDEP believes that safety factors are warranted for any BMP, and particularly for devices whose performance is based on laboratory testing, since trash and debris as well as sediment will reduce the available storage volume. The verification document will be also used by reviewers and designers for proposed projects with no further adjustments by the NJDEP in the same manner as the BMP design and maintenance criteria of other BMPs in the New Jersey Stormwater Best Management Practices Manual.

144. Hydrodynamic: The maintenance interval equation seems unrealistically restrictive.

145. Hydrodynamic: The equation and its basis seems overly conservative in converting 100% of the rainfall to runoff, in setting storage volume at 50% of the available maximum and including a safety factor of 2.

146. Hydrodynamic: Each component of the calculation should be more clearly accurately labeled. The use of 165lbs/cf assumes that sediment captured in the field has uniform a specific gravity of 2.65 and that sediment forms a solid mass. However, sediment piles contain void spaces and gradations of wet sediments have densities between 80-140lbs/cf. The use of this range of values for density would result in a more conservative volume. The computation also assumes 100% of the annual runoff in the device; however, A portion of rainfall never runs off and another portion of the runoff is diverted around treatment. Only the water quality flow is diverted to the device. There are also duplicative safety factors built into the equation (2x bulking factor x 2x safety factor). Combined with assumption that 100% of rainfall is treated by the devices results become gross over estimate of load. The process can be easily simplified as suggested below

Sediment Load/cf Runoff= 0.00624lbs
Density of wet sediment = 140lbs/cf

Runoff volume (cf/acre/yr)
= 3.86ft of rainfall x 43,560ft^2/acre x 0.9(% of rainfall treated) = 151,327cf

Lbs of sediment captured/ acre treated
= 151, 337cf of runoff/acre/yr x 0.00624lbs sediment/cf runoff X Expected Percent Removal

Volume of sediment per acre treated (cf) = lbs of sediment captured/acre treated/ 140lbs

Total storage required = cf of sediment captured X drainage area (acres) x 2 (Safety Factor)

Therefore, a device treating 1 acre and expected to remove 60% TSS would need 8.1cf of usable storage to capture the expected sediment load per year.

The minimum maintenance interval of 6 months can be used to calculate a maximum treated impervious drainage area (MTID) that a separator can be used on. This is similar to the proposed MTID based on the MTFR. However, unlike the MTFR, the required sediment storage volume is a site design criteria will dictate whether additional sump storage or a change MTD size necessary.

147. On Page 9, in the calculations for “Interval for ½ Storage Volume”, the factor (0.0058297) shown in both the “Years” and “Months” equations appears to be incorrect. The correct factor, as shown in lines above these equations, is (0.00058297).

148. The use of 1,000 lbs per year per acre (base on 100 mg/L of sediment concentration and annual rainfall of 46 inches) for estimating the maintenance interval is appropriate. The use of sediment load of approximately 1,000 lbs of sediment load per acre per year (in addition to the use of ½ maximum sediment storage and safety factor of 2) to calculate the sediment maintenance interval initially appears to me as too conservative. But the actual sediment load into the devices could indeed be much larger than 200 lbs TSS load. The entered and settled coarse sediment would not have been characterized as the TSS load with the existing field

sampling method and the TSS laboratory method. I have estimated one verified hydrodynamic device which provided an estimated maintenance interval of 38 months.

149. The safety factor of 2 should be removed for the following reasons:

i. The use of 100 mg/l as an average event mean concentration (EMC) is conservative for most parking lot (separator) applications
ii. The assumption of 100% runoff is conservative
iii. The sediment volume is already assumed to be 50% larger (bulking factor for water/void contents) than its volume based on a density of 2.65
iv. The use of a safety factor of 2 essentially assumes an EMC of 200 mg/l which would not be considered typical.
v. A safety factor is not an appropriate verification parameter. A safety factor is a design parameter and the factor of safety (2 or otherwise) should be a design criteria and not a verification standard.

150. The safety factors should not be part of the verification. The TSS loading should be allowed to vary based on land use, and the drainage area should be clarified as impervious area or directly connected impervious area.

151. A maximum treated impervious area should be defined based on the MTFR of the tested size of the hydrodynamic separator.

The maximum treated impervious area is based on the time of concentration of the site, and the acreage is provided by this equation for runoff from impervious areas: (Flow in cfs)/3.2

152. Maintenance interval should be tested based on solids obtained from the sump of an existing BMP.

While NJDEP recommends that manufacturers perform this additional test for additional maintenance information, the differences in the performance of BMPs that collect sediment could introduce significant inconsistencies into the relative performance of the MTDs.

153. A correction factor should be included in the maintenance interval need to be adjusted if the device is tested in the lab with Sil-Co-Sil 106 to account for the settleable fraction present on site.

All devices approved prior to the adoption of the revised stormwater management rules are due to expire on May 15, 2011 with the exception of devices that have received final certification. Any future testing must be in accordance with the new protocols and the required particle size; therefore, there is no need for an adjustment factor in the protocol. However, devices that have already been verified that were tested with Sil-Co-Sil 106 (Cat III) will receive an adjustment factor to provide for consistency of maintenance intervals. In future testing, if a manufacturer chooses to exceed the requirements to provide a more conservative test, .no adjustments will be made based on the more conservative test.

154. Filter: The frequency of replacement should be based on either the manufacturers recommended depth or 12 months, whichever comes first.

Filters that need to be replaced or recommissioned more frequently than once per year may not be installed for compliance with the Stormwater Management rules at N.J.A.C. 7:8 as reflected in the protocol.

155. Filter: The interim certification is related to a MTFR but the maintenance interval is related to a drainage area. Will the certification be based on MTFR or drainage area? The correlation between drainage area and MTFR should be indicated.

The acknowledgement will be for filters that include both limits for MTFR and inflow drainage area. The correlation of these is on pages 7 and 9.

156. The rainfall intensity of 3.2 in/hr to determine the MTFR is unreasonable. It is not consistent with NJ hydrology. Based on an average of the 15 minute NJ stations (Glassboro, New Brunswick, Watchung) a rainfall intensity of 3.2 in/hr corresponds to treating 96% of the annual runoff volume. NJDEP should reconsider the use of 3.2 in/hr as their design water quality rainfall intensity in favor of something that is more cost beneficial such as 1.5 in/hr.

157. The flow rate from the NJ Water Quality Design Storm is too conservative to achieve the annual TSS removal goal for MTDs. A study by the commenter indicates that the water quality design storm prior to the existence of the current Stormwater Management rules is more correct.

The New Jersey Water Quality Design Storm was adopted into regulation, has a maximum 10 minute rainfall intensity of 3.2 inches/hour and applies to all BMPs. The screen captures below from NOAA for Trenton State College, shows a 10-minute duration, the rainfall intensity is 3.2 inches/hour and 4.09 inches/hour for a five minute duration for a 1-year storm. Similar values are shown for Newark.

NEWARK WSO AIRF
from "Precipitation-F
G.M. E
NOA

Confidence Limits | Seasonality | Loc

Precipitation Intensity Estimates (in/hr)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 da
1	3.98	3.18	2.64	1.81	1.12	0.69	0.51	0.33	0.20	0.11	0.07	0.04	0.02	0.02	0.01	0.01	0.0
2	4.75	3.79	3.17	2.18	1.37	0.84	0.62	0.40	0.24	0.14	0.08	0.04	0.03	0.02	0.02	0.01	0.0

TRENTON STATE COLLEGE, NEW JERSEY (
from "Precipitation-Frequency Atlas of the United Stat
G.M. Bonnin, D. Martin, B. Lin, T. Parzy
NOAA, National Weather Service, Silv
Extracted: Tue Jun

Confidence Limits | Seasonality | Location Maps | Other I

Precipitation Intensity Estimates (in/hr)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	4.09	3.27	2.73	1.87	1.17	0.70	0.52	0.33	0.20	0.11	0.07	0.04	0.02	0.02	0.01	0.01	0.01	0.01

158. The use of a runoff coefficient of 1.0 for 100% impervious is atypical. A runoff coefficient of 0.9 is typically used for 100% impervious areas.

The rational method runoff coefficient for impervious surfaces is 0.95 to 0.99. Therefore, the use of 1 is reasonable.

159. Filter: The load test 100 mg/l would take too long and 200 mg/l should be used instead.

The testing for maintenance interval requires influent at 200 mg/l and not at 100 mg/l.

160. Filter: A drop of 10% in MTFR will not significantly affect the percentage of annual runoff that is treated but will have a great impact on the operating cost of a filter system. The reduction in MTFR should be related to a percentage reduction in the volume of annual storm water treated. The percentage reduction in stormwater volume treated for filter maintenance should be at least 10%. Considering long term economic impacts a 20% reduction in annual runoff volume treatment should be considered.

The review and verification is based on the MTFR. Therefore, any reduction in the MTFR is less than the tested rate. However, NJDEP recognizes that a drop of 10% in the MTFR is reasonable and therefore allows for the drop.

161. Filter: The protocol does not address blinding, which is one of the most critical filter issues.

The filter protocol was specifically written to address "blinding" or clogging of the filter and limits the clogging of the filter to a loss of 10% of the MTFR when replacement of the filter is required.

162. Filter: The filter protocol does not address the sizing for end of life (EOL). As the filter clogs, the flow will decrease or the head loss will increase. In order to claim a maximum flow rate (e.g., 0.2 cfs) , the filter must be designed to handle 0.2 cfs when dirty. However, if the head is fixed, the filter will flow at a higher rate when clean.

The end of life of the filter is when there is a loss of MTFR by 10%, with an associated maintenance interval of once a year. Therefore, at its end of life, the filter flow rate will be no less than 90% of the clean filter MTFR at the same head loss.

163. Filter: Basing the maintenance on a reduction in flow rate makes sense. However, this does not account for filters that function at a constant flow and rising head loss.

Response to Comments 163 through 164.
NJDEP believes that increased head loss is another measure of loss of filter capacity. The protocol has been revised to clarify that the loss of flow rate is measured based on the same depth of driving head. In cases where the head cannot be maintained due to the device, the approved hydraulic computations derived from testing must be used to correlate increases in head loss with decreases in flow assuming the same head available for a clean filter.

164. Filter: The MTFR assigned to a device does not change and is a result of hydraulic head placed on the filters. If head is constant, the flow is constant unless the filter is clogged. The head should be maintained to demonstrate that the flow rate is reduced due to clogging.

165. Filter: Is maintenance interval based on 50% capacity or 10% flow reduction?

The maintenance interval is based on both. When a sedimentation chamber fills to 50% of capacity, it must be cleaned. When there is a 10% reduction in flow, the filter must be replaced and/ or recommissioned.

166. Filter: Each 60-minute simulated storm event should be comprised of 2 different flow rates and flow rate durations, specifically 45 minutes at 50% of MTFR and 15 minutes at 100% of MTFR.

The intent of the maintenance interval is to evaluate the maximum load that will reduce the flow and to allow draindown that re-establishes flow rates in the device to be part of the test. NJDEP does not believe that the change to two different flow rates is warranted.

167. Filter: The longevity testing criteria only allows for a 20 minute drain down between test runs. The draindown time should be adjusted to be more consistent with real world applications and should not exceed 60 minutes.

NJDEP has adjusted the protocol to allow for 20-60 minutes of draindown time.

168. Filter: When the flow rate is reduced by 10% below the MTFR, the test should be stopped.

NJDEP will not prohibit the manufacturer from continuing the test. However, the maintenance interval will be based on the 10% flow rate reduction.

169. Filter: What if the system is not clogged at the end of the first day of testing? Given the coarse silica gradation specified for this task its probable that testing will span multiple days.

The manufacturer has the option to limit the loading and end the test prior to reaching a 10% reduction in flow. This has been clarified in the protocol. However, the load at the time of the test completion will be assumed as the load that will result in a 10% reduction of flow for the maintenance interval equation.

170. Filter: Pre-Laboratory Testing Submittal. The term “Basis of Effective Treatment Area” should be substituted with “Basis of Effective Filter Area and Effective Settling Area”.

The filter protocol has been revised to correct this.

Comments and Responses on Field Testing Protocols for Manufactured Treatment Devices

171. Some of the requirements may be too restrictive and result in escalating costs associated with identification of a qualified site and time span required for BMP performance monitoring.

Response to Comments 171 through 172.
Many manufacturers choose to obtain interim certification using laboratory tests only before proceeding to field verification. The manufacturer can instead choose to evaluate the performance in the field without the additional laboratory removal analysis required for the interim certification, thus reducing the project costs.

172. The additional requirements will almost double the testing costs and require much more time for completion of field testing.

173. The various amendments and revisions will serve to extend the duration and add cost to the field monitoring. It is not clear what value is provided over existing standards. The Department should explain the intent of the changes and justify the time and cost to these projects.

The intent of the changes is to respond to comments previously provided regarding inequities and lack of detailed direction in the protocols, to incorporate maintenance procedures into the BMP evaluation, and to develop a protocol that allows for the comparison of the effectiveness of MTDs for use in compliance with the NJ Stormwater Management Rules at N.J.A.C. 7:8.

174. How many studies in the NJDEP manual comply with the proposed changes? This level of scrutiny applied to existing BMPs should be evaluated when setting standards for MTDs.

The MTDs subject to these protocols are evaluated in a different manner since they are proprietary; non-proprietary devices, such as those currently in the New Jersey Stormwater Best Management Practices manual, are evaluated through the BMP Manual Technical committee. The manufacturers and the verification entity are required to compare MTDs pollutant removal processes with those of the standard BMPs in the manual as part of the MTD evaluation process.

175. The words "laboratory testing" in the last sentence of the third paragraph should be replaced with "field testing."

The field protocol has been revised as recommended.

176. It may be beneficial to add the SSC measurement only to develop a long-term database of system performance. In the future, the requirement for measurement of SSC as well as other constituents may occur and a database of performance will aid in that transition.

NJDEP believes that it is beneficial to have a database comparing SSC removal rates for TSS removal rates for the same sample and that such date may aid in future protocol *development. The protocol has been revised to indicate that SSC data if available should also be submitted to the Department. However, only TSS sampling is required to be acknowledged for TSS removal rates in New Jersey.*

177. Field testing to any protocol does not generate performance data that can be relied on for verification with any confidence for the following reasons: since weather is highly variable, field testing results cannot be reproduced or compared with other technologies; performance of an MTD for one site may be different for another site; automated samplers draw samples that are not representative; the volume of runoff sampled by automated samplers for the smallest storm is 0.5% of the total storm volume. Sampling less than 1% of the storm water does not results representative of the storm. Whether 0.5% or 0.1% of the storm volume is sampled, neither amount will be representative of the storm. Accordingly, field testing should not be used for the verification of a technology but rather to better understand the operational characteristics of a technology in real world applications (i.e. are there unforeseen operational issues with the technology in certain instances?). Field testing of a technology may still be required but this data should not be used to verify the absolute performance of a technology.

Response to Comments 177 through 179.
NJDEP recognizes the challenges in sampling in the field as opposed to a more reproducible laboratory condition. The concerns regarding the total volume of runoff will be applicable whether testing occurs in a lab or in the field. However, since the MTDs are proposed to be installed in the field, the use of field information will be more reflective of the actual performance than an idealized laboratory condition. The use of a mass balance is not required in this protocol since the rule requires the measurement of TSS.

178. It is possible to sample a wide range of flows with an automatic sampler. Automatic samplers cannot adequately represent particles greater than approximately 250 microns. A mass balance analysis after the monitoring period can establish the sampling errors.

179. The goal of the field testing should be to confirm the functional claims of lab testing in the field and confirm the estimated maintenance requirements to continue achieving these results.

180. Both lab and field monitoring should be used if possible. Fluctuating flows during actual events can dramatically affect performance, for example.

NJDEP agrees that the use of both field and laboratory removal efficiency analysis provide a fuller picture of the performance of an MTD.

181. Page 1, 4th paragraph. The second sentence should be revised to state that data “may or may not” be accepted by other TARP states.

The sentence has been revised as recommended.

Section 2.2 Stormwater BMP Screening for Validation

Comments regarding the NJ Environmental Laboratory Certification requirements are addressed in the response to the laboratory protocol comments.

182. The continuous flow measurements should be omitted from the site characterization prior to field testing.

NJDEP believes continuous flow measurements are necessary for site characterization and must be provided.

183. Requiring continuous flow measurements during site characterization without monitoring rainfall would not be of much value.

The same rainfall requirements are required for characterization that is required during the performance testing.

184. All field samples should be analyzed by an independent certified analytical laboratory.

The field protocol has been clarified to indicate that all samples are required to be analyzed by an independent and certified laboratory.

185. Page 2, 4th paragraph, iii. This section should refer to field testing and not lab testing.

The field protocol has been clarified to indicate that stormwater analysis must be performed by an independent certified lab and that all sampling shall be overseen by an independent party.

186. The independent observer should be responsible for approving the site chosen, the field setup of equipment, the type of sampling equipment chosen, the chain of custody of samples, approval of the QA/QC program, review of data for completeness and accuracy, etc.

The review of the QA/QC or QAPP is the responsibility of the verification entity.

187. The requirement for an independent observer to be present for the "full duration" would require an independent observer to be present for a year or more and would result in significant costs to the manufacturer. The "full duration" requirement should be reduces to periodic site visits (e.g, initial visit and two or three visits during field testing) in addition to approving the monitoring set-up and field testing protocol.

NJDEP believes the evaluation of the cost vs. benefit of recognition as a BMP in the State of NJ is the responsibility of the manufacturer and not the Department. However, NJDEP has reassessed this requirement and amended the requirement for an independent observer to be present to a minimum of 20% of the qualifying storm events and all of the site characterization events.

188. This section should be split into two parts. One part should address qualification for test laboratories eligible to perform testing and the other part should address qualifications of analytical laboratories eligible to perform analysis of samples collected.

The protocol has been amended to segregate the testing of the device verus the testing of the samples taken.

189. Both flow weighted composite samples and discrete samples are allowed to be collected

during site characterization. If discrete samples are collected, the samples should also be flow weighted and not time paced.

The field protocol requires both samples to be flow-weighted.

190. The collection of flow-weighted parameter would require a full-blown sampling effort which we consider to be beyond the scope of site characterization, particularly for only three storm events. The development of a test plan and the installation and calibration of the equipment is an involved and lengthy process. To require manufacturers to repeat that in the search of a suitable site is time consuming and costly.

While NJDEP recognizes that significant effort is required for site characterization, we also recognize that if a site is not characterized, all of the performance testing may not be valid. Therefore, the cost of complete testing may result in the added cost of an unacceptable site. In addition, performance data can also be taken during characterization provided the site and rainfall complies with the rainfall, concentration and mean PSD requirements in the field protocol.

191. There is not much point to sample effluent for site characterization and the requirement for effluent samples should be omitted.

The field protocol has been clarified to indicate that influent sampling is only required for site characterization.

192. Grab samples (minimum of 5 to 10 per storm event) should be allowed to calculate the mean influent sediment concentration and the mean particle size.

Both grab and automatic samplers are allowed to be utilized.

193. The required average TSS concentration of 50-100 mg/l is too restrictive. It should be simplified to less than 200 mg/l.

Response to Comments 193 through 202.
NJDEP has re-evaluated this requirement and revised the required average concentration to 100 mg/l and lower and the weighted average TSS concentration for a single storm event to 300 mg/l.

194. The required average TSS concentration of 50-100 mg/l is too restrictive. It should be simplified to less 0 to 300 mg/l.

195. Requiring average influent concentrations for 3 storms to be between 50-100 mg/l can exclude many sites and provide no assurances that future storm event will fall within this range. What scientific value does this provide? The range should be expanded. If NJDEP is concerned about the impact of high concentration, it should establish a maximum allowable concentration for a qualified storm event but not reject the use of a site because concentrations are not within a narrow range. Does the Department not care about the impact of high concentrations mobilized by high intensity storms?

196. Average TSS concentration of the influent should not have a prescribed range of 50-100 mg/l. An upper limit of 100 mg/l is reasonable based on data from the National Stormwater Quality

Database (NSWQD), with no individual value grater than 300 mg/l. According to the NSWQD, the median influent for many land uses is below 50 mg/l.

197. There should be no lower limit because it is conservative and additionally challenging event for performance. This is supported by the allowance of lower limits under the TAPE protocol which then require an effluent limit of 20 mg/l.

198. The existing site selection criteria from the January 2006 NJDEP Tier 2 requirements should be utilized except that the mean influent concentration should range from 0 mg/l to 300 mg/l and the PSD should have a d50 of 100 microns.

199. The existing site selection criteria from the January 2006 NJDEP Tier 2 requirements should be utilized except that the mean influent concentration should range from 50 mg/l to 100 mg/l.

200. It is unnecessary to restrict the TSS concentration of any single storm event to less than 200 mg/l since the overall average is more important than any single storm.

201. Limiting the concentration of any one storm to less than 200 mg/l further lowers the chances of finding a suitable site.

202. The current influent concentration range of 100 to 300 mg/l is difficult to obtain in the field and results in considerable expense. Restriction to between 50 and 100 mg/l will make it more expensive and virtually impossible to find a site. The range should be 50 to 300 mg/l.

203. The requirement to fall between the very narrow ranges of sand, silt and clay is too restrictive and should be removed.

Response to Comments 203 to 210.
The PSD criteria in the protocol have been amended to eliminate the sand, silt and clay percentages and to provide a wider range of conditions. NJDEP is aware that there will be differences in PSD concentrations based on storm events and pollutant loads on the site. Once the site has been accepted by the verification agency based on the PSD characterizations, the PSD data for the removal rate will be utilized to qualify storm events and to ensure that no unusual or extreme conditions, such as new construction, that could significantly skew the results, occur on the site during testing.

204. The requirements for site characterization are likely to add considerable time to the field monitoring process. If numerous sites have to be characterized to meet the narrow range of conditions, it will add cost to an already costly process. Experience in the field has shown that many sites will fail to meet at least one of the criteria, especially PSD. Characterizing a site for three storms provides no assurance that that the pollutant concentrations, PSD, etc. will remain consistent through the study.

205. The requirement for site PSD is not realistic, is problematic and may prevent the inclusion of candidate site. The sample size of n=3 is too small to be representative. Single events may not meet these guidelines while mean and median values from a large population (n). The PSD is hugely influenced by sampling technique. It is dependent on soil types within the

watershed. There is too much variation associated with rainfall intensity and storm depth. PSD may have seasonal variations from a variety of influences including changes in viscosity from cold waters and low specific gravity samples from high leaf litter.

206. Finding a site that matches the tightly defined PSD criteria could approach impossible.

207. What happens if the initial testing meets the criteria but the performance testing does not?

208. The more stringent criteria for PSD proposed will make it more difficult to find a suitable site. Vendors have limited control on where systems are installed. We may have units installed in several areas that do not meet the criteria for a test site. That will not be known until a significant amount of money has been spend and time has passed. Some method to account for seasonal variations and other site variables should be included in the criteria.

209. The average particle size should be increased to 100 microns. The second sentence of bullet 3 should be removed.

210. An alternative would be to have the arithmetic average at <=100 microns, but not to limit the maximum event to >100 microns. This is not needed if the average is <100 microns with 3 sampling events.

211. “Equivalent” particle diameter should be allowed to be used in the particle size criteria of 75 microns and 100 microns. The equivalent particle should be defined as the diameter of particles with the same settling velocity as the particles with a specific gravity of 2.65.

NJDEP believes that the specified limitations of particle sizes are sufficient.

212. Typically, stormwater management studies document the median particle size and not the mean. This should be revised in the PSD criteria.

The protocol has been revised as recommended.

213. Three events are only a snapshot and not representative. However, it is better than no preliminary site information.

Response to Comments 213 through 214.
NJDEP believes that three events are sufficient for characterization. Additional information from the site and requirements for qualifying storm events are address as part of the efficiency testing.

214. The NPDES program asks for 17 events for site characterization and they still have difficulty with accuracy in performance.

Section 2.3 Technology Specifications

Maximum Conveyance and Maximum Treatment Flow Rates (MCFR and MTFRs)

Some comments regarding the MCFR and MTFR are addressed in the response to the laboratory protocol comments.

215. The MCFR and MTFR can be measured in the field instead of only from the laboratory.

The MCFR cannot be measured in the field due to lack of control on the peak runoff rate that flows into the device. MTFR is typically a flow rate that has been adjusted by the manufacturer. Such adjustment to a field-installed device would be difficult.

216. The phrase “that ensures the performance and maintenance interval claimed by the manufacturer” should be revised to “that can be treated to meet the TSS removal efficiency performance claim; provided that the device is maintained according to the Maintenance Plan of the manufacturer.”

The first portion of the sentence was revised as recommended. The second portion was clarified to indicate that the removal rate is related to the approved maintenance plan and interval.

<u>Addition 2: Grates and Trash Racks</u>

217. The statement “of no more than seven (7) square inches should be clarified.”

Response to Comments 217 through 218.
The statedment has been rewritten in the field protocol.

218. The statement regarding grate openings should be revised to delete “minimum of” and substitute “and” in place of “or.”

219. The types of grates/racks, particularly storm drain inlets, used in any part of the country is dependent on state/local regulations and the suppliers. Dictating that a device use only one type of grate/rack everywhere in the county would be difficult, if not impossible, to achieve. The protocol should only require a grate/rack wherever the device is installed.

Response to Comments 219 through 220.
The sizing of grates and racks are those that are required for all new development and redevelopment subject to the stormwater management rules throughout the State of New Jersey and the New Jersey protocol, not requirements throughout the country. The sizing indicates that grates and racks cannot be smaller than the minimum so as to be consistent with those installed in the State.

220. There is no basis to include a component that would not be required in field applications. If a trash rack is necessary to protect the filter for the field testing, it should be a required component on all installations.

Section 3.1 Standardized Test Methods and Procedures

Revision 1: TSS Method Requirement

Comments regarding the SSC vs. the TSS method are addressed in the response to the laboratory protocol comments.

Revision 2: Methods for PSD

221. Eight methods for determining PSDs are listed as acceptable. These methods are known to produce different results from one another, limiting the comparability of PSD results. The list of acceptable methods should be limited.

Response to Comments 221 through 222.
The PSD methods in the protocol have been revised to the following: sieve, hydrometer, laser diffraction and Coulter counter.

222. Too many methods are allowed. It makes the PSD assessments non-comparable. The section should be specific too sample type. Water samples should use optical methods such as Coulter Counter and/or laser diffraction with pre-screening with a 500 and 250 micron sieve. See TAPE PSD protocol for details. Water samples will have very low overall sediment mass, likely less than a gram per liter. Sediment samples taken as residuals from within MTDs should be tested as wet sieving and hydrometer analyses.

Section 3.2 QAPP

No comments received.

Section 3.3 Stormwater Data Collection

223. If the goal of the TARP revisions is to verify the effectiveness of installed BMPs, all runoff from the test site should be sampled and tested. Everything should be mass weighted, to provide an influent and effluent load for all the storms. Simply because a storm was .05" and produced a 20mg/l load that was reduced to 10mg/l it will be given the appropriate weight in the overall, if a storm came 4 hours later and produced a 10mg/l concentration that was cleaned to 5 mg/l so be it, it equates to the mass removed. When a thunderstorm comes and produces a 1000mg/l concentration for 5 minutes, was reduced to 20 mg/l that should be recorded as well. It is unreasonable to use lab level parameters to determine what is acceptable in field data.

The goal of the protocols is to provide requirements for testing of MTDs so that their use for compliance with the Stormwater Management (SWM) rules can be evaluated for TSS by site designers and project reviewers against other BMPs in the New Jersey Stormwater Best Management Practices Manual. The mass balance approach recommended by the commenter is not cited in the regulation which requires TSS removal. The field criteria differ from the lab criteria; however, since performance in the field is the issue in the SWM rules, the requirements for laboratory testing were based on field information.

Addition 1: Rainfall Requirements

No comments received.

Addition 2: Continuous Recording

224. Water levels at both upstream and downstream of the device should be measured continuously. The downstream level would normally be measured as part of the flow measurement for the event mean concentration and the upstream level should be measured to evaluate maintenance and head loss.

While water levels may need to be measured upstream of the device to measure the downstream flow rate, NJDEP has not determined that continuous measurement of the downstream elevation provides additional maintenance information.

225. Clarification should be provided regarding the need to continuously monitor the device water level. What is the purpose of this requirement?

Response to Comments 225 through 226.
The water level recording will establish/confirm the draindown time for each MTD, associated with the total influent load, the inflow hydrograph, and whether draindown mechanisms are functioning as designed. If the equipment fails during non-rainfall periods, it may invalidate the tests for the rainfall being recorded by the level testing equipment. Preliminary research indicates that the power required for level sensors are nominal and can be battery-operated.

226. Continuous recording is an onerous burden and its maintenance and malfunctions. If the recording equipment fails during non-rainfall periods, will it invalidate the entire test? What about the power required?

Addition 3: Recommissioning or repairing

227. The sediment removal provision should be modified to reflect 50% of the “manufacturer's recommended sediment maintenance depth.”

Manufacturers recommended maintenance depths may be based on different factors. The use of the depth associated with the protocol provides an equal method of determining maintenance depths for different devices.

228. The systems must not be maintained during the testing. The testing should be for a complete maintenance interval that will become the required maintenance interval for all installations.

Systems may be maintained during testing; however, documentation of maintenance performed must be included in the submitted reports and incorporated into the maintenance plan and/or allowable maximum inflow drainage area associated with a verification.

Addition 4: Maintenance Reporting

No comments received.

Addition 5: Site Installation for One Year

229. The maintenance interval requirement (especially the one-year interval requirement for filtration devices) could be a drainage area control requirement rather than the MTFR. The estimated maintenance interval may not reflect the field maintenance interval.

The maintenance interval, as proposed, addresses both the MTFR and the maximum inflow drainage area. The actual loading that is associated with the maintenance interval is to be established during the field testing. Adjustments of the maintenance plan for any stormwater BMP can be performed by the property owner every year to adjust for site conditions with the approval of the agencies that approved the project.

230. The device to be monitored does not have to be limited to the newly installed one. The existing device could be used as long as the device is cleaned out before monitoring.

Response to Comments 230 through 231.
NJDEP agrees that for hydrodynamic and settling devices, a newly installed MTD may not be necessary provided that the installation was performed in accordance with the NJ sizing requirements and meets the remainder of the criteria and the function of a device prior to site stabilization will not be useful for predicting post-construction performance. It may not be appropriate to use existing filters that have lost hydraulic capacity. The field protocol has been revised to provide this clarification.

231. The testing should begin once the site has been fully stabilized and not upon device installation. Testing during the construction period will not be representative of post development operation.

NJDEP agrees that testing should not be performed prior to stabilization of the inflow drainage area to the manufactured treatment device.

232. The last word should be changed from “installation” to “commissioning.”

The field protocol has been revised to indicate that it can be either installation, commissioning or beginning of testing.

Revision 1: Minimum 0.1” rainfall and minimum 30 minutes duration

233. Why are shorter duration storms that produce 0.1 inches of storm excluded? Presumably, these higher intensity rain events will provide useful information regarding the device's performance. A minimum 30 minute duration could eliminate thunderstorms that are representative of summer seasons.

Response to Comments 233 through 235.
NJDEP has revised the protocol to base the minimum sampling on the rainfall depth and the number of samples required and has eliminated the minimum duration.

234. The 30-minute minimum appears too short. This should be limited by rainfall depth only.

235. As long as a storm event produces runoff and the appropriate number of samples is collected the storm event should not be excluded.

236. All storms should be included. Selecting or restricting storms has no value for comparative data. NJCAT should be able to determine if the efficiency claim is achieved based on the submitted data.

The protocols are provided to establish comparable performance and consistent criteria. The verification agency is responsible to determine whether the protocol has or has not been followed.

<u>Revision 2: Min and Max Inter-Event dry periods</u>

237. A minimum of 2 antecedent dry days should occur between events.

NJDEP believes that a minimum of 6 hours is sufficient provided that the influent meets the remainder of the requirements for a qualifying storm event, such as concentration.

238. The requirement for a 5 day inter-event dry period should be removed. It does not seem logical and does not provide additional scientific benefit.

Responses to Comments 238 through 243.
NJDEP has re-evaluated the need for a maximum inter-event dry period and removed it from the protocol.

239. There does not appear to be a basis for the maximum inter-event dry period days. There does not appear to be any bias that would be introduced by monitoring two succesive storms in five days. This should be deleted from the protocol.

240. There should be no maximum dry period. This could be problematic for summer sampling.

241. Was there a typo regarding the maximum inter-event 5day dry period? It should be revised to a 3-day minimum instead.

242. A maximum of 5 days between storms does not seem reasonable. Instead, a minimum number of storms covering approximately an even number of storms in all four seasons should be required.

243. The maximum inter-event dry period appears to be counter-intuitive.

<u>Revision 3: Min 20 Storm events</u>

244. The first sentence should be revised to "The number of storms to be sampled for device performance shall be a minimum of 20, although 25 or more are recommended."

The field protocol has been revised as recommended.

245. What is the purpose for increasing the number of storm events? This will increase costs without providing any corresponding benefit, especially since the 15-inch required rainfall total has not been increased?

The increase in storm events allows the comparison of a greater range of storm events and allows for the comparison of performance from different sites and different climates throughout the country.

246. If the minimum rainfall for all storms to be sampled is 15 inches and 20 to 25 storms are to be sampled, the average storm depth would have to be 0.6". An analysis of Watchung rainfall from 1984-1996 indicates that there were 1166 days with rain (rain every 4 days). Of the days with rain, days in which the rain was 0.5" or less represented 71% of all rain days. The requirement for sampling 15" of total rain will significantly extend the number of storms that are required to be sampled past the provided value of 20 to 25. The requirement for 15" of total rain should be removed in favor of restrictions on the number of storms that can be sampled with a certain rainfall depth. For example, if 20 to 25 storms are to be sampled only a maximum of 25% of the storms can be less than 0.2" in depth. These types of restrictions would allow the collection of samples that are representative of the hydrology without requiring endless sampling.

The 15 inch criteria has not been revised from the previous protocols but has only been reiterated for clarity. The average precipitation data in the New Jersey Groundwater Recharge Spreadsheet (NJGWRS) was derived from 52 years of rainfall data by the USGS. Based on the NJGWRS, the average annual rainfall in Watchung Boro, Somerset County is 48.6 inches, with a total average annual rainfall of 46.9 inches for the 79 rainfall events at 0.1 inches or greater. Based on this data, the sampling of 20 storms would be sufficient to meet the 15 inch minimum even the ten largest storms are not sampled.

247. The number of storms over a year is less important than the fact that at least 75% storm runoff be sampled for a year. It should not matter how they occurred. The minimum samples should be 75% of annual runoff from the site or 15", whichever is less. Number of events is less critical but could be a minimum of 15.

The sampling of storms representing 75% of the total runoff in a year would be beneficial, but would generally require that approximately 30 of the largest storm events in any given year be sampled in order to meet that criteria recommended by the commenter. NJDEP does not believe that requiring an increase of samples to a minimum of 30 is warranted.

Revision 4: 10 samples for storm 1 hour or more, 6 samples for lt one hour

248. The change from six sample to ten almost doubles the laboratory costs. Do they add substantial knowledge or a more complete picture regarding the performance of the device?

The requirement for ten (10) samples is consistent with the 2003 TARP protocol. The 2006 amendments to the TARP resulted in a less stringent number of samples without sufficient documentation regarding the change. This return to the TARP criteria allows more data to be *used as part of the Technology Acceptance Reciprocity Partnership to which New Jersey is a signatory.*

249. While I agree with these sampling minimums, it is very difficult to hit them in the field; it often requires “emergency” adjustment of the sample frequencies. I would suggest that if sampling is with multiple bottles that data trends be allowed. For example if it is clear that the storm was only producing very low inlet concentrations toward the middle of the storm and that is all that was collected, this trend can be protracted for the balance of the volume. This will not work with composite samples. *(I assume samples mean aliquots.)*

NJDEP recognizes that additional sampling must be performed in order to have the minimum number of qualifying events. A minimum of 6 or 10 samples is not excessive to account for the variations that occur during a storm event for sites with very short times of concentration.

Revision 5: Max time interval for all rainfall sampling 5 mins

250. Rainfall data at real time .01” intervals can be achieved at negligible cost and should be a requirement. I do not understand why a maximum time interval would be relevant when real time data is recorded by all logging rain gauges.

The minimum sampling is for rain collected on a time basis. For rainfall collected based on volume, a 0.01 inch runoff interval is sufficient. The protocol has been revised to incorporate constant volume collection.

Revision 6: Monitor bypass flows

251. Effluent samples are required to be taken downstream of bypass structures in order to sample any portion of the flow that is bypassed. However, by definition MTFR and MCFR can’t include bypass flow. That being said no bypass flow should occur during any lab trials.

252. Please clarify why a diversion bypass needs to be monitored since it will not provide any direct data on the performance of a device.

253. Since both MTFR and MTCR are required to be entirely treated by the device without bypass, this criterion should be reworded to indicate that sampling should be conducted in such a manner that effluent samples include all internally bypassed flows. Flows in excess of the MCFR and MTFR should not be sampled. Many devices are installed offline so the water quality design storm will bypass the treatment, but they should not be included in evaluating the performance of the device.

254. If the tested device is installed off-line, this requirement will yield little usable data. The bypass concentration does not give any indication of the unit’s performance.

255. This could be problematic. There may be the need to bypass and not comingle upon return.

The diversion or bypass needs to be monitored to address the annual removal rate equation that requires the removal rate from 125% of the MTFR. Where the MCFR is more then 125% of the MTFR, this may not be necessary. The annual performance of a device is computed using both all of the runoff treated within the device and all of the untreated runoff that bypasses the device. Additional language has been provided in the protocol to clarify this issue. If the bypass cannot be monitored to demonstrate the removal rate for 125% of the MTFR, the site may not be suitable for testing in accordance with the New Jersey protocols.

256. NJDEP should revised TARP Section 3.4 to adopt the statistical testing of data consistent with the majority of the International BMP Database. Data is examined as time series, cumulative distribution function, box and whiskers, and for normality. A bootstrap analysis is not recommended.

It may be beneficial have data consistent with the International BMP Database and this issue will be re-evaluated in future revisions of the protocol.

257. The requirement to add bypass sampling will also significantly increase costs and complexity. Will time paced bypass sampling be allowed, or will the bypass sample be conditioned on water being there with a float or is another flow meter required?

The sampling of the bypass flow must be performed downstream of the confluence of the effluent and the bypass flow so that the sampling occurs at the same point as clarified in. the protocol.

Section 6: Report Contents

258. The reporting requirements are not prescriptive enough. The TARP certification reports are currently requiring more than this. In absence of a formal and complete TARP certification reporting guideline, NJDEP should adopt either the TAPE reporting requirements or the recommendations from the ASCE Subcommittee on MTD Certifications Guidelines, Data Reporting Subcommittee. Without detailed standardized reporting, the review process will be cumbersome, lengthy, and unequal.

The reporting requirements provided in the protocols are in addition to the TARP criteria, unless specifically amended. The requirement for the standardized reporting of data may be evaluated in future amendments to the protocol.

Costs

259. Comments were submitted regarding the cost of testing in accordance with the protocols.

NJDEP's objective in the development of this protocol is to provide a consistent way to evaluate the use of manufactured treatment devices for use in compliance with the Stormwater Management rules. While the Department recognizes that changes to the protocol will impact the cost of testing, NJDEP believes that the cost is of secondary importance and that the cost vs. benefit analysis should be performed by the manufacturer.