May 14, 2012

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State Water Resources Control Board
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Sent via email to commentletters@waterboards.ca.gov

RE: Comment Letter – Construction General Permit NEL Amendment

Dear Chair Hoppin and Board Members:

On behalf of the California Coastkeeper Alliance (CCKA), representing 12 Waterkeepers spanning the coast of California, and Heal the Bay, we welcome the opportunity to submit these comments to the proposed amendments to the General NPDES Permit for Discharges of Storm Water Associated with Construction Activities (Construction Permit). Construction activities have the potential to—and when mismanaged do—create massive amounts of sediment and other discharges into nearby waterways, with erosion rates higher than any other land use activity. Construction sites also have the potential to cause large amounts of oil and grease, trash, sewage, phosphorus and other chemicals used in construction activities to wash into creeks, rivers, and their downstream water bodies. The result is the deterioration of water quality and harm to aquatic species and their habitats.

The State Water Board (Board) is responsible under state and federal law for protecting California's water resources from storm water associated with construction activity. The Board has recognized that "the [best management practices] BMP solution to storm water problems has been inadequate, based on 15+ years of experience with construction, industrial, and Phase 1 MS4 storm water permits."[1] Numeric effluent limits (NELs) are required where feasible, as is the case with stormwater discharges associated with construction activity. In recognition of this, in 2009 at the conclusion of an extensive, three-year public process to develop a new construction storm water permit, the Board adopted a permit that included NELs for turbidity and pH.

Following the judgment and peremptory writ of mandate in *California Building Industry Ass'n v. State Water Resources Control Board*,[2] the Board amended the Construction Permit by removing the NELs. While the court ordered the Board to temporarily suspend the adopted NELs for turbidity and pH, the court also made clear that the Board could re-adopt NELs provided it conducted the requisite Clean Water Act analysis when adopting them. Rather than completely abandoning many years of hard work, **we ask the Board to temporarily suspend the NELs, and set a timeline of no longer than one year for developing and reincorporating NELs into the permit.**

[1] State Water Resource Control Board, Draft Permit, Fact Sheet at 19 of 40 (March 2007) (emphasis added), *available at* http://www.swrcb.ca.gov/water_issues/programs/stormwater/docs/constpermits/factsheet070302.pdf.
[2] *Cal. Building Industry Ass'n et al. v. State Water Resources Control Bd.*, No.34-2009-800003380-CU-MW-GDS, slip op. (Cal. Sup. Ct. 2011), *available at* www.waterboards.ca.gov/water_issues/programs/stormwater/docs/construction/judgment.pdf.

I. STAFF SHOULD PRESERVE YEARS OF WORK TO INCLUDE NELS IN THE CONSTRUCTION STORM WATER PERMIT BY PERFORMING THE ANALYSIS REQUIRED BY THE COURT.

We applaud the Board for taking on the critical and necessary task of reissuing an NPDES permit for construction activities in California. The 2009 Construction Permit notably improves the former 1999 Permit, and we strongly support many of the changes made by the State Water Board to better protect water quality. Most laudable of these improvements was the inclusion of NELs in the 2009 Permit—a long overdue mechanism to facilitate the easy implementation and enforcement of the Construction Permit. NELs in the Construction Permit can facilitate more effective permit implementation for both dischargers and Board staff by providing a clear and simple method for evaluating permit compliance. Rather than spending countless hours reviewing stormwater pollution prevention plans and conducting site visits to assess whether BMPs achieve the pollutant reductions required, Board staff can defer to the discharger on how to best meet pollutant concentration levels.

NELs are the most effective method available to the Board to ensure that the permits will meet the dual requirements of the Clean Water Act to force technology-based solutions to reduce pollutants and to ensure that water quality standards are met. The level of restriction and degree of water quality protection afforded by narrative effluent limitations and NELs are intended to be the same under the Clean Water Act. However, the precision, clarity, and enforceability of an NEL is greater than that of a narrative effluent limitation. NELs provide a simple and transparent regulatory scheme that dischargers can readily comply with and that Board staff can easily enforce when necessary. With NELs, determining compliance will be simple, and dischargers will have the quantitative information needed to determine what additional steps are necessary to achieve compliance.

II. IT IS FEASIBLE TO ESTABLISH NELS FOR DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITIES, AND THUS THE BOARD IS REQUIRED TO DO SO UNDER THE CLEAN WATER ACT.

A. The Clean Water Act, its implementing regulations, and case law, require the Board to regulate discharges with NELs whenever feasible.

Not only do NELs increase accountability and provide dischargers with clear requirements to meet, the Clean Water Act, its implementing regulations, and case law interpreting the establishment of technology-based effluent limitations in NPDES permits, all *require* that NPDES permits contain numeric effluent limitations when feasible. The Clean Water Act prohibits the discharge of pollutants to waters of the United States unless in compliance with an NPDES permit adopted pursuant to Section 402.[3] The regulations implementing the NPDES permit scheme require that all NPDES permits include technology-based effluent limitations applicable to a particular category of pollutants.[4] Effluent limitations for toxic and non-conventional pollutants must be set at levels attainable through application of the "best available treatment economically achievable" (BAT).[5] The Board must also determine, for conventional pollutants including TSS/turbidity and pH, "the degree of effluent reduction attainable through the application of the best conventional pollutant control technology (BCT)." Discharges of conventional pollutants must contain no more pollutants than can be achieved through application

[3] 33 U.S.C. § 1311(a).
[4] *See* 40 C.F.R. § 122.41, 122.42, 122.43(a), 122.44(a)(1), and 123.5.
[5] 33 U.S.C. § 1311(b)(2)(A).

of BCT.[6] Absent EPA-promulgated limitation guidelines, the State Board is empowered under the Clean Water Act to use its best professional judgment to develop NELs.

NPDES permits authorizing the discharge of storm water associated with construction activities must include technology-based effluent limitations that achieve BAT and BCT, as applicable.[7] [8] The Clean Water Act does not purport to provide an alternative to imposing numeric effluent limitations. Case law interpreting the permitting authority's duties with respect to setting technology-based effluent limitations establishes that **"[n]on-numeric limits are allowed only when numeric limits are infeasible.**"[9] Conversely, "when numerical effluent limits are infeasible, EPA may issue permits with conditions designed to reduce the level of effluent discharges to acceptable levels."[10]

Rather than committing to conduct the analysis the court directed the Board to undertake prior to adopting NELs, the Board is proposing to simply remove the NELs from the permit and revert back to a BMP-based permitting scheme. However, the authority the State Board has to include BMP requirements in NPDES permits is limited.[11] The Board's authority to impose BMPs is supplemental to its duty to impose numeric, technology-based effluent limitations – a point the regulations themselves make clear when allowing for BMPs when they are "reasonably necessary to achieve effluent limitations," (i.e., to supplement the effluent limitations by ensuring measures are taken to meet them).[12] The allowance for BMPs in NPDES permits is separate and distinct from the requirement that permits contain numeric, technology-based effluent limitations.

In November 2010, U.S. EPA issued a memo that formally recognized the need for clearer permit requirements to address water quality impairments, and recommended that: "NPDES permitting authorities use numeric effluent limitations where feasible as these types of effluent limitations create objective and accountable means for controlling storm water discharges."[13] As EPA made clear, these recommendations reflected the fact that "the use of numeric effluent limitations no longer is a novel or unique approach to storm water permitting."[14]

The Board's proposal to simply remove the NELs in response to the Court's order from the Construction Permit is illegal. Granted the Court ordered the Board to suspend the NELs because the analysis required to support them had not been completed. However, the law is clear, when NELs are feasible, they must be imposed in NPDES permits. To follow the law, and not take further, illegal action, the Board must commit to conducting the required analysis and revising the Construction Permit to include NELs.

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[6] 33 U.S.C. § 1311(b)(2)(E).
[7] 33 U.S.C. § 1342(p)(3)(A).
[8] In contrast, permits for the discharge of municipal storm water are required to include management practices to reduce pollutants to the maximum extent practicable ("MEP"), which is distinct from the technology-based effluent limitations required by Section 301(b).
[9] *Citizens Coal Council v. EPA*, 447 F.3d 879, 897 (6th Cir. 2006)(emphasis added).
[10] *NRDC v. Costle*, 568 F.2d 1369, 1380 (DC Cir. 1977).
[11] *See* 40 C.F.R. § 122.44(k).
[12] *Id.*
[13] James Hanlon, Office of Wastewater Management and Denise Keeher, Office of Wetlands, Oceans and Watersheds, U.S. EPA to Water Management Division Directors, U.S. EPA Regions 1-10, "Revisions to the November 22, 2002 Memorandum 'Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on Those WLAs'," (Nov. 12, 2010), *available at* http://www.epa.gov/npdes/pubs/establishingtmdlwla_revision.pdf.
[14] *Id.*

B. Both the U.S. EPA and the State of California recognize the feasibility of establishing NELs for storm water discharges associated with construction activities.

As explained, NPDES permitting authorities must impose NELs in NPDES permits when feasible. In the context of discharges of storm water associated with construction activity, both the U.S. EPA and the State of California have determined that NELs are feasible. In 2009, the EPA recognized the feasibility and importance of employing NELs with respect to construction activities, stating:

> Numeric effluent limitations are feasible for discharges associated with construction activity. Numeric effluent limitations… are the best way to quantifiably ensure industry compliance and to make reasonable further progress toward the CWA goal of eliminating pollutants into the nation's waters. Numeric effluent limitations are an objective and effective way for the permitting authority to implement, and the regulated community to comply with, the technology-based requirements for this point source category.[15]

California has also long recognized the feasibility and necessity of applying NELs to discharges associated with construction activities. In 2006, a panel of storm water experts convened by the State Water Board to examine the feasibility of developing numeric limits for stormwater permits, found that "active treatment technologies make Numeric Limits technically feasible for pollutants commonly associated with stormwater discharges from construction sites for larger construction sites."[16] In 2009, U.S. EPA relied on California's numeric limit when setting the turbidity numeric limit in the Effluent Limitations Guideline for Construction and Development point sources, recognizing that "California has recently established effluent limitations for some sites within the state, and dischargers within the Lake Tahoe basin have been subject to numeric limitations for some time."[17] In years past, it may have been difficult to set NELs for discharges associated with construction activities. However, new data, and progress in scientific understanding and technical capabilities have made it feasible to establish and implement NELs.

III. There is ample available data to address the court's request for best management practice analysis to support the NELs.

The December 2011 Superior Court decision, *California Building Industry Ass'n. v. State Water Resources Control Board*, declared that the Board had not considered mandatory factors required by the Clean Water Act when setting NELs.[18] The Court found that the Board had not provided adequate performance data for any BCT to support the NELs set for turbidity and pH. In order to adopt NELs, the Board must identify available technologies, gather data characterizing the performance of the technologies, gather data characterizing the performance of the technologies under similar site conditions, and derive an NEL for turbidity or pH consistent with the performance data.[19]

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[15] Effluent Limitations Guidelines for Construction and Development Point Sources, 74 Fed. Reg. 63,024 (Dec. 1, 2009), *available at* http://www.gpo.gov/fdsys/pkg/FR-2009-12-01/html/E9-28446.htm.

[16] Report on the Feasibility of Numeric Effluent Limitations Applicable to Discharges of Storm Water Associated with Municipal, Industrial and Construction Activities ("Blue Ribbon Panel Report").

[17] Effluent Limitations Guidelines for Construction and Development Point Sources, 74 Fed. Reg. 63,025 (Dec. 1, 2009), *available at* http://www.gpo.gov/fdsys/pkg/FR-2009-12-01/html/E9-28446.htm.

[18] State Water Board, NPDES General Permit for Storm Water Discharges Associated Construction and Land Disturbance Activities, *available at* www.waterboards.ca.gov/water_issues/programs/stormwater/docs/construction/2009_0009_dwq_nel_amnd.pdf.

[19] *Supra* note 2, at 16.

However, instead of committing to undertake the analysis required to support numeric limits, the Board is recommending that numeric limits be stricken from the permit. As described above, the Board must include NELs unless infeasible. Here, the presence of a robust data set requires the Board's inclusion of NELs in the Construction Permit. The studies and data in the Administrative Record indicate that the BCT for controlling turbidity can achieve concentrations well below that established by the 500 NTU limit in the Permit. We maintain that NELs can, and should be, established at levels lower than those previously adopted.[20] Dr. Richard Horner, a nationally renowned stormwater engineering expert, summarized his own research showing that blanket materials and mulch achieve effluent turbidity levels of 21 to 73 NTUs.[21] Additionally, studies completed by Caltrans[22] and the Texas Transportation Institute[23] provide data to determine BCT and set a NEL. This evaluation was submitted to the State Water Board in a detailed letter by Dr. Horner on May 4, 2007.

The docket provided in support of the Construction Permit revisions does not reflect a full analysis of readily-available data regarding treatment performance and the cost of BMPs. Table 1 summarizes just a few of the studies available regarding treatment efficiency and costs associated with construction storm water BMPs.

Table 1. Cost and treatment performance of various construction stormwater BMPs

BMP Title	Installed Cost	Performance
Sediment trap[24,25]	~$3,000 per ha	60-90% TSS reduction; effluent turbidity of ~200 NTU
Filter strips and grassed swales[26]	$320/Acre (maintained)	75% TSS removal
Bonded fiber matrix[27]	$13,600 per ha	100% erosion reduction
Straw blanket[28]	$22,000 per ha	98% erosion reduction
Flocculation and coagulation[28]	In 2000, costs estimated at 0.5-1% of total construction costs, which was expected to decrease over time.	Achieve effluent turbidity values of 5-10 NTU, from influent values of 100-14,000 NTU
Flocculation (aluminum sulfate salt treatment)[29]	For very large construction applications, construction costs ranged from $135,000 to $400,000.	95-99% TSS reduction

[20] Setting sediment NELs at 500 NTUs [fails to protect] numerous clean, cold streams that would require limits of 20-25 NTUs to maintain salmon and other aquatic life uses." CCKA August 26, 2009 Letter to State Board at p. 8.
[21] Horner, Guedry, and Kortenhof, Improving the Cost Effectiveness of Highway Construction Site Erosion and Pollution Control (1990), *available at* http://www.wsdot.wa.gov/Research/Reports/200/200.1.htm.
[22] California Department of Transportation, District Seven, District Seven Erosion Control Pilot Study, Doc. No. CTSW-RT-00-012 (2000), *available at* http://www.dot.ca.gov/hq/env/stormwater/pdf/CTSW-RT-00-012.pdf.
[23] Texas Transportation Institute, Test on Erosion Control Products.
[24] Cooperative Research Centre for Catchment Hydrology, Non-structural Stormwater Quality Best Management Practices – A Literature Review of their Value and Life-cycle Costs (2002).
[25] Schueler, T. and J. Lugbill, Performance of Current Sediment Control Measures at Maryland Construction Sites: Watershed Protection Techniques 145-146 (1994).
[26] Minnesota Department of Transportation, The Cost and Effectiveness of Stormwater Management Practices (2009), *available at* http://www.lrrb.org/pdf/200523.pdf.
[27] California Department of Transportation, District Seven, District Seven Erosion Control Pilot Study, Doc. No. CTSW-RT-00-012 (2000), *available at* http://www.dot.ca.gov/hq/env/stormwater/pdf/CTSW-RT-00-012.pdf.
[28] Guy Oliver, Innovative process reduces turbidity and pollutants from construction site stormwater runoff, Puget Sound Newsletter (June 2000).
[29] Harper, H.H. and J.L. Herr, Alum Treatment of Stormwater Runoff: The First Ten Years. Environmental Research and Design; referenced in the Iowa Stormwater Management Manual (1996).

The collection of studies provided in Attachment 1 provides extensive additional information regarding the applicability, performance and cost for a range of construction BMPs, in support of the establishment of NELs for turbidity and pH. Combined, these studies can, and should be used by the State Board to satisfy the court's direction to support the NELs.

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Under the Clean Water Act, the Board is required to include NELs in the Construction Permit. Further, the necessary data and studies to perform the Court's requisite analysis exist—not only in the Administrative Record supporting the 2009 Construction Permit—but also the numerous relevant studies contained in Attachment 1 and incorporated in this record related to this proceeding. The Board's development of a timeline of no longer than one year to reincorporate NELs into the permit is essential to preserve years of work to develop an enforceable permit that ensures compliance with the Clean Water Act and protects water quality.

We look forward to assisting Board staff's efforts to do so in any way that we can. Thank you for your attention to these comments.

Sincerely,

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attachment

Study Title	Contributing Agency or Journal Reference	Study Location	Study Summary	BMPs Analyzed	Parameters of Interest	Treatment Performance Data?	Cost/ Economic Analysis?	Link to Source
Construction Site Stormwater Runoff Control – Menu of BMPs	United States Environmental Protection Agency (US EPA)	United States	Provides extensive information regarding applicability, performance and cost for a range of construction BMPs, in support of the NPDES program.	chemical stabilization, compost blankets, dust control, geotextiles, gradient terraces, mulching, riprap, seeding, sodding, soil retention, soil roughening, temporary slope drain, wind and sand fences, check dams, grass-lined channels, permanent slope diversions, diversion dikes, brush barriers, compost filter berms and socks, construction entrances, fiber rolls, filter berms, sediment basins and rock dams, sediment filters and sediment chambers, sediment traps, silt fences, storm drain inlet protection, straw bales, vegetated buffers, concrete washout	TSS, turbidity	Yes	Yes	http://tinyurl.com/dju8vv
Construction Site Erosion and Sediment Controls: Planning, Design and Performance	By Robert Pitt, Shirley Clark and Donald W. Lake, DESTech Publications, Inc. (2007)	United States	400 page book devoted to stormwater management at construction sites. Includes information on performance, applicability and cost	Various	Many parameters	Yes	Yes	http://tinyurl.com/7mejq3b
Temporary Non-Vegetative Soil Stabilization Evaluation Study for the 200-2001 Season, Orange County, California, CTSW-RT-01-066	Caltrans (2002)	Orange County, CA	Technical report summarizes the scope, testing methods, and findings for seven temporary erosion control products tested at two field sites.	polyacrylamide, cellulose fiber mulch (hydro seed), emulsifiers	TSS	Yes	Yes	http://tinyurl.com/d8yrrus
Soil Stabilization BMP Research for Erosion and Sediment Controls Cost Survey Technical Memorandum	Caltrans (2007)	California	A survey of erosion and sediment control contractors in California was conducted in order to update cost data for twelve soil stabilization techniques common to Caltrans projects. The purpose of this Technical Memorandum is to provide Caltrans with a matrix of the average installed costs for soil stabilization Best Management Practices (BMPs) as well as supporting graphics of the distribution of the installed cost information. The results of the survey are intended to help designers estimate costs for standard versus more difficult applications and for small and large size projects as well.	hydroseed, bonded fiber matrix, polyacrylamide, straw with tackifier, pneumatically-applied wood bark mulch and rolled erosion control products (i.e. blankets and netting).	N/A – limited to data pertaining to costs of applying erosion and sediment controls	No	Yes	http://tinyurl.com/bmkqbrh
District 7 Erosion Control Pilot Study; Caltrans Document No. CTSW-RT-00-012	Caltrans (2000)	California	Provides extensive information regarding performance and cost of various erosion control techniques and products.	bonded fiber matrix, coconut blanket, coir, compost, curled wood fiber blanket, paper mulch with polymer, paper mulch with psyllium, straw blanket, straw-coconut blanket, wood fiber blanket, wood mulch with polymer, wood mulch with psyllium, straw	pH, TSS, metals, nutrients, others	Yes	Yes	http://tinyurl.com/6sj5wko

Study Title	Contributing Agency or Journal Reference	Study Location	Study Summary	BMPs Analyzed	Parameters of Interest	Treatment Performance Data?	Cost/ Economic Analysis?	Link to Source
Improving the cost effectiveness of highway construction site erosion and pollution control	Washington State Transportation Center (1990)	Washington	Provides laboratory analysis and cost data regarding various stormwater control techniques used for highway applications. Cost estimates likely outdated, though performance information still valid.	jute netting, plastic netting, paper fabric, sodding, straw (with and without tackifier) chemical soil stabilizer, wood fiber mulch, wood chips, hydroseeding, plastic sheeting,	TSS, metals, nutrients, others	Yes	Yes	http://tinyurl.com/86tmgrq
Innovative process reduces turbidity and pollutants from construction site stormwater runoff	Article from the Puget Sound Water Quality Action Team (2000)	Washington	Abstract summary: Experience at six construction sites has demonstrated that treatment of stormwater runoff with polymers provides a 95 to 99 percent reduction in turbidity and associated pollutants. Cost of using the polymer has ranged from 0.5 to 1 percent of the total construction cost. Contractors have expressed satisfaction with the system.	polymer-assisted stormwater clarification process	pH, turbidity and conductivity	Yes	Yes	http://tinyurl.com/bpy96ms
International Stormwater BMP Database - Summary of Cost Data	Prepared by Wright Water Engineers and GeoSyntec Consultants (2007)	Various – CA, WA, FL, CO, TX, MI, VA, OH, PA, OR	Spreadsheet developed in 2007 to accompany the Intl. Stormwater BMP Database. Summarizes cost data contained in the database.	Various, though primarily associated with structural BMPS, some of which are applicable to the construction sector.	N/A – limited to data pertaining to costs for construction, operation and maintenance	No	Yes	http://tinyurl.com/6qsd4qv http://tinyurl.com/8xsyzpm
International Stormwater BMP Database Pollutant Category Summary: Solids (TSS, TDS and Turbidity)	Prepared by Wright Water Engineers and GeoSyntec Consultants (2011)	Aggregation of data from the BMP Database	Technical summary addressing these topics: • Solids data in the BMP Database for TSS, TDS and turbidity • Regulatory context and sources • Fate and transport processes, removal mechanisms and associated BMP design considerations for solids • Overview and analysis of solids data in the BMP Database • Conclusions and recommendations	Various, though primarily associated with structural BMPS, some of which are applicable to the construction sector.	Turbidity, TSS, TDS, Summarizes data from 25 studies involving turbidity specifically.	Yes	No	http://tinyurl.com/729cv72 http://tinyurl.com/8xsyzpm
Non-structural Stormwater Quality Best Management Practices – A Literature Review of their Value and Life-cycle Costs	Cooperative Research Centre for Catchment Hydrology (2002)	Australia and the United States	Literature review regarding costs of non-structural BMPs of direct applicability to the construction sector. An Australian document, though it relies heavily on data collected in the US.	turf, seed, seed & mulch, mulch, terracing, sediment basins, sediment traps, filter fabric fence, straw bales, stormwater inlet protection, construction entrance, filter strips	N/A – limited to data pertaining whole life costs of non-structural BMP implementation (i.e. temporary BMPs)	No	Yes	http://tinyurl.com/7xglcxe
Performance of Sediment Controls at Maryland Construction Sites (The Practice of Watershed Protection	Center for Watershed Protection (2000)	Maryland	Performance data of stormwater detention systems in Maryland, including turbidity performance.	detention basin	Turbidity, TSS	Yes	No	http://tinyurl.com/77tnq64

Study Title	Contributing Agency or Journal Reference	Study Location	Study Summary	BMPs Analyzed	Parameters of Interest	Treatment Performance Data?	Cost/ Economic Analysis?	Link to Source
Evaluation of stormwater from compost and conventional erosion control practices in construction activities	Journal of Soil and Water Conservation. 2005. 60(6)	Georgia	Evaluated four types of compost blankets, hydroseed, silt fence, and a bare soil (control) in field test plots. After three months, the compost generated five times less runoff than hydroseed with silt fence, and after one year, generated 24 percent less runoff.	compost blankets	TSS	Yes	No	http://tinyurl.com/7ubvman
Polyacrylamide use for erosion and turbidity control on construction sites	Journal of Soil and Water Conservation. 2005. 60(4)	North Carolina	Evaluated the use of polyacrylamide (PAM) for erosion control. Includes applicability information for California and performance data.	polyacrylamide (PAM), mulch, seeding	Runoff, turbidity and sediment loading	Yes	No	http://tinyurl.com/7bsnvbn
Flocculation of Construction Site Runoff in Oregon	Oregon Department of Environmental Quality	Oregon	Provides economic and performance data regarding the use of flocculation equipment at typical construction sites. Directly applicable to determining performance and cost criteria for advanced treatment systems.	flocculation	turbidity	Yes	Yes	http://tinyurl.com/88djndz
Polymer Coagulants and Flocculants for Stormwater Applications	Protech General Contracting Services, Inc.	California (Sacramento area)	This report presents the results of a series of tests performed to evaluate and compare performance, aquatic safety, and cost of four common polymers that are in use today for construction stormwater management.	two synthetic polymers (aluminum chlorhydroxide and DADMAC) and two derived from “natural” materials (Mimosa tree bark and Chitosan).	Turbidity, toxicity	Yes	Yes	http://tinyurl.com/7hhel9h
The Cost and Effectiveness of Stormwater Management Practices	Minnesota Department of Transportation (2005)	Minnesota and California	Stormwater management practices for treating construction and urban runoff were evaluated for cost and effectiveness in removing suspended sediments and phosphorus. Construction and annual operating and maintenance cost data was collected and analyzed for dry detention basins, wet basins, sand filters, constructed wetlands, bioretention filters, infiltration trenches, and swales using literature that reported on existing SMP sites across the United States.	dry detention basins, wet basins, sand filters, constructed wetlands, bioretention filters, infiltration trenches, and swales. Primarily structural BMPs, though some of the data is directly applicable to the construction sector	TSS, nutrients	Yes	Yes	http://tinyurl.com/7alcaoz
Iowa Stormwater Management Manual - Coagulation and Flocculation	Iowa State University	Iowa	Provides extensive information regarding opportunities and constraints of using coagulation and flocculation techniques, as well as performance efficiency and indicative costs.	flocculation and coagulation	TSS, nutrients, metals	Yes	Yes	http://tinyurl.com/c3gfq8m
Economic Analysis of Final Effluent Limitation Guidelines and Standards for the Construction and Development Industry	U.S. EPA (2009)	nationwide	Economic impacts analysis prepared in support of U.S. EPA efforts to establish effluent limitations guidelines (ELGs) and new source performance standards (NSPS) for stormwater discharges from the Construction and Development (C&D) industry.	N/A	N/A	No	Yes	http://tinyurl.com/7bk7lgk

Study Title	Contributing Agency or Journal Reference	Study Location	Study Summary	BMPs Analyzed	Parameters of Interest	Treatment Performance Data?	Cost/ Economic Analysis?	Link to Source
Best Management Practices for Chemical Treatment Systems for Construction Stormwater and Dewatering	Federal Highway Administration (2009)	n/a	The overall objectives of this book are twofold. First, it is designed to provide a technically credible basis for best management practices for the use of chemical treatment systems for turbidity reduction on road construction projects. Secondly, it is designed to identify the most important variables to address when selecting chemical treatment best management practices for a particular site. Includes examples of chemical treatment systems and costs.	flocculation and coagulation	N/A – no performance efficiency data provided	No	Yes	http://tinyurl.com/6v9rufg
Best Management Practices for Stormwater Discharges Associated with Construction Activities	Oregon Department of Environmental Quality	Oregon	Provides qualitative and quantitative descriptions of treatment performance for a variety of construction BMPs	Various	TSS, turbidity	Yes	No	http://tinyurl.com/7pcxtfe
The Economics of Stormwater BMPs in the Mid-Atlantic Region	Center for Watershed Protection (1997)	Mid-Atlantic	Economic analysis of structural stormwater BMPs used for urban and construction runoff management.	Primarily structural BMPs, though some of direct applicability to the construction sector (e.g. ponds, sand filters, bioretention)	n/a	No	Yes	http://tinyurl.com/7lyvao8
Guidance for Temporary Soil Stabilization	Caltrans (2003)	California	The main purpose of this document is to help direct the planning, selection, and implementation of Caltrans-approved temporary soil stabilization Best Management Practices (BMPs). Includes costs for hydraulic mulch, hydroseed, soil binders, straw mulch, various rolled erosion control products, and wood mulch. Quantitative performance data not provided.	hydraulic mulch, hydroseed, soil binders, straw mulch, various rolled erosion control products, and wood mulch, plastic netting, plastic mesh, jute blanket, straw blanket, coconut fiber blanket, coconut fiber mesh, straw coconut fiber blanket, wood fiber blanket, curled wood fiber, biodegradable fibers with synthetic netting, synthetic fiber with synthetic netting, bonded synthetic fibers	n/a	No	Yes	http://tinyurl.com/7rqmg4w
Illinois Urban Manual	U.S. Department of Agriculture and others (2010)	Illinois	Includes detailed data on more than 40 practices designed to reduce erosion and address water quality and stormwater management problems. Provides information regarding applicability, design and general performance efficiency.	Over 40 BMPs assessed, many of which are applicable to the construction sector, including: diversions, inlet Protection, permanent and temporary seedings, silt fence, stabilized construction entrance, straw bale barrier, streambank stabilization, temporary sediment trap, temporary slope drain, topsoiling	TSS, turbidity, metals, nutrients, others	Yes	No	http://tinyurl.com/8x4tyo4
Stormwater Management Manual for Western Washington Volume II- Construction Stormwater Pollution Prevention	Department of Ecology State of Washington (2005)	Washington	Provides guidance on measures necessary to control the quantity and quality of stormwater produced by new development and redevelopment such that they comply with water quality standards and contribute to the protection of beneficial uses of the receiving waters.	Flocculation and coagulation, sand filters, pH neutralization, others	pH, TSS (non-quantitative performance data)	Yes	No	http://tinyurl.com/83r7owy