

**An Integrated Storm Water Management
Approach and a Summary of Clear Water
Diversion and Isolation Best Management
Practices for Use in the
State of Hawaii, by the
Federal Highway Administration and
Hawaii Department of Transportation**

Practitioners Guide

Prepared By:



U.S. Department of Transportation
Federal Highway Administration
Central Federal Lands Highway Division
Lakewood, Colorado

April 2016

Version 1: Draft

TABLE OF CONTENTS

1	Introduction.....	3
1.1.	Purpose.....	3
1.1	Acknowledgements	4
1.2	Disclaimer.....	5
1.3	Scope of this Guide	6
1.4	Regulatory Setting.....	6
1.4.1	Federal Requirements:.....	6
1.4.2	State Requirements:	13
1.5	Considerations for working in Riverine Systems	15
1.6	The Riparian Zone.....	18
1.6.1	Practices to Promote	21
1.6.2	Practices to Avoid	21
2	Integrated Approach to Stormwater Management.....	23
2.1	Strategies for Stormwater Quality Management into Project Development	23
2.1.1	Assemble a Collaborative Team Early	23
2.1.2	Consider the Site and its Surroundings	24
2.1.3	Identify Opportunities and Constraints	24
2.1.4	Preserve Valuable Site Features	25
2.1.5	Lay Out the Site with Topography and Soils in Mind	26
2.1.6	Put Landscaping to Work	26
2.1.7	Stop Pollution at Its Source.....	26
2.1.8	Reduce Runoff Close to Its Source.....	27
2.1.9	Promote Infiltration Where Feasible	27
2.1.10	Minimize Impervious Surfaces.....	28
2.1.11	Where Feasible, Avoid Draining Impervious Areas Directly to a Storm Drain	28
2.1.12	Treat Runoff	28
2.1.13	Hydromodification Management.....	29
2.2	Construction Sites and Potential Pollutants	29
2.3	Potential Pollutants	31
2.3.1	Total Suspended Solids (TSS) AKA Sediment and Soil.....	31
2.3.2	Nutrients	31
2.3.3	Pesticides.....	32
2.3.4	Metals (Particulate and Dissolved).....	32
2.3.5	Pathogens	32
2.3.6	Trash	33

2.3.7	Petroleum Products	33
2.3.8	Chemicals	33
2.4	Water Chemistry	33
2.4.1	pH	33
2.4.2	Hardness	33
2.4.3	Salinity and Temperature	33
2.5	Transport of Stormwater Pollutants	34
2.5.1	Initial Transport	34
2.5.2	During “First Flush”	34
2.5.3	After Entry into a Water Body	34
2.5.4	During Downstream Transport	35
2.6	Impacts of Water Quality Pollution on Aquatic Organisms	35
2.6.1	Water Temperature.....	35
2.6.2	Sediment.....	35
2.6.3	Metals	36
2.6.4	Nutrients	36
2.6.5	Organic Pollutants	36
2.6.6	Acute and Chronic Effects	36
2.6.7	Indirect Impacts to Water Quality	37
2.7	Step by Step Process for SWPPP/IWPPP Development and Implementation.....	38
2.7.1	Internal Roles and Responsibilities	38
2.7.2	External Roles and Responsibilities.....	38
2.7.3	Step By Step Process Description and Recommendations	39
3	Stormwater Treatment Program - Best Management Practices and Selection Matrix	43
3.1	Summary	43
3.2	Stormwater Treatment Guidance and BMP Selection Matrix.....	44
3.3	BMPS in the Selection tool	50
3.4	Defining Treatment Effectiveness Using Treatment Mechanisms	50
3.5	Treatment Effectiveness Matrix.....	53
3.6	BMP Selection Tool – Metric Ratings.....	55
4	Construction Site Best Management Practices.....	60
4.1	Construction Operations and Applicable Best Management Practices Matrix	62
4.2	Construction BMPs	75
4.2.1	Soil Stabilization BMPs	75
4.2.2	Sediment Control Practices.....	85
4.2.3	Tracking Control Practices.....	88
4.2.4	Wind Erosion Control	89

4.2.5	Non-Storm Water Controls.....	89
4.2.6	Waste Management and Materials Pollution Control	92
4.3	Monitoring and Inspection Program	94
4.4	Rain Event Action Plans	103
4.4.1	Rain Event Triggered Observations and Inspections.....	104
4.4.2	Visual Observations Prior to a Forecasted Qualifying Rain Event	104
4.4.3	BMP Inspections During an Extended Storm Event	104
4.4.4	Visual Observations Following a Qualifying Rain Event.....	105
5	Construction BMPs for working In, Over or adjacent to Waters of the U.S.:	106
5.1	Working On or Over Water; Including Material and Equipment Use on Water:	106
5.1.1	Description and Purpose	106
5.1.2	Appropriate Applications.....	106
5.1.3	Limitations	106
5.1.4	Standards and Specifications.....	106
5.1.5	Inspection and Maintenance	107
5.2	Demolition Over or Adjacent to Water	108
5.2.1	Description and Purpose	108
5.2.2	Appropriate Applications.....	108
5.2.3	Limitations.....	108
5.2.4	Standards and Specifications.....	108
5.2.5	Inspection and Maintenance	108
5.3	Temporary Stream/River Crossing.....	109
5.3.1	Description and Purpose	109
5.3.2	Appropriate Applications.....	109
5.3.3	Limitations	109
5.3.4	Standards and Specifications.....	110
5.3.5	Inspection and Maintenance	112
5.4	Streambank Stabilization.....	114
5.4.1	Description and Purpose	114
5.4.2	Suitable Applications	114
5.4.3	Limitations.....	114
5.4.4	Implementation	117
5.4.5	Streambank Stabilization Methods.....	119
5.5	Clear Water Diversion and Isolation Techniques	122
5.5.1	Description and Purpose	122
5.5.2	Design Considerations	122
5.5.3	Suitable Applications	123

5.5.4	Limitations	123
5.5.5	Standards and Specifications.....	124
5.5.6	General Considerations.....	124
5.6	Filter Fabric Isolation Technique.....	129
5.6.1	Definition and Purpose	129
5.6.2	Appropriate Applications.....	129
5.6.3	Limitations	129
5.6.4	Standards and Specifications.....	130
5.6.5	Installation	130
5.6.6	Inspection and Maintenance	130
5.7	Turbidity Curtain Isolation Technique.....	131
5.7.1	Definition and Purpose	131
5.7.2	Appropriate Applications.....	134
5.7.3	Limitations	134
5.7.4	Standards and Specifications.....	134
5.7.5	Inspection and Maintenance	136
5.8	K-Rail (Jersey Barrier) River Isolation Technique.....	137
5.8.1	Definition and Purpose	137
5.8.2	Appropriate Applications.....	137
5.8.3	Limitations	137
5.8.4	Standards and Specifications.....	138
5.8.5	Inspection and Maintenance	138
5.9	Cofferdam and/or Sheet Pile Isolation Technique	139
5.9.1	Definition and Purpose	139
5.9.2	Appropriate Applications.....	140
5.9.3	Limitations	140
5.9.4	Standards and Specifications.....	140
5.9.5	Inspection and Maintenance	141
5.10	Gravel/Rock Berm with Impermeable Membrane Isolation Technique	142
5.10.1	Definition and Purpose.....	142
5.10.2	Appropriate Applications	142
5.10.3	Limitations.....	142
5.10.4	Standards and Specifications	142
5.10.5	Inspection and Maintenance	143
5.11	Gravel bag or Sandbag Isolation Technique.....	144
5.11.1	Definition and Purpose.....	144
5.11.2	Appropriate Applications	144

5.11.3	Limitations.....	145
5.11.4	Standards and Specifications	145
5.11.5	Inspection and Maintenance	145
5.12	Pipe Piles and Caisson Isolation Technique	146
5.12.1	Definition and Purpose.....	146
5.12.2	Appropriate Applications	147
5.12.3	Limitations.....	147
5.12.4	Standards and Specifications	147
5.12.5	Inspection and Maintenance	148
5.13	Stream Diversion Techniques: Pumped, Pipe/Flume, and Excavated.....	119
5.13.1	Definition and Purpose.....	119
5.13.2	Appropriate Applications	120
5.13.3	Advantages.....	120
5.13.4	Limitations.....	120
5.13.5	Standards and Specifications	121
5.13.6	Inspection and Maintenance	122
5.14	In-stream Construction Sediment Control.....	123
5.14.1	Definition and Purpose.....	123
5.14.2	Appropriate Applications	123
5.14.3	Limitations.....	123
5.14.4	Standards and Specifications	124
5.14.5	Inspection and Maintenance	125
5.15	Washing Fines (Streambed Restoration Technique).....	126
5.15.1	Definition and Purpose.....	126
5.15.2	Appropriate Applications	126
5.15.3	Limitations.....	126
5.15.4	Standards and Specifications	126
6	Glossary.....	127

TABLE OF FIGURES AND TABLES

Figure 1. Regulatory Boundaries in Waters of the United States.....	8
Figure 2. Hawaii CZM Network- A Spatial Perspective.	11
Figure 3: Lane’s Balance of Sediment Supply & Sediment Size with Slope (energy grade) & Discharge	16
Figure 4: Channel Evolution Process (Source: Schumm, S., 1984).	18
Figure 5: Conceptual Riparian Cross Section.....	22
Figure 7. Schematic of BMP Selection Tool	48
Figure 8. BMP Selection Process	49
Table 1. Treatment Mechanism- Target Pollutant Matrix	52

Table 2. Treatment Mechanism- BMP Matrix	54
Table 3. BMP Performance Summary Table	56
Table 4. Storm Water BMPs for Construction Operations.....	66
Table 5: Construction Site BMPs By Construction Activity	70
Table 6: Temporary Soil Stabilization Criteria Matrix	75
Table 7 - BMP Implementation and Maintenance Schedule.....	98
Figure 9. Example of streambank stabilization options during bridge replacement.	115
Figure 10. Example of roadway with riprap and bioengineering features.....	116
Figure 11: Geotextiles, Silt Barriers, Curtain Enclosure Method.....	129
Figure 12: Turbidity Curtain Enclosure Method.....	131
Figure 13: Turbidity Curtain Enclosure Method.....	132
Figure 14: Turbidity Curtain Enclosure Method.....	133
Figure 15: K-Rail Isolation Method.....	137
Figure 16: Cofferdam Isolation Method.....	139
Figure 17: Sheet Pile Isolation Method.....	139
Figure 18: Water-Filled Geotextile (Bladder Dam).....	140
Figure 19: Gravel/Rock Berm with Impermeable Membrane.....	142
Figure 20: Gravel Bag / Sand Bag Method	144
Figure 21: Diversion Method	119
Figure 22: Diversion Methods.....	120

APPENDICES

APPENDIX A: CONSTRUCTION BEST MANAGEMENT PRACTICES FIELD MANUAL

APPENDIX B: STORM WATER PERMANENT BEST MANAGEMENT PRACTICES MANUAL

APPENDIX C: DEVELOPING YOUR STORMWATER POLLUTION PREVENTION PLAN; A GUIDE FOR CONSTRUCTION SITES

APPENDIX D: HAWAII NPDES GENERAL PERMIT AUTHORIZING DISCHARGES OF STORM WATER ASSOCIATED WITH CONSTRUCTION ACTIVITY AND DEPARTMENT OF HEALTH STANDARD NPDES PERMIT CONDITIONS

APPENDIX E: FHWA-CFLHD TYPICAL DETAILS

APPENDIX F: RAIN EVENT ACTION PLAN FORM

APPENDIX G: IN-WATER POLLUTION PREVENTION PLAN SAMPLE

ABBREVIATIONS AND ACRONYMS

AASHTO	American Association of State Highway and Transportation Official	HDOT	Hawaii Department of Transportation
BFM	Bonded Fiber Matrix	HGM	Hydrogeomorphic
BMP	Best Management Practice	HRS	Hawaii Revised Statutes
CCS	Cellular Confinement System	IWPPP	In Water Pollution Prevention Plan
CFLHD	Central Federal Lands Highway Division	JD	Jurisdictional Delineation
CFR	Code of Federal Regulations	LEDPA	Least Environmentally Damaging Practicable Alternative
CFT	Cross Functional Team	LOP	Letter of Permission
CNPCP	Coastal Nonpoint Pollution Control Program	LRR	Land Resource Region
CWA	Clean Water Act	MLRA	Major Land Resource Area
CWB	Clean Water Branch	NAEL	National Elk Wildlife Refuge
CZARA	Coastal Zone Act Reauthorization Amendments	NHD	National Hydrographic Datum
CZM	Coastal Zone Management	NPDES	National Pollution Discharge Elimination System
CZMA	Coastal Zone Management Act	NPS	Non-Point Source
DLNR	Department of Land and Natural Resources	NRCS	Natural Resource Conservation Service
DOH	Department of Health	NRPW	Non-Relatively Permanent Water
DOT	Department of Transportation	NWI	National Wetland Inventory
DSA	Disturbed Soil Area	NWPL	National Wetland Plant List
EMD	Environmental Management Division	OBL	Obligate
EO	Executive Order	OHWM	Ordinary High Water mark
EPA	Environmental Protection Agency	OP	Office of Planning
ESA	Environmentally Sensitive Area	PAH	Polycyclic Aromatic Hydrocarbons
ETAP	Environmental Technologies Action Plan	PDT	Project Delivery Team
FAC	Facultative	PE	Project Engineer
FACU	Facultative Upland	PEM	Palustrine Emergent
FACW	Facultative Wetland	PFO	Palustrine Forested
FHWA	Federal Highway Administration	POC	Pollutants of Concern
FH	Forest Highway	PSS	Palustrine Scrub/Shrub
FLAP	Federal Lands Access Program	QA	Quality Assurance
FLH	Federal Lands Highway	QSP	Qualified Stormwater Professional
GPS	Global Positioning System	RE	Resident Engineer
HAR	Hawaii Administrative Rules	REAP	Rain Event Action Plan
		ROW	Right of Way
		RPW	Relatively Permanent Water

SR	State Route	US	United States
SRNF	Six Rivers National Forest	USACE	United States Army Corps of Engineers
SWANCC	Solid Waste Agency of Northern Cook County	USC	United States Code
TMDL	Total Maximum Daily Load	USDA	United States Department of Agriculture
TNW	Traditional Navigable Water	USGS	United States Geological Service
TSS	Total Suspended Solids	USFWS	United States Fish and Wildlife Service
SDWA	Safe Drinking Water Act	UTM	Universal Transverse Mercator
SWPPP	Storm Water Pollution Prevention Plan	WUS	Waters of the United States
UPL	Upland	WWB	Wastewater Branch

REFERENCES

The following documents are incorporated by reference:

- American Society of Civil Engineers/Environmental and Waters Research Institute (ASCE/EWRI). 2001. Guide for BMP Selection in Urban Developed Areas.
- City and County of Honolulu's Department of Environmental Services in cooperation with The General Contractors Association of Hawaii (Honolulu 1999) ; Best Management Practices Manual for Construction Sites in Honolulu, May 1999
- City and County of Honolulu's Department of Environmental Services (Honolulu 2011); Stormwater Best Management Practices Manual for Construction, November 2011
- California Department of Transportation (Caltrans). 2000; Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, November 2000.
- Caltrans. 2003. California Storm Water Quality Handbooks, Construction Site Best Management Practices (BMPs) Manual, March, 2003.
- Caltrans. 2003. Construction Site BMP Field Manual and Trouble Shooting Guide. January 2003
- Caltrans. 2005. Stormwater Quality Handbooks: Project Planning and Design Guide.
- Colorado Water Quality Control Division. 2000. Colorado Regulation Number 82. 5 Code of Colorado Regulations (CCR) 1002-82 401 Certification Regulation, Appendix I: The Selection of Best Management Practices for Clean Water Act 401 Certifications, October 2000
- Department of Transportation (FHWA 2014), Federal Highway Administration; Standard Specifications for construction of roads and bridges on Federal Highways projects (FP-14); 2014
- Hawaii, Department of Health, Clean Water Branch (DOH-CWB). 2015. Hawai'i's Nonpoint Source Management Plan 2015-2020. Polluted Runoff Control Program. Available at: <http://health.hawaii.gov/cwb/site-map/clean-water-branch-home-page/polluted-runoff-control-program/>
- Hawaii Department of Transportation (HDOT). 2008. Construction Best Management Practices Field Manual, 2008.
- HDOT. 2015a. Storm Water Management Program, Storm Water Permanent Best Management Practices Manual, April 2015.
- HDOT. 2015b. Storm Water Management Program, Stormwater Management Program Plan, April 2015
- Hawaii, OP. 1996. Hawaii Coastal Zone Management Program. Hawaii's Coastal Nonpoint Pollution Control Program, Management Plan, Volume 1
- Hawaii Office of Planning (OP). 2013. Stormwater Impact Assessment: Connecting primary, secondary and cumulative impacts to Hawaii's Environmental Review Process. May 2013.
- Hawaii, OP. 2015. Hawai'i's State Land Use System, Informational Briefing Before the Senate Committee on Water and Land, January 28, 2015. Department of Business, Economic Development and Tourism, State of Hawaii Available at: <http://planning.hawaii.gov/>
- Idaho Department of Transportation (IDOT). 2014. Stormwater Best Management Practices Manual, January 2014.
- Lake Tahoe Regional Planning Agency (Tahoe 2014); Best Management Practices Handbook, May 2014.

- Lane, E.W. 1955. The Importance of Fluvial Morphology in Hydraulic Engineering. Proceedings of the American Society of Civil Engineers, Journal of the Hydraulics Division, vol. 81, paper no. 745.
- Minnesota Stormwater Manual. 2005. Version 1; Minnesota Stormwater Steering Committee, November 2005. Available at <http://www.pca.state.mn.us/water/stormwater/stormwater-manual.html>
- National Cooperative Highway research Program (NCHRP). 2006. Evaluation of Best Management Practices and Low Impact Development for Highway Runoff Control.
- Oregon Department of Transportation (ODOT). 2008. Memorandum: Stormwater Treatment Program – BMP Selection Tool. October 22, 2008.
- ODOT. 2008. Memorandum: Stormwater Treatment BMP Summary Reports. October 22, 2008.
- ODOT. 2008. Memorandum: Water Quality Design Storm Evaluation and Guidance.
- ODOT. 2008. Memorandum: Water Quantity (Flow Control) Design Storm Performance Standard.
- Portland Water Bureau. 2008. Erosion and Sediment Control Manual
- Portland Bureau of Environmental Services. 2006. Effectiveness Evaluation of Best Management Practices for Stormwater Management in Portland, Oregon.
- River Corridor Protection and Management FACT SHEET Colorado Water Conservation Board
- Sacramento Region Steering Committee. 2014. Stormwater Quality Design Manual, Integrated Design Solutions for Urban Development, Protecting Our Water Quality. May, 2014.
- Schumm, S.A. 1984. The Fluvial System. John Wiley and Sons, New York.
- Shoemaker, Leslie; Lahlou, Mohammed; Doll, Amy and Patricia Cazenias, 2000, Stormwater Best Management Practices in an Ultra-Urban Setting: Selection and Monitoring. U.S. Department of Transportation, Federal Highway Administration Publication No. FHWAEP-00-002, Office of Natural Environment, Federal Highway Administration, Washington, D.C. 287p.
- United States Army Corps of Engineers. 2016. Pictorial Representations of Jurisdiction. Available at http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits/juris_info.aspx
- United States Department of Agriculture, Natural Resources Conservation Service. 1998. The Practical Streambank Bioengineering Guide, User's Guide for Natural Streambank Stabilization Techniques in the Arid and Semi-Arid Great Basin and Intermountain West.
- Water Environment Research Foundation (WERF). International Stormwater BMP Database. (www.bmpdatabase.org).