

**Methylmercury Control Study Guidance  
For the Delta Methylmercury Control Program Implementation Phase I**

**Central Valley Regional Water Quality Control Board  
15 May 2012**

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**I. Purpose of Delta TMDL Phase 1 Methylmercury Control Studies**

The purpose of the Phase 1 Methylmercury Control Studies is to evaluate existing methylmercury control methods and develop additional control methods that could be implemented to achieve methylmercury load and wasteload allocations. At the end of the Phase 1 Study period, entities responsible for meeting the allocations will report on effectiveness, feasibility, costs, and potential environmental effects of control methods evaluated and a plan and schedule for implementing methods to reduce methylmercury loads. Control Studies shall evaluate the feasibility of reducing methylmercury loads more than the minimum amount needed to achieve allocations.

Each Control Study Final Report should provide a plan for how the allocations will be met. If the study results indicate that achieving a particular methylmercury allocation is infeasible, then the responsible entity must detail why full compliance is not achievable, what methylmercury load reduction is achievable, and an implementation plan and schedule to achieve partial compliance.

**II. Phase 1 Methylmercury Control Study Scope**

Entities that are required to conduct methylmercury studies are listed below. All Delta hydrologic subareas except the Central and West Delta subareas require methylmercury reductions.

- a. Irrigated agricultural lands that discharge to the Yolo Bypass and Delta subareas that require methylmercury reductions.
- b. Managed wetlands and wetland restoration projects that discharge to the Yolo Bypass and Delta subareas that require methylmercury source reductions.
- c. NPDES permitted facilities in the Delta and the Yolo Bypass.
- d. Sacramento Area MS4, Stockton MS4, and Contra Costa County MS4 service areas within and upstream of the legal Delta boundary.
- e. State and Federal agencies whose activities affect the transport of mercury and the production and transport of methylmercury through the Yolo Bypass and Delta, or which manage open water areas in the Yolo Bypass and Delta. These agencies include CA Department of Water Resources, CA State Lands Commission, CA Central Valley Flood Protection Board, U.S. Army Corps of Engineers, and U.S. Bureau of Reclamation.

In addition to existing water management activities that contribute to the methylmercury impairment, studies must be done for new projects that have the potential to increase methylmercury loads. In the Yolo Bypass and Delta subareas needing reductions in methylmercury, proponents of new wetland and wetland restoration projects scheduled for construction after 20 October 2011 shall participate in Control Studies or implement site-specific study plans that evaluate practices to minimize methylmercury discharges.

Agencies responsible for projects that may increase open water methylmercury levels in the Delta (e.g., by increasing the input of or exposure to mercury-contaminated sediment or changing other variables that control methylmercury production) must conduct studies for those projects. Changes in flood conveyance (and related seasonal wetland flooding and import of contaminated material to previously unaffected areas), salinity concentrations of Delta waters (with the resulting changes in sulfate concentrations) and other water management activities may influence ambient methylmercury levels in the Delta. The objectives for a study of a new water management or flood conveyance project are to obtain a quantitative estimate of the project's effect on methylmercury loads in the Delta and Yolo Bypass and to describe potential measures to mitigate any methylmercury increases. Studies should focus on new projects that will significantly change water management, including flow, channel morphology, and timing of flooding. Examples of new water and flood management projects that would necessitate a methylmercury control study are:

- a. New or changes to existing flood conveyance projects (e.g., new or modified weirs, increased flows through the Yolo Bypass, and increased flood frequency or flood duration in the Yolo Bypass);
- b. New or changes to existing water management projects (e.g., alternative conveyance, barriers, or new within-Delta diversion or storage projects);
- c. Changes to water quality objectives for salinity and flow or flow management practices used to maintain current objectives;
- d. Dredging projects that could increase mercury and/or methylmercury levels and dredge disposal areas that discharge methylmercury.

Responsible entities are required to develop individual or collaborative Control Study Workplans. Entities are encouraged to participate in coordinated, comprehensive studies that focus on representative sources within each source type.

Agencies that manage water in the Yolo Bypass and any other areas where wetland and agricultural lands are subject to managed flood flows should coordinate with wetland and agricultural landowners to develop management measures.

Regional Board staff will work closely with study planners to design studies and will provide comments on Control Study Workplans as they are developed. Entities writing Workplans are encouraged to provide draft documents to Regional Board staff well before the Workplans are due to allow time for exchange of ideas.

By four months after plans are submitted, the Executive Officer will either approve Workplans or will provide responsible entities written notification that the Workplan approval period is extended beyond four months. Staff anticipates that Workplan and report approval periods will be extended only if more time is needed for review and comment by the Technical Advisory Committee (TAC). Responsible entities are expected to initiate their study as quickly as possible after their Workplan is approved.

### III. Phase 1 Schedule

Date	Event
October 20, 2011	Effective Date of Delta Mercury Control Program
March 6, 2012	Public Study Planning Workshop with TAC
April 20, 2012	Due date for Responsible Parties to submit Organizational Letters. Letters must describe how the Responsible Party: (a) will organize with other dischargers and stakeholders to develop a coordinated, comprehensive Control Study Workplan or (b) will develop an individual Control Study Workplan.
July 20, 2012	Due date for Responsible Parties working individually to submit Methylmercury Control Study Workplans.
August 17, 2012	Due date for preliminary Concept Proposals for collaborative studies submitted for TAC review prior to the full Workplan
September 19 & 20, 2012	TAC reviews Methylmercury Control Study Workplans submitted in July and preliminary Concept Proposals. <i>(tentative schedule – TAC review of Workplans and Concept proposals on Day 1; public presentation of recommendations on Day 2)</i>
April 20, 2013	Extended due date for Responsible Parties to submit Methylmercury Control Study Workplans if working collaboratively.
May 2013	Public meeting with TAC for review of Methylmercury Control Study Workplans
October 20, 2015	Due date for Responsible Parties to submit Progress Report that includes Study progress and results to-day and amended Workplans for any additional studies.
November 2015	Public meeting with TAC for reviews of Progress Reports
October 20, 2018	Due date for Final Reports
November 2018	Public meeting with TAC for reviews of Final Reports
Year 2020	Regional Board reviews Delta Mercury Control Program

### IV. Minimum Content for Control Study Workplans

This outline describes the Central Valley Water Board's expectations of what should be contained, at a minimum, in the Control Study Workplans. Consistency in format of each Workplan will aid other stakeholders and the TAC in reviewing the Workplans. Workplans should be submitted electronically. Approved plans will be posted on the Central Valley Water Board's website.

An expected outcome of the Methylmercury Control Studies is the identification of management and control actions that are based on best available science and will allow for incorporation of future scientific findings, technological advances and modification to changing conditions. Management plans should be designed with adaptive management in mind. To that end, Study

Workplan monitoring and data collection methods should be designed to allow for comparability of control action efficiencies using statistical or other methods of assessment. Workplans should be designed to be adapted to incorporate “what if” scenarios and TAC feedback. An adaptive management approach to the Methylmercury Control Studies is consistent with stakeholder expectations for the Delta Mercury Control Program and should result in the design of more effective methylmercury management and control actions.

**Optional Concept Proposal:** Proponents of collaborative studies are encouraged, but not required, to submit 4-page, preliminary concept proposals by **August 17, 2012** for review and feedback from the TAC.

Concept proposals should briefly address the first **five** elements listed below. Workplans should contain **seven** elements in detail. Participating entities, primary contact person(s), and person(s) primarily responsible for conducting the proposed study should be identified in both the Concept Proposals and Workplans.

1. **Problem Statement.** Identify the Delta hydrologic subarea that you are addressing, the percent reduction in methylmercury needed for that subarea, and whether the activity that will be addressed is an existing activity, a new project, or both. Briefly state how your management activity may affect methylmercury production and export.
2. **Objectives.** To the extent possible, provide objectives that are specific, measurable, and relevant to the TMDL, for: 1) the study activity (i.e., experiments, evaluations, and/or modeling) that will be conducted and 2) application of the study results to your ultimate goal of methylmercury control.
  - a. Study Objective: What hypotheses do you plan to test with your study? Clearly state your hypotheses in a manner that focuses on the mechanism(s) by which your control measure may contribute to the control objective.<sup>1</sup>
  - b. Control Objective: Describe your total allocation responsibility. Demonstrate how your control measure could be applied, scaled-up or combined with other control measures to achieve the methylmercury allocation.
3. **Mechanisms Underlying the Study.** Provide a conceptual model or set of underlying assumptions to support your hypotheses and explain why or how your proposed control study will achieve the study and control objectives. To the extent that you can, describe factors affecting methylmercury within your source area, including seasonal dynamics. Reference sources include the Delta Regional Ecosystem Restoration Implementation Plan

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<sup>1</sup> Hypotheses will vary by source type and activity being evaluated. The hypothesis should be able to be statistically tested with data and calculations produced in the study. Although a null hypothesis (e.g., the treatment to be tested will have no effect) is the classic format, it is acceptable to phrase hypotheses in an alternative format (e.g., the treatment to be tested will have a particular effect). Examples: In a floodplain, directing water around areas where sediment mercury concentrations are relatively high will reduce the load of methylmercury discharged, in comparison with no change in water flow pattern. Reducing organic matter on the ground surface before inundation will reduce loads of methylmercury discharged in comparison with not removing organic matter.

(DRERIP) conceptual model<sup>2</sup> and the NPS Workgroup mercury synthesis<sup>3</sup>. Summarize existing aqueous methylmercury concentrations and loads from your source.<sup>4</sup>

4. **Proposed Control Measures.** Describe how the study will be designed to test the hypotheses and conceptual models as described in Elements 2 and 3 above. Explain whether the measure is targeted research, a pilot project, or larger in scope. If the project is targeted research, explain why the targeted research cannot be incorporated into a pilot project. If you are proposing a measure that is large in scope, describe the level of risk and how potential negative impacts could be managed or reversed.
5. **Monitoring and Data Collection Plan.** Identify parameters and media that will be measured and over what frequency and duration. Describe how these measurements will be used to determine the effectiveness of the control measure(s). Describe the statistical approach you will use to evaluate the results and compare outcomes with the hypotheses. Studies to assess the effects of water management on methylmercury may largely rely on methylmercury data already collected.
6. **Quality Assurance Procedures:** The Control Study Workplan must contain or summarize and reference quality assurance procedures that cover all aspects of sample collection, handling, and analyses for all parameters that will be measured. Quality assurance plans that may be referenced include:
  - a. Monitoring and Reporting Plans (MRP) that have been approved for Irrigated Agriculture Coalitions and NPDES permittees.
  - b. SWAMP Quality Assurance Program Plan<sup>5</sup>
  - c. CALFED Mercury Quality Assurance Project Plan<sup>6</sup>

Note that the SWAMP QAPP describes appropriate sample containers, preservation, and analytical methods for many parameters, including mercury and methylmercury. It does not cover sample collection methods. Appendix A of the SWAMP QAPP describes acceptable frequency and types of quality control tests. If an entity is following an MRP or quality assurance plan that does not address a measurement that will be taken during the study, then quality assurance procedures must be described in the Control Study Workplan.

Aqueous samples for mercury and methylmercury should be collected using clean hands/dirty hands techniques (US EPA Method 1669). Water samples that will be used for direct comparisons with the methylmercury allocations should be analyzed as unfiltered.

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<sup>2</sup> <http://www.dfg.ca.gov/ERP/DRERIP.asp>

<sup>3</sup> <http://delta-mercury-nps.org/>

<sup>4</sup> The Delta Methylmercury TMDL Report Chapter 6 provides methylmercury load and concentration estimates for each source type within each Delta hydrologic subarea. Other reports listed in the Study Guidance provide methylmercury concentration and load information for some specific land uses. The Delta Regional Ecosystem Restoration Implementation Plan (DRERIP) Conceptual Model for Mercury describes mercury processes, including transport, methylation, and accumulation in fish. Section VII References contains methylmercury information for point sources.

<sup>5</sup> Surface Water Ambient Monitoring Program Quality Assurance Program Plan 2008 is available at: [http://www.waterboards.ca.gov/water\\_issues/programs/swamp/docs/qapp/qaprp082209.pdf](http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/qapp/qaprp082209.pdf).

<sup>6</sup> The CALFED Quality Assurance Project Plan was developed for CALFED-funded multi-disciplinary mercury studies in the Delta and major tributaries between 2000 and 2008. It is available at: <http://mercury.mlml.calstate.edu/quality-assurance/>

For methylmercury, aqueous samples should be analyzed using USEPA method 1630 with a method detection limit of 0.02 ng/L or less. For total recoverable mercury, aqueous samples should be analyzed with a method detection limit of 0.2 ng/l or less. The preferred method for total mercury is USEPA Method 1631 Revision E.<sup>7</sup>

Entities developing Study Workplans are encouraged to contact Central Valley Water Board staff or the SWAMP QA Help Desk with any data collection or analysis questions.

7. **Project Evaluation and Data Sharing Plan:** Describe the information that will be gathered and how it will be used to evaluate the effectiveness of the management practices or actions. Consider that Final Study Reports will be expected to address:
- effectiveness of the control method at reducing methylmercury in discharge;
  - estimates of cost if this control method were implemented;
  - potential, redirected environmental impacts of the control method; and
  - overall feasibility of implementing the control methods.

The evaluation of a control method's effectiveness should include a general description of the hydrologic and climactic conditions under which the study was conducted and a description of additional information that would be needed, if any, to adapt the method to likely changes in conditions.

So that data can be easily shared, all entities collecting data are encouraged to compile data in a consistent format and place it in a centralized location. Staff will work with entities to develop a process for reporting and sharing data within the California Data Exchange Network (CEDEN) or other repository.<sup>8</sup>

**Optional:** Estimate of Methylmercury Control Study Costs: The purpose of including cost estimates in the Workplan is for Central Valley Water Board and the TAC to obtain updated estimates of the cost of methylmercury studies.

Please limit Workplans to 30 pages excluding tables, figures, and maps. If more than two control methods or two methylmercury source types will be discussed within one Workplan, the plan may be longer. The Technical Advisory Committee is expected to review and provide thoughtful comments on all Workplans. To that end, it will help if Workplans are concise.

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<sup>7</sup> If quality control objectives are not being met (for example, recoveries in matrix spike samples are outside of expected limits) and matrix interferences are suspected as the cause, study proponents should consult with their laboratory personnel and Water Board staff. Water Board may allow the use of USEPA Method 245.7 if detectable concentrations are within the range of the method's calibration and quality control criteria met for that method.

<sup>8</sup> CEDEN is a system that allows exchange of data between federal, State, county and other organizations collecting data within California. Spreadsheet templates for field and chemistry data, along with other information about CEDEN, are available at [http://www.ceden.org/ceden\\_submitdata.shtml](http://www.ceden.org/ceden_submitdata.shtml).

## Appendix A. Questions to Guide Development of Methylmercury Control Studies

These questions were first posed in an Adaptive Management Plan that Board staff and stakeholders developed prior to adoption of the Delta Methylmercury TMDL.<sup>9</sup> The questions are intended to focus thinking about the design of control studies and reports and to generate information useful for completing the Control Study Workplan Elements (Guidance Document Section IV). The questions do not replace the Control Study Workplan Elements.

### A. Control Studies for Existing Land Uses and Water Management Practices to Meet Methylmercury Allocations

- 1) What factors that affect methylmercury production, fate, and transport could be adjusted? Factors that affect methylmercury production, loss, and export include:
  - concentration of total mercury in source water and in sediment;
  - organic material (dissolved and sediment-based) available to methylating bacteria;
  - degree and extent of anaerobic conditions;
  - cycle of wetting and drying of land surface;
  - residence time, clarity, and depth of water (affect rates of photodemethylation and loss through particle settling);
  - extent of wetted surface;
  - management of water (includes extent of wetted surface; flow, seasonality and extent of inundation)
  - concentrations and forms of chemicals that affect reactivity of mercury (for example, ferrous ion, selenium, nitrate, sulfide and sulfate)
- 2) Are there on-site methods to reduce methylmercury exported from the site or area?
- 3) Would reducing total mercury in your source water result in reducing methylmercury levels in your discharge?
- 4) What other management practices could be implemented to reduce the amount of methylmercury in your discharge (or, for WWTPs, your influent)?
- 5) Which management options would enable compliance with methylmercury allocations?
- 6) Which management options would enable effluent methylmercury concentrations to be reduced to equal to or less than the implementation goal for ambient Delta water (an annual average of 0.06 ng/l)? Or, if source water methylmercury concentrations are above 0.06 ng/L, which management options would enable discharge methylmercury concentrations to not exceed source water methylmercury concentrations?
- 7) Are there particular sites where potential methylmercury management practices can be tested in pilot projects?
- 8) What are the negative and positive environmental effects of the management practices or activities being tested?

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<sup>9</sup> Adaptive Management Plan for Implementing the Delta Methylmercury Control Program, Working Draft June 22, 2010  
[http://www.waterboards.ca.gov/centralvalley/water\\_issues/tmdl/central\\_valley\\_projects/delta\\_hg/stakeholder\\_workgroup\\_mtgs/22jun2010\\_adapt\\_mgmt\\_plan.pdf](http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/delta_hg/stakeholder_workgroup_mtgs/22jun2010_adapt_mgmt_plan.pdf)

- 9) Do any of the management practices or activities have effects that could counter practices for pollution control or other necessary activities? For example, could there be conflicts with mosquito abatement, salt, dissolved oxygen, total mercury, and invasive species management practices?
- 10) Which management practices or activities are more technically feasible?
- 11) What are the implementation and operations/maintenance costs of the management practices or activities?
- 12) Is there sufficient information to be able to apply the management practices or activities in an adaptive manner? How effective do you expect that the management practices and activities will be over time as climactic and other conditions in the Delta change?
- 13) Final Report: What are your preferred methylmercury management practices and activities? Will these options enable compliance with adopted methylmercury allocations?
- 14) Final Report: What schedule is needed to implement preferred methylmercury management practices and activities and ultimately comply with your methylmercury allocation?

#### B. Control Studies for New Projects

Methylmercury Control Studies must be completed for activities that have the potential to increase methylmercury levels in water in the Delta and Yolo Bypass.

1. What are the baseline conditions (e.g., seasonal and annual methyl concentrations and loads imported to and exported from the project area) and how were they identified?
2. What are the variables that control methylmercury production and degradation in the project area?
3. How would you evaluate or model the effect of the project on methylmercury levels?
4. How would the new project change baseline conditions? For projects that contain an evaluation of alternatives, effects of each alternative on methylmercury should be considered.
5. If the new project would increase methylmercury loads, what management measures or control actions, on-site or upstream, can be implemented to mitigate the methylmercury increase?
6. Which management options would completely mitigate the amount of methylmercury increase caused by the project? Partially mitigate?
- 15) Is there sufficient information to be able to apply the management practices or activities in an adaptive manner? How effective do you expect that the management practices and activities will be over time as climactic and other conditions in the Delta change?
7. Which management options have the least and greatest environmental impact to implement?
8. Final Report: What are your preferred methylmercury management practices and/or mitigations that can be incorporated into the new project? Will these options enable compliance with adopted methylmercury allocations

## Appendix B. List of References and Ongoing Studies

See also references in these documents.

This is an initial and partial list. Readers are encouraged to suggest additions.

### Factors Affecting Methylmercury

CVRWQCB, 2010. Delta Methylmercury TMDL Report, Chapters 3 (Factors), 6 (Methylmercury source analysis) and 7 (total mercury source analysis)

[http://www.waterboards.ca.gov/centralvalley/water\\_issues/tmdl/central\\_valley\\_projects/delta\\_hg/april\\_2010\\_hg\\_tmdl\\_hearing/apr2010\\_tmdl\\_staffrpt\\_final.pdf](http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/delta_hg/april_2010_hg_tmdl_hearing/apr2010_tmdl_staffrpt_final.pdf)

CVRWQCB, 2010 Delta Mercury Basin Plan Amendment Staff Report, Chapter 4.3

[http://www.waterboards.ca.gov/centralvalley/water\\_issues/tmdl/central\\_valley\\_projects/delta\\_hg/april\\_2010\\_hg\\_tmdl\\_hearing/apr2010\\_bpa\\_staffrpt\\_final.pdf](http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/delta_hg/april_2010_hg_tmdl_hearing/apr2010_bpa_staffrpt_final.pdf)

Alpers, Eagles-Smith, Foe, Klasing, Marvin-di Pasquale, Slotton, and Windham-Myers, 2008.

Mercury Conceptual Model. Delta Regional Ecosystem Restoration Implementation Plan.

[http://www.dfg.ca.gov/ERP/conceptual\\_models.asp](http://www.dfg.ca.gov/ERP/conceptual_models.asp) - under Stressors, select link for "mercury"

### Management Practice Studies

#### *Ongoing Yolo Bypass Permanent Pond Management Practice Study*

Funded by the CalFed Ecosystem Restoration Program and conducted by CDFG Moss Landing

Marine Laboratories. Project runs 2010-2013. First year data have been collected. Objectives are to evaluate management practices for reducing methylmercury from seasonal wetlands.

Management practices being evaluated are: routing high methylmercury-containing water from seasonal wetland through a permanent wetland or pond; grazing to reduce vegetation before flood up; and effect of various summer plant species on methylmercury produced after flooding. The study will evaluate pond design.

#### *Ongoing Cosumnes River Preserve Wetland and Rice Management Practice Study.*

Funded by the USEPA 319(h) Program and conducted by US Bureau of Land Management,

USGS, and CDFG. Project runs 2010-2013. First year data have been collected. Objectives are to evaluate effects of reducing amounts of organic matter available in rice fields and in seasonal wetlands that can be a nutrient source to methylating bacteria during winter flooding.

Gustin, Chavan, Dennett, Marchand, and Donaldson. 2006. *Evaluation of Wetland Methyl Mercury Export as a Function of Experiment Manipulations*. Journal of Environmental Quality 35:2352-2359.

Siegel, Bachand, Gillenwater, Chappell, Wickland, Rocha, Stephenson, Heim, Enright, Moyle, Crain, Downing, and Bergamaschi. 2011. Final Evaluation Memorandum: Strategies for Resolving Low Dissolved Oxygen and Methylmercury Events in Northern Suisun Marsh.

Prepared for State Water Resources Control Board, Sacramento. SWRCB Project No. 06-283-555-0. May. Available for download at: [www.swampthing.org](http://www.swampthing.org)

### Wetlands and Agricultural Lands Characterization Studies

Heim, Deverel, Ingram, Piekarski, and Stephenson, 2009. Methylmercury from Delta Farmed Islands

[http://www.waterboards.ca.gov/centralvalley/water\\_issues/tmdl/central\\_valley\\_projects/delta\\_hg/other\\_technical\\_reports/Farmed-Island-Study\\_Aug2009.pdf](http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/delta_hg/other_technical_reports/Farmed-Island-Study_Aug2009.pdf)

Windham-Meyers, Marvin-diPasquale, Fleck, Alpers, Ackerman, Eagles-Smith, Stricker, Stephenson, Feliz, Gill, Bachand, Brice, and Kulakow, 2010. Methylmercury Cycling in Rice Field and Wetlands in the Yolo Bypass.

[http://www.waterboards.ca.gov/centralvalley/water\\_issues/tmdl/central\\_valley\\_projects/delta\\_hg/other\\_technical\\_reports/ybwa\\_hg\\_final\\_rpt.pdf](http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/delta_hg/other_technical_reports/ybwa_hg_final_rpt.pdf)

CalFed Mercury Program Series of Methylmercury Loading Studies in Delta Wetlands, 2008.

Studies conducted by USGS and CDFG occurred at Twitchell Island, Sycamore Slough and Suisun Marsh, Grizzly Island, and Brown's Island.

<http://mercury.mlml.calstate.edu/reports/reports/>

### Wastewater Effluent

Bosworth, Louie, Wood, Little, and Kulesza, 2010. Review of Methylmercury and Mercury Discharges from NPDES Facilities in the Central Valley. Central Valley Regional Water Quality Control Board

[http://www.waterboards.ca.gov/centralvalley/water\\_issues/tmdl/central\\_valley\\_projects/delta\\_hg/other\\_technical\\_reports/npdes\\_mehg\\_final\\_rpt.pdf](http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/delta_hg/other_technical_reports/npdes_mehg_final_rpt.pdf)

Dean and Mason, 2009. Estimation of Mercury Bioaccumulation Potential from Wastewater Treatment Plants in Receiving Waters. Prepared for the Water Environment Research Foundation. 05-WEM-1CO and 05-WEM-1COa

### Urban Stormwater Runoff

Contra Costa County MS4's Marsh Creek Mercury Study (obtain from county)

Sacramento Area and Stockton Area MS4's results of BMP effectiveness studies required under their existing MS4 permits. (Obtain from Stormwater Quality Partnerships)

Monson, B. 2007. Effectiveness of Stormwater Ponds/Constructed Wetlands in the Collection of Total Mercury and Production of Methylmercury – Final Project Report. Minnesota Pollution Control Agency. St. Paul, MN. May 2007.

<http://www.pca.state.mn.us/index.php/view-document.html?gid=289>