SWAMP
Surface Water Ambient Monitoring Program

Water Quality Monitoring Report	2000-06

Summary Report for the North Coast Region (RWQCB-1) for years 2000-2006

March 2008

California Water Quality Control Board, North Coast Region
5550 Skylane Blvd, Suite A
Santa Rosa, Ca, 95403
http://www.waterboards.ca.gov/northcoast/

California Water Boards

www.waterboards.ca.gov/swamp

Surface Water Ambient Monitoring Program (SWAMP)

Summary Report for the North Coast Region (RWQCB-1) for years 2000-2006

March 2008

California Water Quality Control Board, North Coast Region
5550 Skylane Blvd., Suite A
Santa Rosa, Ca, 95403
http://www.waterboards.ca.gov/northcoast/

Authors

Rich Fadness
North Coast Regional Water Quality Control Board

Krista Kamer and Stacey Swenson
Marine Pollution Studies Laboratory, Moss Landing Marine Laboratories

With special thanks to:

Peter Otis and Donald Coates
North Coast Regional Water Quality Control Board

Russell Fairey, Cassandra Lamerdin, Susan Mason, Lara Pranger, Mark Pranger, and Marco Sigala
Marine Pollution Studies Laboratory, Moss Landing Marine Laboratories

Andres Aguilar
NOAA National Marine Fisheries Service
Southwest Fisheries Science Center

Table of Contents

List Of Tables xv
List Of Figures xix
List Of Acronyms xxi
Beneficial Uses Designations xxiii
Units xxiii

1. Introduction 1

1.1. Overview of the Surface Water Ambient Monitoring Program 1
1.1.1. Statewide SWAMP Program goals 1
1.1.2. The SWAMP Goals in the North Coast Region FYs 2000-2006 2
1.1.3. Regional Monitoring 2
1.1.4. Site-specific Monitoring 3
1.2. Related Water Quality Programs 3
1.2.1. North Coast Watershed Assessment Program 1999-2003 3
1.2.2. Total Maximum Daily Load (TMDL) program 4
1.3. The SWAMP in the North Coast Region 5
1.3.1. Long-term Trend Monitoring Station Selection 6
1.3.2. Rotating Monitoring Station Selection 6
1.4. Overview of the North Coast Region 7
1.4.1. Natural History of the North Coast Region 7
1.4.2. Salmonids 8
1.4.3. Salmon Habitat and Anthropogenic Impacts 10
1.4.4. Current Status of Salmon Populations in the NCR 16

2. NCR Watershed Descriptions 19

2.1. Klamath Watershed Management Area 21

2.1.1. Overview 22
2.1.2. Climate 22
2.1.3. Water Resources 23
2.1.4. Fishery 23
2.1.5. Topography and Geology 25
2.1.6. Hydrologic Areas of the Klamath River WMA 27
2.1.6.1. Upper Klamath River HA 27
2.1.6.1.1. Overview 27
2.1.6.1.2. Lost River HA 29
2.1.6.2. Middle Klamath River HA 31
2.1.6.3. Shasta River HA 32
2.1.6.3.1. Overview 33

2.1.6.3.2. History and Land Use 33
2.1.6.3.3. Vegetation 34
2.1.6.3.4. Climate 34
2.1.6.3.5. Water Resource Management 35
2.1.6.3.6. Fishery 36
2.1.6.3.7. Topography and Geology 37
2.1.6.4. Scott River HA 38
2.1.6.4.1. Overview 39
2.1.6.4.2. History and Land Use 39
2.1.6.4.3. Vegetation 40
2.1.6.4.4. Climate and Hydrology 40
2.1.6.4.5. Fishery 41
2.1.6.4.6. Topography and Geology 41
2.1.6.5. Lower Klamath River HA 43
2.1.7. Water Quality Issues in the Klamath River WMA 44
2.1.7.1. Klamath River Watershed 44
2.1.7.2. Shasta River Watershed 45

2.2. Trinity River Watershed Management Area 47

2.2.1. Overview 48
2.2.2. History and Land Use 48
2.2.3. Vegetation 49
2.2.4. Climate 49
2.2.5. Water Resources 50
2.2.6. Fishery 50
2.2.7. Topography and Geology 52
2.2.8. Sedimentation 52
2.2.9. Hydrologic Areas of the Trinity River WMA 54
2.2.9.1. Upper Trinity River HA 54
2.2.9.2. Middle Trinity River HA 55
2.2.9.3. Lower Trinity River HA 55
2.2.9.3.1. Overview 55
2.2.9.3.2. New River HSA 55
2.2.9.3.3. Helena HSA 56
2.2.9.4. South Fork Trinity River HA 56
2.2.10. Water Quality Issues in the Trinity River WMA 57

2.3. Humboldt Bay Watershed Management Area 60

2.3.1. Overview 61
2.3.2. History and Land Use 61
2.3.3. Redwood Creek HU 63
2.3.3.1. Overview 64
2.3.3.2. History and Land Use 64
2.3.3.3. Vegetation 64

2.3.3.4. Climate 64
2.3.3.5. Fishery 65
2.3.3.6. Topography and Geology 65
2.3.3.7. Sedimentation 65
2.3.4. Mad River HU 67
2.3.5. Water Quality Issues in the Humboldt Bay WMA 68

2.4. Eel River Watershed Management Area 70

2.4.1. Overview 71
2.4.2. Fishery 72
2.4.3. Upper Main Eel River HA 73
2.4.3.1. Overview 74
2.4.3.2. History and Land Use 74
2.4.3.3. Climate 74
2.4.3.4. Fishery 75
2.4.3.5. Topography and Geology 76
2.4.3.6. Sedimentation 76
2.4.4. Middle Fork Eel River HA 77
2.4.4.1. Overview 78
2.4.4.2. History and Land Use 78
2.4.4.3. Climate 78
2.4.4.4. Fishery 79
2.4.4.5. Sedimentation 80
2.4.5. North Fork Eel River HA 81
2.4.5.1. Overview 82
2.4.5.2. History and Land Use 82
2.4.5.3. Vegetation 82
2.4.5.4. Climate 82
2.4.5.5. Fishery 83
2.4.5.6. Topography and Geology 83
2.4.5.7. Sedimentation 84
2.4.6. Middle Main Eel River HA 85
2.4.6.1. Overview 86
2.4.6.2. Vegetation 86
2.4.6.3. Fishery 86
2.4.6.4. Sedimentation 87
2.4.7. South Fork Eel River HA 88
2.4.7.1. Overview 89
2.4.7.2. History and Land Use 89
2.4.7.3. Fishery 89
2.4.7.4. Topography and Geology 90
2.4.8. Van Duzen River HA 91
2.4.8.1. Overview 91
2.4.8.2. History and Land Use 92
2.4.8.3. Vegetation 92

2.4.8.4. Climate 92
2.4.8.5. Fishery 93
2.4.8.6. Topography and Geology 93
2.4.8.7. Sedimentation 94
2.4.9. Water Quality Issues in the Eel River WMA 95

2.5. North Coast Rivers Watershed Management Area 96

2.5.1. Overview 98
2.5.2. Smith River HU 99
2.5.2.1. Overview 100
2.5.2.2. Land Use and History 101
2.5.2.3. Vegetation & Wildlife 101
2.5.2.4. Topography and Geology 101
2.5.2.5. Water Quality Issues 102
2.5.3. Cape Mendocino HU (Mattole River HA) 103
2.5.3.1. Overview 104
2.5.3.2. History and Land Use 104
2.5.3.3. Vegetation 105
2.5.3.4. Climate and Hydrology 105
2.5.3.5. Fishery 105
2.5.3.6. Topography and Geology 106
2.5.3.7. Sedimentation 107
2.5.3.8. Water Quality Issues 107
2.5.4. Mendocino Coast HU 109
2.5.4.1. Rockport HA – (Ten Mile River HSA) 109
2.5.4.1.1. Overview 110
2.5.4.1.2. History and Land Use 110
2.5.4.1.3. Vegetation 110
2.5.4.1.4. Climate 111
2.5.4.1.5. Fishery and Wildlife 111
2.5.4.1.6. Topography and Geology 111
2.5.4.1.7. Sedimentation 112
2.5.4.1.8. Water Quality Issues 112
2.5.4.2. Noyo River HA 114
2.5.4.2.1. Overview 114
2.5.4.2.2. History and Land Use 114
2.5.4.2.3. Fishery 115
2.5.4.2.4. Topography and Geology 116
2.5.4.2.5. Sedimentation 116
2.5.4.2.6. Water Quality Issues 116
2.5.4.3. Big River HA 118
2.5.4.3.1. Overview 119
2.5.4.3.2. History and Land Use 120
2.5.4.3.3. Vegetation 121
2.5.4.3.4. Climate 121

2.5.4.3.5. Fishery 121
2.5.4.3.6. Topography and Geology 122
2.5.4.3.7. Sedimentation 122
2.5.4.3.8. Water Quality Issues 123
2.5.4.4. Albion River HA 125
2.5.4.4.1. Overview 125
2.5.4.4.2. History and Land Use 126
2.5.4.4.3. Climate 127
2.5.4.4.4. Water Resources 127
2.5.4.4.5. Fishery 127
2.5.4.4.6. Topography and Geology 128
2.5.4.4.7. Sedimentation 129
2.5.4.4.8. Water Quality Issues 129
2.5.4.5. Navarro River HA 131
2.5.4.5.1. Overview 131
2.5.4.5.2. History and Land Use 132
2.5.4.5.3. Fishery 132
2.5.4.5.4. Topography and Geology 132
2.5.4.5.5. Sedimentation 133
2.5.4.5.6. Water Quality Issues 134
2.5.4.6. Garcia River HA 136
2.5.4.6.1. Overview 136
2.5.4.6.2. History and Land Use 137
2.5.4.6.3. Vegetation 137
2.5.4.6.4. Climate and Hydrology 138
2.5.4.6.5. Fishery 138
2.5.4.6.6. Topography and Geology 138
2.5.4.6.7. Sedimentation 139
2.5.4.6.8. Water Quality Issues 141
2.5.4.7. Gualala River HA 142
2.5.4.7.1. Overview 142
2.5.4.7.2. History and Land Use 143
2.5.4.7.3. Vegetation 143
2.5.4.7.4. Climate 144
2.5.4.7.5. Fishery 144
2.5.4.7.6. Topography and Geology 144
2.5.4.7.7. Sedimentation 145
2.5.4.7.8. Water Quality Issues 145

2.6. Russian /Bodega Watershed Management Area 147

2.6.1. Overview 148
2.6.2. Russian River HU 148
2.6.2.1. Overview 149
2.6.2.2. History and Land use 149
2.6.2.3. Vegetation 151

2.6.2.4. Climate 151
2.6.2.5. Water Resource Management 152
2.6.2.6. Fishery 152
2.6.2.7. Topography and Geology 155
2.6.3. Bodega HU 155
2.6.3.1. Overview 156
2.6.3.2. Americano Creek/Estero Americano HA 156
2.6.3.3. Stemple Creek/Estero de San Antonio HA 156
2.6.3.4. Salmon Creek HA 157
2.6.4. Water Quality Issues in the Russian/Bodega WMA 158

3. Data Analysis 161

3.1. Introduction 161

3.2. Klamath River WMA/HU 165

3.2.1. Upper Klamath River HA 166
3.2.1.1. Field Parameters 167
3.2.1.2. Conventional Water Quality Parameters 167
3.2.1.3. Trace Metals 168
3.2.1.4. Pesticides, PCBs, and Phenols 169
3.2.2. Middle Klamath River HA 170
3.2.2.1. Field Parameters 171
3.2.2.2. Conventional Water Quality Parameters 171
3.2.2.3. Trace Metals 172
3.2.2.4. Pesticides and PCBs 173
3.2.3. Shasta River HA 174
3.2.3.1. Shasta River – Above Dwinnell Reservoir 175
3.2.3.1.1. Field Parameters 175
3.2.3.1.2. Conventional Water Quality Parameters 175
3.2.3.1.3. Trace Metals 176
3.2.3.1.4. Pesticides, PCBs, and Phenols 177
3.2.3.2. Shasta River – Below Dwinnell Reservoir 177
3.2.3.2.1. Field Parameters 178
3.2.3.2.2. Conventional Water Quality Parameters 178
3.2.3.2.3. Trace Metals 179
3.2.3.2.4. Pesticides, PCBs, and Phenols 180
3.2.3.3. Yreka Creek 181
3.2.3.3.1. Field Parameters 182
3.2.3.3.2. Conventional Water Quality Parameters 182
3.2.3.3.3. Trace Metals 183
3.2.3.3.4. Pesticides, PCBs, and Phenols 183
3.2.4. Scott River HA 185
3.2.4.1. Field Parameters 186
3.2.4.2. Conventional Water Quality Parameters 187

3.2.4.3. Trace Metals 187
3.2.4.4. Pesticides, PCBs, and Phenols 188
3.2.5. Lower Klamath River HA 190
3.2.5.1. Field Parameters 191
3.2.5.2. Conventional Water Quality Parameters 191
3.2.5.3. Trace Metals 192
3.2.5.4. Pesticides and PCBs 193
3.2.6. Trend Monitoring – Klamath River WMA 193
3.2.6.1. Klamath River Mainstem 194
3.2.6.1.1. Field Parameters 194
3.2.6.1.2. Conventional Water Quality Parameters 194
3.2.6.1.3. Trace Metals 194
3.2.6.2. Shasta River 194
3.2.6.2.1. Field Parameters 194
3.2.6.2.2. Conventional Water Quality Parameters 195
3.2.6.2.3. Trace Metals 195
3.2.6.3. Scott River 195
3.2.6.3.1. Field Parameters 195
3.2.6.3.2. Conventional Water Quality Parameters 195
3.2.6.3.3. Trace Metals 195

3.3. Trinity River WMA/HU 196

3.3.1. Middle Trinity River HA 197
3.3.1.1. Field Parameters 198
3.3.1.2. Conventional Water Quality Parameters 198
3.3.1.3. Trace Metals 199
3.3.2. South Fork Trinity River HA 200
3.3.2.1. Field Parameters 201
3.3.2.2. Conventional Water Quality Parameters 201
3.3.2.3. Trace Metals 202
3.3.2.4. Pesticides, PCBs, and Phenols 203
3.3.3. Lower Trinity River HA 204
3.3.3.1. Field Parameters 205
3.3.3.2. Conventional Water Quality Parameters 205
3.3.3.3. Trace Metals 206
3.3.3.4. Pesticides, PCBs, and Phenols 207

3.4. Humboldt Bay WMA 208

3.4.1. Redwood Creek HU 209
3.4.1.1. Field Parameters 210
3.4.1.2. Conventional Water Quality Parameters 210
3.4.1.3. Trace Metals 211
3.4.1.4. Pesticides, PCBs, and Phenols 212
3.4.2. Trinidad HU 213

3.4.2.1. Field Parameters 214
3.4.2.2. Conventional Water Quality Parameters 214
3.4.2.3. Trace Metals 215
3.4.3. Mad River HU 216
3.4.3.1. Mad River – Above Ruth Lake 217
3.4.3.1.1. Field Parameters 217
3.4.3.1.2. Conventional Water Quality Parameters 217
3.4.3.1.3. Trace Metals 218
3.4.3.2. Mad River – Below Ruth Lake 219
3.4.3.2.1. Field Parameters 219
3.4.3.2.2. Conventional Water Quality Parameters 220
3.4.3.2.3. Trace Metals 220
3.4.3.2.4. Pesticides, PCBs, and Phenols 222
3.4.4. Eureka Plain HU 223
3.4.4.1. Field Parameters 225
3.4.4.2. Conventional Water Quality Parameters 225
3.4.4.3. Trace Metals 225
3.4.5. Trend Monitoring – Humboldt Bay WMA 226
3.4.5.1. Redwood Creek 226
3.4.5.1.1. Field Parameters 226
3.4.5.1.2. Conventional Water Quality Parameters 227
3.4.5.1.3. Trace Metals 227
3.4.5.2. Mad River 227
3.4.5.2.1. Field Parameters 227
3.4.5.2.2. Conventional Water Quality Parameters 227
3.4.5.2.3. Trace Metals 227

3.5. Eel River WMA/HU 228

3.5.1. Upper Main Eel River HA 229
3.5.1.1. Field Parameters 230
3.5.1.2. Conventional Water Quality Parameters 231
3.5.1.3. Trace Metals 231
3.5.1.4. Pesticides, PCBs, and Phenols 232
3.5.2. Middle Fork Eel River HA 233
3.5.2.1. Field Parameters 234
3.5.2.2. Conventional Water Quality Parameters 235
3.5.2.3. Trace Metals 235
3.5.3. North Fork Eel River HA 238
3.5.3.1. Field Parameters 239
3.5.3.2. Conventional Water Quality Parameters 239
3.5.3.3. Trace Metals 240
3.5.3.4. Pesticides, PCBs, and Phenols 241
3.5.4. Middle Main Eel River HA 242
3.5.4.1. Field Parameters 243
3.5.4.2. Conventional Water Quality Parameters 243

3.5.4.3. Trace Metals 244
3.5.4.4. Pesticides, PCBs, and Phenols 245
3.5.5. South Fork Eel River HA 247
3.5.5.1. South Fork Eel River 248
3.5.5.1.1. Field Parameters 248
3.5.5.1.2. Conventional Water Quality Parameters 249
3.5.5.1.3. Trace Metals 250
3.5.5.1.4. Pesticides, PCBs, and Phenols 251
3.5.5.2. Elder Creek 252
3.5.5.2.1. Field Parameters 253
3.5.5.2.2. Conventional Water Quality Parameters 253
3.5.5.2.3. Trace Metals 253
3.5.5.2.4. Pesticides, PCBs and Phenols 254
3.5.6. Lower Eel River HA 255
3.5.6.1. Field Parameters 256
3.5.6.2. Conventional Water Quality Parameters 256
3.5.6.3. Trace Metals 257
3.5.6.4. Pesticides, PCBs, and Phenols 258
3.5.7. Van Duzen River HA 260
3.5.7.1. Field Parameters 261
3.5.7.2. Conventional Water Quality Parameters 262
3.5.7.3. Trace Metals 262
3.5.8. Trend Monitoring – Eel River WMA 263
3.5.8.1. Field Parameters 263
3.5.8.2. Conventional Water Quality Parameters 264
3.5.8.3. Trace Metals 264

3.6. North Coast Rivers WMA 265

3.6.1. Smith River HU 267
3.6.1.1. Field Parameters 268
3.6.1.2. Conventional Water Quality Parameters 268
3.6.1.3. Trace Metals 269
3.6.1.4. Pesticides, PCBs, and Phenols 270
3.6.2. Cape Mendocino HU (Mattole River) 272
3.6.2.1. Field Parameters 274
3.6.2.2. Conventional Water Quality Parameters 274
3.6.2.3. Trace Metals 274
3.6.3. Mendocino Coast HU 275
3.6.3.1. Rockport HA 276
3.6.3.1.1. Field Parameters 277
3.6.3.1.2. Conventional Water Quality Parameters 277
3.6.3.1.3. Trace Metals 277
3.6.3.2. Noyo River HA 278
3.6.3.2.1. Field Parameters 279
3.6.3.2.2. Conventional Water Quality Parameters 279

3.6.3.2.3. Trace Metals 279
3.6.3.3. Big River HA 280
3.6.3.3.1. Field Parameters 281
3.6.3.3.2. Conventional Water Quality Parameters 281
3.6.3.3.3. Trace Metals 282
3.6.3.4. Albion River HA 283
3.6.3.4.1. Field Parameters 284
3.6.3.4.2. Conventional Water Quality Parameters 284
3.6.3.4.3. Trace Metals 284
3.6.3.5. Navarro River HA 285
3.6.3.5.1. Field Parameters 286
3.6.3.5.2. Conventional Water Quality Parameters 287
3.6.3.5.3. Trace Metals 287
3.6.3.6. Point Arena HA 288
3.6.3.6.1. Field Parameters 289
3.6.3.6.2. Conventional Water Quality Parameters 289
3.6.3.6.3. Trace Metals 289
3.6.3.7. Garcia River HA 290
3.6.3.7.1. Field Parameters 291
3.6.3.7.2. Conventional Water Quality Parameters 291
3.6.3.7.3. Trace Metals 291
3.6.3.8. Gualala River HA 292
3.6.3.8.1. Field Parameters 293
3.6.3.8.2. Conventional Water Quality Parameters 293
3.6.3.8.3. Trace Metals 294
3.6.3.8.4. Pesticides, PCBs, and Phenols 295
3.6.4. Trend Monitoring – North Coast Rivers WMA 296
3.6.4.1. Smith River 296
3.6.4.1.1. Field Parameters 296
3.6.4.1.2. Conventional Water Quality Parameters 296
3.6.4.1.3. Trace Metals 296
3.6.4.2. Gualala River 296
3.6.4.2.1. Field Parameters 296
3.6.4.2.2. Conventional Water Quality Parameters 297
3.6.4.2.3. Trace Metals 297

3.7. Russian/Bodega WMA 297

3.7.1. Upper Russian River HA 299
3.7.1.1. West Fork Russian River 300
3.7.1.1.1. Field Parameters 300
3.7.1.1.2. Conventional Water Quality Parameters 301
3.7.1.1.3. Trace Metals 301
3.7.1.1.4. Pesticides, PCBs, and Phenols 302
3.7.1.2. East Fork Russian River 302
3.7.1.2.1. Field Parameters 303

3.7.1.2.2. Conventional Water Quality Parameters 303
3.7.1.2.3. Trace Metals 304
3.7.1.2.4. Pesticides, PCBs, and Phenols 305
3.7.1.3. Mainstem Russian River 305
3.7.1.3.1. Field Parameters 306
3.7.1.3.2. Conventional Water Quality Parameters 306
3.7.1.3.3. Trace Metals 307
3.7.1.3.4. Pesticides, PCBs, and Phenols 308
3.7.2. Middle Russian River HA 309
3.7.2.1. Mainstem Russian River 310
3.7.2.1.1. Field Parameters 311
3.7.2.1.2. Conventional Water Quality Parameters 312
3.7.2.1.3. Trace Metals 313
3.7.2.1.4. Pesticides, PCBs, and Phenols 314
3.7.2.2. Big Sulphur Creek 315
3.7.2.2.1. Field Parameters 315
3.7.2.2.2. Conventional Water Quality Parameters 316
3.7.2.2.3. Trace Metals 317
3.7.2.2.4. Pesticides, PCBs, and Phenols 317
3.7.2.3. Dry Creek 318
3.7.2.3.1. Field Parameters 318
3.7.2.3.2. Conventional Water Quality Parameters 318
3.7.2.3.3. Trace Metals 319
3.7.2.3.4. Pesticides, PCBs, and Phenols 320
3.7.2.4. Laguna de Santa Rosa 320
3.7.2.4.1. Field Parameters 320
3.7.2.4.2. Conventional Water Quality Parameters 321
3.7.2.4.3. Trace Metals 322
3.7.2.4.4. Pesticides, PCBs, and Phenols 322
3.7.3. Lower Russian River HA 324
3.7.3.1. Mainstem Russian River 325
3.7.3.1.1. Field Parameters 325
3.7.3.1.2. Conventional Water Quality Parameters 326
3.7.3.1.3. Trace Metals 326
3.7.3.1.4. Pesticides, PCBs, and Phenols 328
3.7.3.2. Austin Creek 330
3.7.3.2.1. Field Parameters 330
3.7.3.2.2. Conventional Water Quality Parameters 330
3.7.3.2.3. Trace Metals 331
3.7.3.2.4. Pesticides, PCBs, and Phenols 331
3.7.4. Trend Monitoring – Russian River WMA 332
3.7.4.1. Field Parameters 332
3.7.4.2. Conventional Water Quality Parameters 332
3.7.4.3. Trace Metals 333

4. References ____ 334

Appendix A. Quality Assurance and Quality Control ____ A-1

Appendix B. Analytical Information ____ B-1

Appendix C. Metals-Hardness Graphs ____ C-1

Appendix D. Reviewer Comments and Response ____ D-1

List of Tables

Table 1 Schedule of NCWAP assessments as originally envisioned and after programmatic changes. 4
Table 2 Original Schedule of TMDL completions (1997 Consent Decree Waterbodies) 5
Table 3 Salmonid populations listed as threatened or endangered under the Federal Endangered Species Act. 18
Table 4 Basin Plan and Drinking Water standards for field-measurable parameters and dissolved solids 162
Table 5 Freshwater Aquatic Life Protection Criteria and USEPA Nutrient Recommendations 163
Table 6 Klamath River WMA/HU. Station types, locations and sampling periods 165
Table 7 Summary of sample types, sample numbers, detections, and objective exceedances in the Upper Klamath River HA 167
Table 8 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Upper Klamath River HA 169
Table 9 Summary of sample types, sample numbers, and objective exceedances in the Middle Klamath River HA 171
Table 10 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Middle Klamath River HA 173
Table 11 Summary of sample types, sample numbers, and objective exceedances in the Shasta River HA - above Dwinnell Reservoir 175
Table 12 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Shasta River HA - above Dwinnell Reservoir 176
Table 13 Summary of sample types, sample numbers, and objective exceedances in the Shasta River HA - below Dwinnell Reservoir 178
Table 14 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Shasta River below Dwinnell Reservoir 180
Table 15 Summary of sample types, sample numbers, and objective exceedances in the Shasta River HA - Yreka Creek 182
Table 16 Summary of sample types, sample numbers, and objective exceedances in the Scott River HA 186
Table 17 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Scott River HA 188
Table 18 Summary of sample types, sample numbers, and objective exceedances in the Lower Klamath River HA 191
Table 19 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Lower Klamath River HA 193
Table 20 Trinity River WMA/HU station types, locations and sampling periods 196
Table 21 Summary of sample types, sample numbers, and objective exceedances in the Middle Trinity River HA 198
Table 22 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Middle Trinity River HA 199
Table 23 Summary of sample types, sample numbers, and objective exceedances in the South Fork Trinity River HA 201
Table 24 Trace metal exceedances of the NCR Basin Plan and Drinking Water

standards in the South Fork Trinity River HA 202
Table 25 Summary of sample types, sample numbers, and objective exceedances in the Lower Trinity River HA 205
Table 26 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Lower Trinity River HA 207
Table 27 Humboldt Bay WMA station types, locations and sampling periods 208
Table 28 Summary of sample types, sample numbers, and objective exceedances in the Redwood Creek HU 210
Table 29 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Redwood Creek HU 212
Table 30 Summary of sample types, sample numbers, and objective exceedances in the Trinidad HU – Little River 214
Table 31 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Trinidad HU – Little River 215
Table 32 Summary of sample types, sample numbers, and objective exceedances in the Mad River HU - above Ruth Lake 217
Table 33 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Mad River HU - above Ruth Lake 218
Table 34 Summary of sample types, sample numbers, and objective exceedances in the Mad River HU - below Ruth Lake 219
Table 35 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Mad River HU - below Ruth Lake 222
Table 36 Summary of sample types, sample numbers, and objective exceedances in the Eureka Plain HU 224
Table 37 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Eureka Plain HU 226
Table 38 Eel River WMA station types, locations and sampling periods 228
Table 39 Summary of sample types, sample numbers, and objective exceedances in the Upper Main Eel River HA 230
Table 40 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Upper Main Eel River HA 232
Table 41 Summary of sample types, sample numbers, and objective exceedances in the Middle Fork Eel River HA 234
Table 42 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Middle Fork Eel River HA 237
Table 43 Summary of sample types, sample numbers, and objective exceedances in the North Fork Eel River HA 239
Table 44 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the North Fork Eel River HA 241
Table 45 Summary of sample types, sample numbers, and objective exceedances in the Middle Main Eel River HA 243
Table 46 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Middle Main Eel River HA 245
Table 47 Summary of sample types, sample numbers, and objective exceedances in the South Fork Eel River HA 248
Table 48 Trace metal exceedances of the NCR Basin Plan and Drinking Water

standards in the South Fork Eel River HA 251
Table 49 Summary of sample types, sample numbers, and objective exceedances in the South Fork Eel River HA - Elder Creek 253
Table 50 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the South Fork Eel River HA - Elder Creek 254
Table 51 Summary of sample types, sample numbers, and objective exceedances in the Lower Eel River HA 256
Table 52 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Lower Eel River HA 258
Table 53 Summary of sample types, sample numbers, and objective exceedances in the Van Duzen River HA 261
Table 54 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Van Duzen River HA 263
Table 55 North Coast Rivers WMA station types, locations and sampling periods 265
Table 56 Summary of sample types, sample numbers, and objective exceedances in the Smith River HU 268
Table 57 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Smith River HU 270
Table 58 Summary of sample types, sample numbers, and objective exceedances in the Cape Mendocino HU - Mattole River 273
Table 59 Summary of sample types, sample numbers, and objective exceedances in the Rockport HA 277
Table 60 Summary of sample types, sample numbers, and objective exceedances in the Noyo River HA 279
Table 61 Summary of sample types, sample numbers, and objective exceedances in the Big River HA 281
Table 62 Summary of sample types, sample numbers, and objective exceedances in the Albion River HA 284
Table 63 Summary of sample types, sample numbers, and objective exceedances in the Navarro River HA 286
Table 64 Summary of sample types, sample numbers, and objective exceedances in the Point Arena HA - Greenwood Creek 289
Table 65 Summary of sample types, sample numbers, and objective exceedances in the Garcia River HA 291
Table 66 Summary of sample types, sample numbers, and objective exceedances in the Gualala River HA 293
Table 67 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Gualala River HA 295
Table 68 Russian/Bodega WMA. Station types, locations and sampling periods 298
Table 69 Summary of sample types, sample numbers, and objective exceedances in the Upper Russian River HA - West Fork Russian River 300
Table 70 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Upper Russian River HA – West Fork Russian River 302
Table 71 Summary of sample types, sample numbers, and objective exceedances in the Upper Russian River HA – East Fork Russian River 303
Table 72 Trace metal exceedances of the NCR Basin Plan and Drinking Water

standards in the Upper Russian River HA – East Fork Russian River 305
Table 73 Summary of sample types, sample numbers, and objective exceedances in the Upper Russian River HA – Mainstem Russian River 306
Table 74 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Upper Russian River HA – Mainstem Russian River 307
Table 75 Summary of sample types, sample numbers, and objective exceedances in the Middle Russian River HA – Mainstem Russian River 311
Table 76 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Middle Russian River HA – Mainstem Russian River 314
Table 77 Summary of sample types, sample numbers, and objective exceedances in the Middle Russian River HA – Big Sulphur Creek 316
Table 78 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Middle Russian River HA – Big Sulphur Creek 317
Table 79 Summary of sample types, sample numbers, and objective exceedances in the Middle Russian River HA – Dry Creek 318
Table 80 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Middle Russian River HA – Dry Creek 319
Table 81 Summary of sample types, sample numbers, and objective exceedances in the Middle Russian River HA – Laguna de Santa Rosa 320
Table 82 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Middle Russian River HA – Laguna de Santa Rosa 322
Table 83 Summary of sample types, sample numbers, and objective exceedances in the Lower Russian River HA – Mainstem Russian River 325
Table 84 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Lower Russian River HA – Mainstem Russian River 328
Table 85 Summary of sample types, sample numbers, and objective exceedances in the Lower Russian River HA – Austin Creek 330
Table 86 Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Lower Russian River HA – Austin Creek 331

List of Acronyms

ARM	Aggregate Resources Management
ASBS	Areas of Special Biological Significance
BLM	Bureau of Land Management
CCA	Critical Coastal Area
CDF	California Department of Forestry and Fire Protection
CDFG	California Department of Fish and Game
CDHS	California Department of Health Services
CTR	California Toxics Rule
CVP	Central Valley Project
CWA	Clean Water Act
CZM	Coastal Zone Management
DO	Dissolved oxygen
DWR	Department of Water Resources
ESHA	Environmentally Sensitive Habitat Areas
ESU	Evolutionarily Significant Unit
FESA	Federal Endangered Species Act
FY	Fiscal Year
HA	Hydrologic Area
HSA	Hydrologic Sub-Area
HU	Hydrologic Unit
LWD	Large woody debris
MDL	Method Detection Limit
MRC	Mendocino Redwood Company
MWAT	Maximum weekly average temperatures
MWCD	Montague Water Conservation District
NCR	North Coast Region
NCRWQCB	North Coast Regional Water Quality Control Board
NCWAP	North Coast Watershed Assessment Program
NEP	National Estuary Program
NERR	National Estuarine Research Reserve
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NRA	National Recreation Area
NTU	Nephelometric turbidity unit
PALCO	Pacific Lumber Company
PCB	Polychoronatedbiphenol
PCE	Perchloroethylene
PCP	Pentachlorophenol
PG&E	Pacific Gas and Electric
POTW	Publicly Owned Treatment Works
PVP	Potter Valley Project
RL	Reporting Limit
RM	River mile

RNSP	Redwood National and State Parks
RWQCB	Regional Water Quality Control Board
SCWA	Sonoma County Water Agency
SPW	Super Planning Watershed
SWAMP	Surface Water Ambient Monitoring Program
SWQPA	State Water Quality Protection Area
SWRCB	State Water Resources Control Board
TMDL	Total Maximum Daily Load
TPZ	Timber Production Zone
TRD	Trinity River Diversion
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geologic Survey
VOC	Volatile organic compound
WMA	Watershed Management Area
YOY	Young of year

Beneficial Use Designations

AGR	agricultural supply
COLD	cold freshwater habitat
COMM	commercial or sport fishing
EST	estuarine habitat
FRSH	freshwater replenishment
GWR	groundwater recharge
IND	industrial service supply
MAR	marine habitat
MIGR	migration of aquatic organisms
MUN	municipal and domestic supply
NAV	navigation
RARE	rare, threatened, or endangered species
REC-1	water contact recreation
REC-2	non-contact water recreation
SHELL	shellfish harvesting
SPWN	spawning, reproduction, and/or early development
WARM	warm freshwater habitat
WILD	wildlife habitat

Units

af y^{-1}	acre-feet per year
cfs	cubic feet per second
mi	mile(s)
miles mi^{-2}	miles per square mile
mg/L	milligrams per liter
ng/L	nanograms per liter
t mi^{-2} yr^{-1}	tons per square mile per year
ug/L	micrograms per liter

1. Introduction

The Porter-Cologne Water Quality Control Act and the federal Clean Water Act (CWA) direct that water quality protection programs be implemented to protect and restore the integrity of waters of the State. California Assembly Bill 982 (Water Code Section 13192; Statutes of 1999) requires the State Water Resources Control Board (SWRCB) to assess and report on the State's water quality monitoring programs.

AB 982 required the SWRCB to prepare a proposal for a comprehensive surface water quality monitoring program. The SWRCB report to the Legislature entitled, "Proposal for a Comprehensive Ambient Surface Water Quality Monitoring Program" (November 2000 Legislative Report) proposed to restructure existing water quality monitoring programs into a new program, the Surface Water Ambient Monitoring Program (SWAMP). The SWAMP was envisioned as an ambient monitoring program that would be independent of, yet coordinated with, other water quality regulatory programs, and serve as a measure of: (1) the overall status of the beneficial uses of the State's water resources, and (2) the overall effectiveness of the prevention, regulatory, and remedial actions taken by the State Water Board and the nine Regional Water Quality Control Boards (RWQCB). To implement this directive, funding for ambient surface water quality monitoring was allocated to the State Water Board (and thereby to the Regional Water Boards) beginning in State Fiscal Year 2000–2001.

1.1. Overview of the Surface Water Ambient Monitoring Program

The SWAMP calls for a combination of (1) regional monitoring to provide a picture of the status and trends in water quality and (2) site-specific monitoring to better characterize areas of degraded water quality versus those locations where water quality is suitable. This approach balances the two important monitoring needs of the SWRCB and serves as a unifying framework for the monitoring activities being conducted by the SWRCB and RWQCBs. The coordinated SWRCB and RWQCB involvement in study design and sampling is critical to providing a comprehensive, effective monitoring program that results in identifying degrading and improving conditions in waterways.

1.1.1. Statewide SWAMP Program goals

The SWAMP is a comprehensive environmental monitoring program focused on providing the information the SWRCB and RWQCBs need to effectively manage the State's water resources. The SWAMP integrates all existing water quality monitoring occurring at the SWRCB and RWQCBs and coordinates with monitoring programs at other agencies, permitted facilities, and citizens groups. The RWQCBs establish monitoring priorities for the water bodies within their jurisdictions, in coordination with the SWRCB. This monitoring is done in accordance with protocols and methodologies laid out in the SWAMP program.

The SWAMP was created to meet four goals:

1. Establish an ambient monitoring program that addresses all hydrologic units of the State using consistent and objective monitoring, sampling and analytical methods; consistent

data quality assurance protocols; and centralized data management. Provide a comprehensive environmental monitoring program that monitors and interprets that data for each hydrologic unit at least one time every five years.

2. Document ambient water quality conditions in potentially clean and polluted areas. The scale for these assessments ranges from the site-specific to statewide.

3. Identify specific water quality problems preventing the SWRCB, RWQCB's, and the public from realizing beneficial uses of water in targeted watersheds.

4. Provide the data to evaluate the overall effectiveness of water quality regulatory programs in protecting beneficial uses of waters of the State.

The SWAMP program is essential to the success of the Total Maximum Daily Load (TMDL) program. Extensive monitoring data and information on the quality of the waters of the State are the backbone of the TMDL program. The SWAMP program also produces water quality data to improve RWQCB's abilities to place waterbodies on and remove them from the 303(d) List.

1.1.2. The SWAMP Goals in the North Coast Region FYs 2000-2006

In the North Coast Region (NCR), the SWAMP uses a two-component approach to address regional and site-specific monitoring: 1) long-term monitoring sites for trend analysis, and 2) rotating intensive basin surveys. The rotation schedule is designed to collect and analyze data within each hydrologic unit on at least one occasion every five years. The SWAMP was also closely coordinated with the North Coast Watershed Assessment Program (NCWAP) and the TMDL program schedule to provide additional and current information on water quality parameters to the NCWAP assessment and the TMDL process.

1.1.3. Regional Monitoring

The overall goal of the SWAMP's Regional Monitoring is to develop a statewide and regionwide picture of the status and trends of the quality of California's surface water resources. It is intended that this portion of the SWAMP will be implemented in each hydrologic unit (including coastal waters) of the State at least one time every five years. This portion of the SWAMP is focused on collecting information on water bodies for which the State presently has little information and to determine the effects of diffuse sources of pollution and the baseline conditions of potentially clean areas.

The SWAMP implements a rotating basin framework where each Region will be divided into five areas consisting of one or more hydrologic units. The major watercourses and tributaries in one of these areas would be monitored for a one-year period at least once every five years.

The regional monitoring component will allow the SWRCB and RWQCBs to complete the comprehensive monitoring required to satisfy CWA Section 305(b) requirements and will contribute to the achievement of the State's various water quality programs. These programs allow the State and USEPA to track trends in water quality. This in turn may be used to track the effectiveness of the SWRCB and RWQCB water quality control programs. The regional monitoring component complements the site-specific monitoring effort in two ways. First, it provides additional information that can be used to put the data from targeted sites into a broader regional context. Equally important, the regional component can serve as a periodic screening mechanism to identify new problem areas that were not previously known.

1.1.4. Site-specific Monitoring

The overall goal of the SWAMP's site-specific monitoring is to develop information on sites that are (1) known or suspected to have water quality problems and (2) known or suspected to have good water quality. This portion of the SWAMP is targeted at specific locations in each region. The SWAMP is focused on collecting information from sites in water bodies of the State that could be potentially listed or delisted under CWA Section 303(d). The RWQCBs are given significant flexibility to select the specific locations to be monitored. The RWQCBs may, at their discretion, perform monitoring at sites with good water quality to determine baseline conditions.

The site-specific monitoring provides flexibility for RWQCBs to focus monitoring resources in specific waterbodies to better understand what the water quality issues are and how they are impacting beneficial uses. Site-specific monitoring allows for the verification of problems identified in statewide surveys. Additionally, locations may be monitored to document their pristine water quality for use in determining background or natural conditions. This assessment and documentation of a site's water quality status is a key component of the Section 303(d) listing process.

1.2. Related Water Quality Programs

1.2.1. North Coast Watershed Assessment Program (NCWAP) 1999-2003

In 1999, the California Resources Agency and the California Environmental Protection Agency developed an interagency watershed assessment program for California's North Coast. The purpose of the program was to develop consistent, scientifically credible information to guide landowners, agencies, watershed groups, and other stakeholders in their efforts to improve watershed and fisheries conditions. The resulting NCWAP was to provide a process for collecting and analyzing information to answer a set of critical questions designed to characterize current and past watershed conditions. It was designed to cover approximately 6.5 million acres of private and state lands within the 12 million acre North Coast Hydrologic Region. NCWAP was scheduled to assess approximately one million acres a year for a 7-year period. Programmatic delays and alterations to the NCWAP necessitated changes to the NCWAP schedule as outlined in Table 1. The State Legislature ceased to fund NCWAP after FY 2002-03.

Table 1. Schedule of NCWAP assessments as originally envisioned and after programmatic changes.

NCWAP Watersheds	Watershed Management Area (WMA)	Synthesis Reports were to be completed by December of given year								
		Original NCWAP Schedule (2001)			Revised NCWAP Schedule (2002)			Revised NCWAP Schedule (2003)		
		2001	2002	2003	2002	2003	2004	2003	2004	
Redwood Creek	Humboldt Bay	X			X			X		
Gualala River	North Coast Rivers	X			X			X		
Mattole River	North Coast Rivers	X			X			X		
Big River	North Coast Rivers	X			X			X		
Albion River	North Coast Rivers	X			X			X		
Middle Klamath River	Klamath River					X				
Scott River	Klamath River	X					X		X	
Shasta River	Klamath River	X					X			
North Fork Eel River	Eel River	X								
Middle Fork Eel River	Eel River		X			X			X	
Trinity River	Trinity River		X							
North Coastal Streams	North Coast Rivers		X							
Upper Mainstem Eel River	Eel River			X						
Middle Mainstem Eel River	Eel River			X						
South Coastal Streams	North Coast Rivers			X						

1.2.2. Total Maximum Daily Load (TMDL) program

The Federal Clean Water Act (CWA) contains two strategies for managing water quality. One, a technology-based approach that envisions requirements to maintain a minimum level of pollutant management using the best available technology. The other, a water quality-based approach, relies on evaluating the condition of surface waters and setting limitations on the amount of pollution that the water can be exposed to without adversely affecting the beneficial uses of those waters. Section 303(d) of the CWA bridges these two strategies. Section 303(d) requires that the states make a list of waters that are not attaining standards after the technology-based limits are put into place. For waters on this list (and where the US EPA administrator deems they are appropriate), the states are to develop TMDLs. A TMDL must account for all sources of the pollutants that caused the water to be listed. Federal regulations require that the TMDL, at a minimum, account for contributions from point sources (federally permitted discharges) and contributions from nonpoint sources.

The requirement to develop TMDLs has been in the Clean Water Act since 1972. In the 1970's, point source pollution was considered the most significant problem affecting water quality in rivers and streams. During the 25 years following the enactment of the Clean Water Act, the technology-based effort received the highest priority and the vast majority of funding. In California, the State and Regional Boards also used state authorities provided by the Porter-Cologne Act to implement smaller scale corrective actions for nonpoint source pollution problems.

By the late 1980s, programs focusing on treatment facilities resulted in better controls of point source pollution. However, the concerns over general water quality were elevated again due to the growing impacts of nonpoint source pollution. In 1996, the Coast Action Group and the

Sierra Club Legal Defense Fund sued the United States Environmental Protection Agency for the development of Clean Water Act Section 303(d) TMDLs, as identified in the Consent Decree, Pacific Coast Federation of Fishermen's Associations v. Marcus, U.S. District Court for the Northern District of California, No. 95-4474 MHP, requiring timely development of TMDLs for certain named watersheds in the North Coast Region. An abbreviated schedule and listing of North Coast watersheds are identified in Table 2, however many of the timelines have changed from this original schedule.

Table 2. Original Schedule of TMDL completions (1997 Consent Decree Waterbodies)

Waterbody	Lead Agency	Watershed Management Area (WMA)	2001	2002	2003	2004	2005	2006	2007
Consent Decree Watersheds									
Trinity River	EPA	Trinity River	X						
Albion River	EPA	North Coast Rivers	X						
Gualala River	NCRWQCB	North Coast Rivers	X						
Big River	NCRWQCB	North Coast Rivers	X						
Mattole River	NCRWQCB	North Coast Rivers		X					
North Fork Eel River	EPA	Eel River		X					
Middle Fork Eel River	EPA	Eel River			X				
Upper Eel River	EPA	Eel River				X			
Upper Lost River	NCRWQCB	Klamath River				X			
Lower Lost River	NCRWQCB	Klamath River				X			
Klamath River	NCRWQCB	Klamath River				X			
Salmon River	NCRWQCB	Klamath River				X	X		
Scott River	NCRWQCB	Klamath River					X		
Shasta River	NCRWQCB	Klamath River					X		
Middle Eel River	EPA	Eel River					X		
Lower Eel River	EPA	Eel River						X	

1.3._______The SWAMP in the North Coast Region

The watershed evaluation process employed by the NCR is responsive to the Watershed Management Initiative as called for in the State Water Resources Control Board Strategic Plan (June 22, 1995). It essentially involved designating Watershed Management Areas (WMAs) and performing the following steps:

- Assessing water quality related issues on a watershed basis
- Developing prioritized water quality goals for watersheds from the issues
- Addressing the issues with various programs through a multi-year implementation strategy
- Evaluating progress at the end of a specified time period

The NCR uses a two-component approach to address the regional and site-specific monitoring requirements of the SWAMP:

1) Long-term monitoring sites for trend analysis.
2) Rotating intensive basin surveys on a planned basis, as resources allow.

This allows the NCR to focus on a few watersheds at a time, which is considered the best use of resources. Additionally, monitoring will cycle through WMAs every five to seven years as identified by the guiding goals of the SWAMP. The monitoring cycles for the WMAs are prioritized based on a number of factors, including the known water quality impairment, adequacy of existing data, the extent of development and/or land use change, likelihood for problems to increase, and the availability of management tools for the problems.

The overall goal for the SWAMP is to develop site-specific information on locations that are

- Known or suspected to have water quality problems.
- Known or suspected to have good water quality.

The SWAMP monitoring will target specific locations in each WMA, and collect information from sites in waterbodies of the State to support remedial actions as well as the listing/delisting process under Clean Water Act Section 303(d). Information collected through this program was used in the development of NCWAP assessment products and is currently being used in the development of TMDLs. In addition, the SWAMP coordinates with other programs within the Regional Water Boards purview.

1.3.1. Long-term Trend Monitoring Station Selection

Long-term monitoring sites were chosen from both impaired (303(d) listed) and unimpaired (non 303(d) listed) waterbodies within each of the WMAs. This component of the SWAMP monitoring plan is designed to monitor trends in water quality to evaluate improvement or degradation to water quality through time. The long-term monitoring sites are located at the bottom of large drainage areas in order to reflect the impacts of management activities occurring within the basins.

1.3.2. Rotating Monitoring Station Selection.

The rotating basin component in the NCR was driven by the NCWAP and TMDL programs. In FY2000-01, the NCR focused on the Coastal Watersheds WMA to gather data for NCWAP and the TMDL program and collect baseline information on water quality conditions of these watersheds. In FY 2000-01, the SWAMP also focused on the Russian River WMA to collect background and baseline information. In FY 2001-02, the SWAMP in the NCR focused on four WMAs: Trinity River, Eel River, Klamath River, and Humboldt Bay. The Trinity River WMA and Eel River WMA were monitored to provide information to the NCWAP process. Data collected from the Eel River WMA and Klamath River WMA was used for the TMDL process, and the Humboldt Bay WMA was monitored to provide baseline information. During FY 2002-03 the NCR focused on collecting additional data in the Trinity River WMA and Klamath River WMA for NCWAP, and data collected in the Klamath River WMA was provided to the TMDL program. In FY 2004-05, NCR focused the rotating basin approach on the Russian River WMA, providing data for upcoming TMDLs. In FY 2005-06, funding limitations necessitated the abandonment of the rotating basin approach and focus exclusively on maintaining our long-term monitoring sites.

1.4 Overview of the North Coast Region

The text presented within this section includes information that has been previously published by North Coast Regional Water Quality Control Board 2005 (Watershed Planning Chapter), USEPA 1999 (Noyo River Total Maximum Daily Load for Sediment), Entrix et al. 1998 (Navarro River Restoration Plan), USEPA 2001 (Gualala River Total Maximum Daily Load for Sediment), North Coast Regional Water Quality Control Board 2001 (Technical Support Document for the Gualala River Watershed Water Quality Attainment Action Plan for Sediment) and references included therein.

The NCR comprises all of the watershed basins draining into the Pacific Ocean from the California-Oregon state line (including Lower Klamath Lake and Lost River basins) south to the southern boundary of the watershed of the Estero de San Antonio and Stemple Creek in Marin and Sonoma Counties (Figure 1). The NCR covers all of Del Norte, Humboldt, Trinity, and Mendocino Counties, major portions of Siskiyou and Sonoma Counties, and small portions of Modoc, Glenn, Lake, and Marin Counties. The NCR encompasses a total area of approximately 19,390 mi^2; including 340 miles of scenic coastline, 362 miles of designated Wild and Scenic Rivers, 416 mi^2 of National Recreation Areas, and 1627 mi^2 of National Wilderness Areas, as well as urbanized and agricultural areas.

1.4.1. Natural History of the North Coast Region

The NCR is characterized by steep, mountainous forested terrain with distinct temperature and precipitation zones. The climate along the coast is mild and foggy, experiencing moderate variations in seasonal temperatures. In these temperate areas, coastal redwoods and Douglas fir-tanoak forests dominate the landscape. Inland areas, away from the coastal influence, undergo more extreme seasonal temperature ranges with seasonal maximums of more than 100°F. Oaks and pines interspersed with grasslands and chaparral are more common inland. The region experiences significant amounts of rainfall, with precipitation exceeding 100 inches annually in coastal areas, and can have as little as 10 inches annually fall on the Modoc Plateau. This large amount of precipitation can create significant flooding in the region, and has produced three devastating floods in the 20th century.

Distinct temperature zones characterize the NCR. Along the coast, the climate is moderate and foggy and the temperature variation is not great. For example, at Eureka, the seasonal variation in temperature has not exceeded 63°F for the period of record. Inland, however, seasonal temperature maximums in excess of 100°F have been recorded.

Rocks of the Franciscan Complex, many of which are highly erodible and mechanically weak, underlie many of the watersheds in the NCR. The Franciscan Complex is composed mainly of marine sandstone and shale with lesser amounts of marine chert and basaltic rocks some of which have been altered to serpentinite. Significant seismic activity in the area further weakens the sedimentary rocks. Thus, the watersheds are naturally prone to storm-induced erosion and other natural sediment delivery processes, such as mass movement (also known as mass wasting, or landslides), and produce large amounts of sediment even in the absence of human activity.

The NCR is rich in wildlife resources. Deer, elk, bears, mountain lions, and many upland bird and mammal species can be found in the region. Additionally, the region is home to several species listed as threatened or endangered under the Federal Endangered Species Act (FESA). Aquatic systems are a valuable resource. Tidelands and marshes provide important nursery and foraging habitat for many species of waterfowl and shore birds, fish, and marine invertebrates. Numerous streams, rivers, and reservoirs support both coldwater and warmwater fish.

The North Coast Regional Water Quality Control Board (NCRWQCB) faces numerous water quality issues. Overarching issues are protection of the coastline, protection and restoration of anadromous fish populations, protection of drinking water, and pollution prevention. More specifically, water quality problems include contamination of surface water due to nonpoint source pollution from storm water runoff, erosion and sedimentation (roads, agriculture, and timber harvest), failing septic tanks, channel modification, gravel mining, dairies, and MTBE and dioxin contamination.

Ground water contamination from perchloroethylene (PCE) from drycleaners, leaking underground tanks containing hydrocarbons and PCEs, and health and safety issues from contaminated areas that are open to the public are also priority issues. High priority water quality problems due to point sources include chronic violations by some Publicly-Owned Treatment Works (POTWs) and lack of permit compliance. Lack of or limited funding for water quality monitoring and watershed assessment compounds the difficulty of addressing these issues.

1.4.2. Salmonids

Salmonids are particularly important in the NCR. The family Salmonidae includes salmon, trout, and char. In the NCR, the most common salmonids are coho (or silver) salmon (Oncorhynchus kisutch), Chinook (or king) salmon (O. tshawytscha), steelhead trout (O. mykiss), and coastal cutthroat trout (O. clarki). Chum (or dog) salmon (O. keta), pink (or humpback) salmon (O. gorbuscha), and sockeye (or red) salmon (O. nerka) are rare in the NCR. These fish are anadromous, i.e., they are born in fresh water, migrate to the ocean to mature, and return to their natal streams to spawn. Many populations of cutthroat trout are anadromous; some are freshwater residents, while others travel between the brackish estuaries and the fresh water tributaries. Non-anadromous fish, such as rainbow trout (O. mykiss), reside in fresh water streams their whole lives.

Anadromous salmonids have a five-stage life cycle:

1) Adult salmonids lay their eggs in nests (known as redds) in clean streams. The eggs incubate for about 35-60 days depending on water temperature.
2) The eggs hatch into alevins, which live in the gravel for two to three weeks until their yolk sacs are absorbed. During these first two lifestages, the eggs and alevins are very sensitive to intergravel water quality conditions which may become impaired due to siltation, depressed oxygen concentrations, desiccation, nest movement, and other water quality impairments. Once the yolk sacs are absorbed, the young fish (known as fry at

this stage) emerge from the gravel and enter the stream to begin the fresh water rearing stage, seeking shelter in pools and adjacent wetlands; pools and banks provide the fry with cool areas of slow moving water needed by the younger fish.

3) The juvenile fish leave their natal streams and migrate downstream to the estuary where they undergo smoltification, the process of physiological transformations that will allow them to survive in the saline environment of the ocean. Smolts may reside in the estuary to feed and adjust to saltwater for up to a year before continuing on to the ocean. Residence in the estuary may be particularly important for Chinook and steelhead in terms of growth, survival, and reproductive fitness.
4) The juvenile fish mature in the ocean.
5) Adult fish return to their home stream to spawn. Pacific salmonids, with the exception of steelhead and cutthroat trout, die after spawning; their total energies are devoted to producing the next generation, and their bodies help enrich the stream for that generation.

Life history specifics vary with each species. Coho generally spend 18 months in fresh water and 18 months in the ocean, before returning to spawn in their natal stream in their third year. This three-year cycle is fairly rigid, and spawning years with relatively poor reproductive success can result in poor spawning runs three years later. Upstream migration and spawning usually occur in late fall and early winter when low stream flow may limit the ability and extent of their migration. Coho spawn at the heads of riffles, or in riffles, with gravel substrate of sufficient size. This placement may lead to the destruction of the redds during high winter storm flows. The fertilized eggs incubate for 35-50 days with the fry emerging from their gravel nests between early March and mid-May. The fry first congregate along stream margins, in shallow pools, and in backwaters and eddies. As they mature into juveniles, they seek out the heads of deep pools where there is an optimum mix of high food availability and good cover with low swimming effort. In the following April or May, when temperatures are rapidly warming, they migrate downstream to the estuary where they undergo smoltification. After coho return to their natal streams to spawn, they die.

Chinook typically migrate to sea within the first three months of life, but they may spend up to a year in fresh water prior to emigration to the sea and can spend between 2 and 5 years in the ocean before returning to spawn in their natal streams. The average is a three-year cycle and a spawning year with relatively poor reproductive success can result in a poor spawning run three years later. Chinook salmon return to their natal streams or rivers during two distinct “runs,” a spring run and a fall run. Spring run Chinook enter the fresh water system beginning in late spring, continuing through late summer and typically spawn in September and early October. Fall run Chinook typically begin their migration in early to mid-October and proceed to spawn when arriving at their nesting grounds. This usually takes place beginning in late October and is generally completed by early December. Emergence timing of Chinook salmon fry is highly dependent on water temperature during egg incubation (Piper et al., 1982) as well as time of spawning. Fertilized eggs incubate for 35-50 days; fry generally emerge from their gravel nests between early March and mid-May. Chinook salmon tend to use estuaries and coastal areas more extensively than other pacific salmonids for juvenile rearing. Out-migration by Klamath River Chinook has been determined by Sullivan (1989) to follow three separate paths:

- Type I - rear in fresh water for several months before migrating to the ocean during the summer months.
- Type II - rear in fresh water for an extended time period and migrate to the ocean in the autumn or as late as mid-winter. This type includes both juveniles that rear in the tributaries until autumn rains, and those that migrate into the main river in spring or early summer and then rear in either the mainstem or estuary until ocean entry.
- Type III - rear in fresh water through the summer, autumn, and winter before entering the ocean in the following spring as yearlings.

Timing of escapement depends on rearing conditions during the summer months in the mainstem and tributaries. After Chinook return to their natal streams to spawn, they die.

Steelhead have the greatest diversity of life history patterns of any Pacific salmonid species, including varying degrees of anadromy, differences in reproductive biology, and plasticity of life history between generations. They generally spend one to three years in fresh water before migrating to the ocean where they remain for one to two years before returning to spawn for the first time. Steelhead exhibit variability in the state of sexual maturity at the time of river entry and upstream migration. Fall steelhead enter the fresh water system during early summer through late summer, in a sexually immature condition and require several months to mature and spawn. They typically spawn from December through February. Winter steelhead typically begin their migration in November though April and enter the fresh water with well-developed gonads, spawning shortly thereafter. The steelhead migration is timed when stream levels are higher, which may increase the distance upstream they can travel. They spawn in habitat similar to that of coho, except the gravels that steelhead use for spawning may be smaller. They spawn after winter storms, reducing the likelihood that the redds will be washed out. Unlike other anadromous pacific salmonids, steelhead may survive spawning, return to the ocean and spawn in later years. Young of year (YOY) steelhead often utilize riffle and run habitat during the growing season, and move to deeper, slower water habitat during the high flow months. Larger steelhead, usually yearlings or older, have been observed to use heads of pools for feeding. Out-migration typically occurs between March and June

1.4.3. Salmon Habitat and Anthropogenic Impacts

The text presented within this section includes information that has been previously published by Humboldt Watersheds Independent Scientific Review Panel 2003(Phase II Report: Independent Scientific Review Panel on Sediment Impairment and Effects on Beneficial Uses of the Elk River and Stitz, Bear, Jordan and Freshwater Creeks), North Coast Regional Water Quality Control Board 2000 (Reference Document for the Garcia River Watershed Water Quality Attainment Action Plan for Sediment), USEPA 2001 (Gualala River Total Maximum Daily Load for Sediment), North Coast Regional Water Quality Control Board 2001 (Technical Support Document for the Gualala River Watershed Water Quality Attainment Action Plan for Sediment) and references included therein.

The success of salmonids depends on many factors, including:

- Cool stream temperatures.
- Adequate dissolved oxygen (DO) levels in the water column and redds.
- Unimpeded access to abundant, appropriately sized spawning gravels with few fines.
- Adequate food.
- Adequate cover as protection from predators.
- Protection from winter and spring freshets, including adequate availability of deep pools, backwater pools, and in-stream and bank cover.

Waters also need to be free from high concentrations of chemical constituents, pesticides, and toxic substances. These criteria apply at all salmonid life stages.

Temperature influences growth and feeding rates, metabolism, development of embryos and alevins, timing of life history events such as upstream migration, spawning and incubation, fresh water rearing, seaward migration, and the availability of food.

Cool winter water temperatures promote spawning (4.4-9.4 °C) and embryo incubation (4.4-13.3 °C). When fry begin their lives as free-swimming fish in the late spring or early summer, they are immediately confronted with low summer flows and the summer water temperatures. Higher water temperatures can result in decreased growth and reproductive fitness, increased susceptibility to disease, and ultimately, mortality. In warmer water, fish require more abundant food because of increase in metabolic rate. Increased foraging can increase exposure to predation.

Juvenile steelhead can typically tolerate warmer temperatures than coho; temperatures between 12^{o} and 14°C are considered optimal for coho while the preferred temperature range for steelhead is 12.8-15.6°C. Maximum weekly average temperatures (MWAT) over 17°C are unsuitable for coho and over 19°C are unsuitable for steelhead. Salmonids can use areas of cooler water, when they are present, as an avoidance strategy to survive during periods of elevated temperatures. Discrete areas of colder water, called thermal refugia, can be created by tributaries, groundwater seeps, inter-gravel flow, deep pools, and areas separated from currents by obstructions. The existence of these thermal refugia allows salmonids to persist in these reaches of otherwise poor or marginal habitat.

Inadequate DO can cause physiological stress, limiting growth and reproductive fitness and mortality. Minimum oxygen requirements of spawning fish vary from 5.0-6.3 mg/L with at least 80% saturation. Salmonid embryos need inter-gravel oxygen concentrations of 7 to 9 mg/l for successful development and emergence. DO below 6.5-7.0 mg/l can impede adult and juvenile coho swimming performance, DO below 4.5 mg/l can inhibit adult migration (Bjornn and Reiser, 1991 in USFS, 2003), and DO below 4-5 mg/l can cause juvenile coho salmon growth rates, food consumption rates, and efficiency of food utilization to decline. The solubility of DO in water is affected by water temperature; higher temperatures result in lower DO saturation, i.e., less oxygen is needed to saturate the water to the same degree. Generally, rearing salmonids function without impairment when DO is >7.75 mg/l with percent saturation increasing from 76% to 93% as the temperature increases from 0^{o} to 25°C (Bjornn and Reiser, 1991 *in* USFS, 2003).

Salmonids need different habitat types in different parts of their lifecycle to accommodate different life stage functions. They need clean, abundant gravel and cobble for successful spawning. Steelhead and coho salmon generally prefer substrate sizes of 0.5 to 6 inches dominated by 2- to 3-inch gravel, while Chinook salmon require substrate from 0.5 to 10 inches dominated by 1- to 3-inch gravel. To build the redd, the female turns horizontally, parallel to the channel bed, and uses her tail fin to slap the gravel, moving it downstream. She lays her eggs in the excavated area, while the male swims beside her to fertilize the eggs. She then covers the nest with gravel from just upstream. When flows are adequate, the process of moving the gravels to build and cover the nest helps to clean them as well.

Steelhead spawn in relatively small pockets of gravel, but Chinook and coho generally require larger areas of gravel. The gravel must be clean so that flowing, oxygenated water can permeate the gravel to reach the embryos and remove metabolic waste. High turbidity can lead to increased sedimentation, which reduces the quantity of oxygenated water able to percolate through the gravel and covers nests, preventing emergence.

Juvenile coho require pools for both summer and overwinter rearing. In the summer, pools provide cool, quiet habitat where coho feed and hide from predators. At depth, pools can be 3-9°C cooler than surface waters (Nielsen et al., 1994), thus providing cool refuge at the bottom when air and surface water temperatures are above the optimal range. Steelhead prefer riffles for rearing during their first summer but make more regular summer use of pool habitat as they grow. During the winter, off-channel pools provide habitat in which Chinook, coho, and steelhead can get out of flood flows to avoid being washed down river and out to sea.

Other important habitat components are in-stream cover and riparian buffer zones to shade the stream, and to provide food supply. Complex in-stream structure in the form of woody debris, overhanging or undercut banks, root wads, overhanging terrestrial vegetation, aquatic vegetation, boulders, and bedrock ledges provides microhabitats essential in the rearing and social structure of salmonids. Juvenile and adult fish use this in-stream cover as shelter from predators, territorial niches, and eddies where they can rest and conserve energy during high flows.

Large woody debris (LWD; any tree component that is 12 inches or more in diameter) is particularly important in structuring stream habitats and communities and is linked to the diversity of juvenile salmonid populations. LWD affects stream morphology, sediment movement, organic matter retention, and biological productivity. LWD can be instrumental in gravel bar formation and stabilization and pool formation by directing or concentrating stream flow in such a way that the bank or bed is scoured, or by impounding water upstream from the obstruction. Gravel collects in these pools and they become suitable for spawning. LWD and other large obstructions also provide shelter from high flows.

Small woody debris trapped by LWD is the food base for benthic invertebrates such as larval or nymph stage mayflies, caddisflies, midges, stoneflies, dragonflies and damselflies on which rearing salmonids feed. Excessive fine sediment in the channel may reduce insect production, limiting the food base available to fish. When insect production is low, higher stream temperatures become significant. The increased water temperatures increase the metabolic rate of the salmonids, and they require a greater abundance of food. Under conditions of both increased stream temperatures and reduced food availability, the ability of salmonids to survive is compromised.

Native vegetation in riparian zones along streams is crucial to the health and stability of a river system. Riparian trees and under-story plants stabilize stream banks and control erosion, provide canopy cover that reduces solar radiation and maintains low stream temperatures, contribute material to enhance fish cover and habitat, and provide nutrient inputs that stimulate primary production. The riparian corridor also filters upland runoff, reducing the quantity of sediment entering the stream.

The amount of rearing habitat in the tributaries for coho and steelhead, which is determined by stream flow, is generally considered to be the limiting factor of population size. Stream flow is also a critical factor affecting other water quality measures such as temperature, DO, and sedimentation. Adequate flow is required for successful upstream migration, spawning¸ incubation, rearing, and out-migration. High flows help to prevent increases in temperature and reductions in dissolved oxygen. High flows also move LWD and gravel downstream and remove silt from gravel, creating suitable spawning habitat. Alternatively, flow can be too high, preventing fish from migrating upstream, scouring nests, or washing juveniles downstream too early.

Human efforts to manage the land in the NCR have accelerated natural sediment generation and delivery processes and compromised the abilities of the waterways to efficiently transport sediment downstream and out of the systems. Major land use activities in the North Coast region today that contribute to the local economies include logging and timber milling; aggregate mining; agriculture, including livestock and dairy production, vineyards, and wineries; residential development; commercial fisheries; and tourism and recreation, including sport fishing. The timber, mining, agriculture, and construction industries – along with the associated building and use of roads – contribute to increased erosion in the watershed, leading to excessive sedimentation of streams, which in turn threatens water quality and aquatic habitat.

Timber harvesting, for example, results in greater volumes of sediment delivered to streams than is delivered in the absence of timber harvest and harvest-related activities. Coastal redwoods and associated vegetation can intercept as much as 0.5 inches of rainfall per event, thus reducing the amount of precipitation that penetrates the soil or runs off. Removing vegetation increases soil moisture levels, and less rainfall is required to saturate soils compared to vegetated areas. Removal of vegetation, especially by clear-cutting, also decreases the strength of the roots that hold the soil together and increases the amount of bare ground. These factors increase the likelihood of mass wasting; there is a significant positive relationship between rates of timber harvest and rates of landsliding.

The heavy machinery used in timber harvest can compact soils, decreasing infiltration rates and increasing runoff, which increases erosion of ground bared by the removal of vegetation. The direct sedimentation of stream channels by heavy equipment use occurred frequently prior to enactment of the Z'berg-Nejedly Forest Practice Act in 1973 (Forest Practice Act), which prohibited the practice of building roads and yarding logs that resulted in the direct sedimentation of stream channels. The increase of sediment delivery has an effect on stream morphology. For example, pools are much more frequent and their average depth is greater in the channels surrounded by old-growth forests compared to second-growth areas that have been previously harvested. Logging also reduces the availability and delivery of LWD to streams, significantly altering channel morphology and fish habitat.

A large number of roads and skid trails generally accompany silviculture as well as residential and commercial development. As the percentage of land covered by impervious or compacted surfaces (such as homes, roads, and driveways) increases, the area available for infiltration decreases and surface runoff increases. Parking lots, drainage ditches, roads, and storm drains concentrate storm runoff and increase the rate and volume of runoff to streams. This tends to increase the magnitude and frequency of peak flows, which increases erosion rates along streambanks.

Sediment delivery also typically increases during construction activities, particularly during the wet winter months. Road construction increases the potential for surface erosion and slope instability by increasing the area of bare soil exposed to rainfall and runoff, by obstructing stream channels and by altering subsurface flow pathways. Residential and commercial development and road construction also increase the likelihood of water quality pollution due to runoff of substances such as oil, grease, and heavy metals.

Agriculture, including row crops, orchards, and vineyards can also increase sediment production and delivery to streams. The clearing of vegetation for viticulture, which is continually expanding in the NCR, may considerably increase surface erosion through exposure of bare earth to rainfall and runoff. Many vineyards are being developed on hillsides where there is increased erosion potential and delivery of sediment to nearby streams. Livestock grazing can also affect sediment delivery.

The removal of natural vegetation and modification of soil characteristics affects the hydrologic and erosional processes. Reduction of vegetative cover exposes soils, increases surface erosion and runoff velocities, and reduces soil strength provided by roots. Trampling can compact soils and decrease infiltration rates, thereby increasing runoff and surface erosion. Livestock often congregate in riparian areas for water and shade and their trampling can cause stream banks to collapse, leading to increased sedimentation and changes in channel morphology. Grazing can also change the structure and composition of riparian vegetation, thus indirectly increasing sediment delivery.

Natural events have had significant impacts on sedimentation in the North Coast region as well. In December of 1964, several days of very heavy rain on top of an early snowpack in the higher mountains created the greatest flood on record on the North Coast. The Russian, Eel, Klamath, and Rogue Rivers all rose to unprecedented heights. Dozens of small towns were inundated, and several were completely swept away. This flood was a major structuring force in streams throughout the region. In general, massive amounts of sediment were mobilized from hillsides and deposited in streams. Deposition to the depth of the tens of feet occurred in some areas. Extensive riparian vegetation was lost along stream channels. Sedimentation in streams continued for years after the flood as sediments from upstream areas were mobilized and deposited further downstream. In a number of watersheds, the flood of 1964 negatively impacted salmonid populations, which were already beginning to suffer declines from anthropogenic impacts. By the 1990s, some areas showed evidence of recovery both in terms of stream channel characteristics and biological resources.

The effects of sediment on salmonids are different from effects of other pollutants like trace metals or toxic substances. These latter constituents often directly affect organisms' physical well-being, and laboratory experiments can determine the level of exposure resulting in deleterious effects and mortality. In contrast, sedimentation generally affects salmonids indirectly by reducing the quality and quantity of aquatic habitat available rather than directly affecting their physical health. For example, excess fine sediment surrounds and fills in streambed gravels, causing them to become embedded (defined as >50% covered in fine material), which effectively cements them into the channel bottom. Embeddedness can prevent the spawning salmon from building their redds. Excessive fine sediment can reduce egg and embryo survival and juvenile salmonid development; embryo survival decreases as the amount of fine sediment increases. Deposits of these finer sediments can also smother the redds and prevent the fry from emerging. Chronic exposure to high levels of suspended sediment can reduce smolt body size, which directly affects survival and reproduction rates.

Sedimentation may affect behavior as well. Adult salmon migrating upstream to spawn may avoid turbid waters, limiting or delaying their ability to return to their natal stream. Feeding rates and success may also be reduced, negatively impacting the fish. For example, the abundance of invertebrates, a primary food source for juvenile salmonids, can be reduced by excessive fine sediment. LWD, which provides shelter, can be buried. Lastly, suspended sediment can cause direct damage to the fish by clogging gills.

Removal and disturbance of vegetation, particularly the riparian canopy, reduce shading and increase the amount of solar radiation reaching streams, resulting in higher average summer stream temperatures and increased daily temperature fluctuations. Removal of riparian canopy also often results in streambank instability and increased sedimentation, which can increase stream temperatures in several ways:

- Sedimentation can reduce the frequency, volume, and depth of pools that serve as thermal refugia. There is a direct link between sediment storage in pools and thermal impacts on anadromous fish. Coho in Northern California tend to be found in streams in which ~40% of the area consists of pools that are at least two to three feet deep.
- Sedimentation can reduce overall stream depth and cause channels to widen, which increases the amount of surface area exposed to solar radiation. This is compounded by loss of riparian canopy, which, left intact, would provide shade and reduce solar heating. Riparian vegetation can have an indirect effect on in-stream temperatures as well because riparian conditions can influence local air temperature, wind speed, relative humidity, and ground temperature. Shady locations are typically cooler, less windy, and more humid than open areas.
- Sedimentation may also eliminate cold water seeps.

Agricultural activities that divert water during summer low flow periods also serve to increase stream temperatures and reduce or even eliminate aquatic habitat. Groundwater, particularly in flat alluvial areas, usually contributes to the baseflow of streams during the summer months. Groundwater extraction for irrigation can lower water tables and reduce baseflow contributions. Not only does this result in less water for aquatic habitat, but it may also cause stream temperatures to increase because groundwater inputs to streams are generally cooler than surface inputs. Road construction and urban development contribute to this problem as well. As vegetation is replaced by impervious surfaces and surface runoff is increased, groundwater storage is decreased, and the associated groundwater inputs to summer baseflows decrease. The problem may be compounded by extraction of drinking water from wells and springs.

Seasonal and permanent dams pose additional threats to anadromous fish by preventing both upstream and downstream migration and blocking access to habitat. The migration of adult salmon upstream requires that there be no impassable barriers between the ocean and their spawning streams. Similarly, once the fry emerge from the gravel, there must be no barrier to the passage of these small fish from the spawning reaches to and among rearing habitats, particularly during the summer when flows may be low and temperatures warm. Finally, once the juveniles are ready to return to the ocean, their passage from their rearing reaches to the estuary and out to the ocean must be unimpeded. In addition, dams alter river flow and temperature and block sediment transport, which can cause a stream to incise and/or erode its banks downstream. Lastly, the dams create habitat for other species, often predatory warmwater fish, that threaten salmonids.

1.4.4. Current Status of Salmon Populations in the NCR

The text presented within this section includes information that has been previously published by USEPA 2004 (Upper Main Eel River and Tributaries (including Tomki Creek, Outlet Creek and Lake Pillsbury) Total Maximum Daily Loads for Temperature and Sediment), USEPA 2003 (Middle Fork Eel River Total Maximum Daily Loads for Temperature and Sediment), USEPA 2003 (Mattole River Total Maximum Daily Loads for Sediment and Temperature), USEPA 2001 (Gualala River Total Maximum Daily Load for Sediment), North Coast Regional Water Quality Control Board 2001 (Technical Support Document for the Gualala River Watershed Water Quality Attainment Action Plan for Sediment) and references included therein.

Populations of anadromous fish have declined dramatically throughout the state of California over the last 50 years. California coho populations have declined approximately 94% since the 1940s and 70% since the 1960s. There were an estimated 200,000 to 500,000 native coho spawning statewide in the 1940s; that number declined to ~100,000 in the 1960s, ~30,000 by 1985, and <5,000 in 1994. Historically, at least 582 California streams supported coho salmon populations at some time; today, coho are found in just 51% of those streams, and many current populations have less than 100 individuals.

In the early 1960s, California Department of Fish and Game (CDFG) estimated that 256,000 Chinook and 573,000 steelhead spawners returned each year to the coastal rivers of California.

Over the 1940s, 1950s, and 1960s, North Coast counting stations showed declines of ~65% in Chinook salmon and steelhead spawners. West coast steelhead stocks in northern California are very low relative to historic estimates, and recent data confirm the downward trend. Many of these populations are threatened or endangered under FESA (Table 3). Steelhead are generally more abundant than coho, perhaps due to their ability to spawn multiple times and timing of spawning, tolerance to warmer water temperatures, and ability to use more habitat types. Chinook and steelhead in the upper Klamath River basin, and the Trinity River, have not yet warranted listing under FESA.

Reasons for the decline of coho and Chinook salmon and steelhead trout in California include loss of stream habitat due to natural and anthropogenic causes, breakdown of genetic integrity of native stocks, increased competition, increased disease, over-harvest, and climatic change.

Table 3. Salmonid populations listed as threatened or endangered under the Federal Endangered Species Act.

Species	Coho Salmon (Oncorhynchus kisutch)		Chinook Salmon (Oncorhynchus tshawytscha)	Steelhead Trout (Oncorhynchus mykiss)	
Evolutionary Significant Unit (ESU)	Southern Oregon/ Northern California	Central California Coast	California Coastal	Northern California	Central California Coast
Range (inclusive)	Cape Blanco, OR to Punta Gorda, Humboldt County, CA	Punta Gorda to San Lorenzo River, Santa Cruz County and populations in tributaries to San Francisco Bay with the exception of the Sacramento-San Joaquin River system	Redwood Creek in Humboldt County to Russian River	Redwood Creek to Gualala River in Mendocino County	Russian River to Aptos Creek in Santa Cruz County
Status	Threatened	Threatened; endangered	Threatened	Threatened	Threatened
Date of Listing	1997	1996; 2005	1999	2000	1997
North Coast Watersheds					
Albion River		X	X	X	
Big River		X	X	X	
Eel River	X		X	X	
Garcia River		X	X	X	
Greenwood Creek		X	X	X	
Gualala River		X	X	X	
Klamath River (including Scott and Shasta Rivers)	X				
Mad River	X		X	X	
Mattole River	X		X	X	
Navarro River		X	X	X	
Noyo River		X	X	X	
Redwood Creek	X		X	X	
Russian River		X	X		X
Smith River	X				
Ten Mile River		X	X	X	
Trinity River	X				

2. NCR Watershed Descriptions

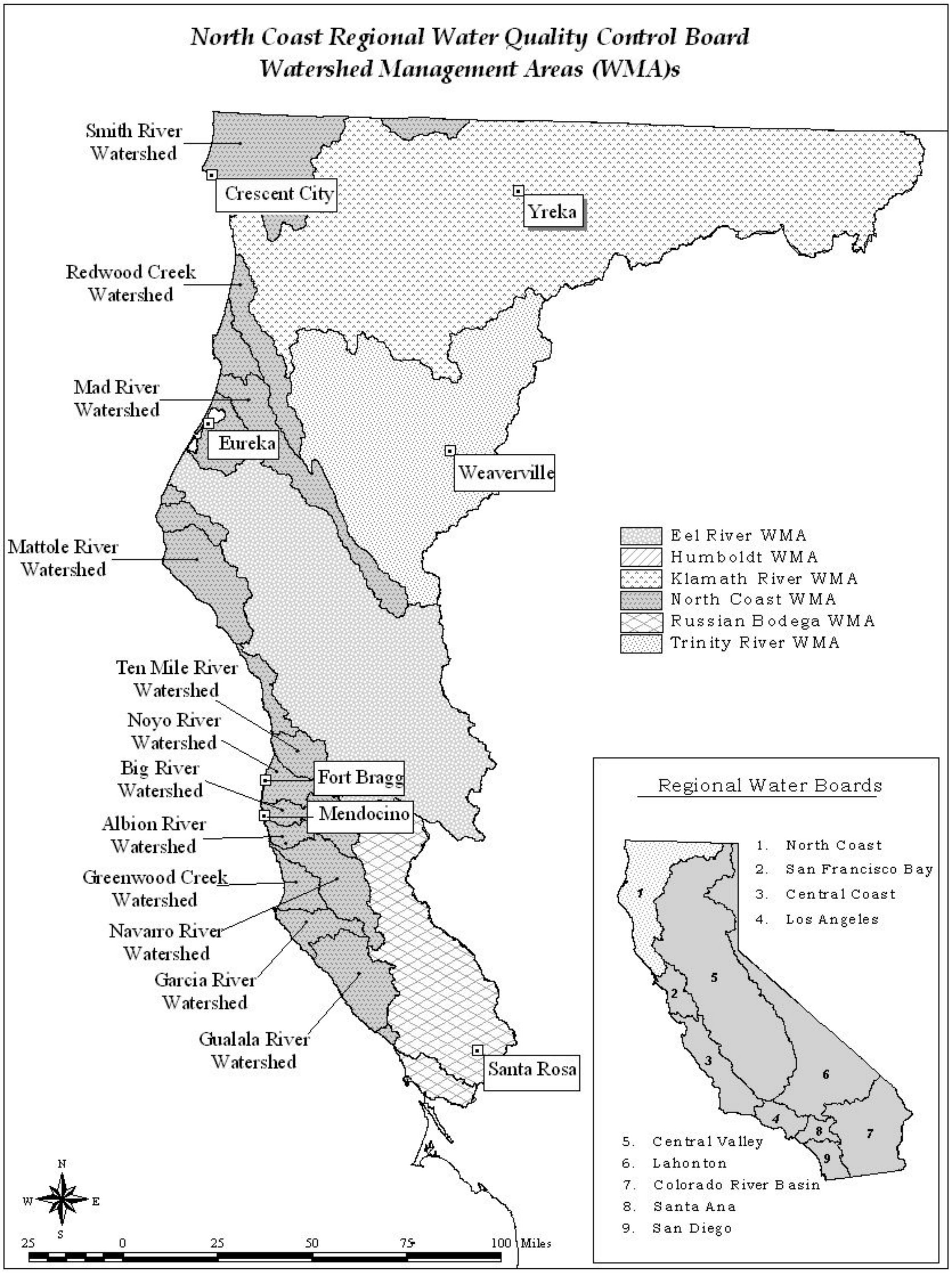

Figure 1. Watershed Management Areas of the North Coast Regional Water Quality Control Board

The text presented within this section includes information that has been previously published by the North Coast Regional Water Quality Control Board 2005 (Watershed Planning Chapter), Entrix et al. 1998 (Navarro River Restoration Plan) and references included therein.

For management purposes, water resources are divided into "management areas", which may contain one or more drainage basins or watersheds, or a portion of a drainage basin or watershed. The Watershed Management Areas (WMAs) of the NCR are:

- Klamath WMA
    - Lost River
    - Klamath River
    - Shasta River
    - Scott River
    - Salmon River
- Trinity River WMA
- Humboldt Bay WMA
    - Redwood Creek
    - Mad River
- Eel River WMA
- North Coast Rivers WMA
    - Smith River
    - Mattole River
    - Ten Mile River
    - Noyo River
    - Big River
    - Albion River
    - Navarro River
    - Garcia River
    - Gualala River
- Russian/Bodega WMA
    - Russian River
    - Americano Creek
    - Stemple Creek
    - Salmon Creek

2.1.________Klamath River WMA (Hydrologic Unit [HU] 105.00)

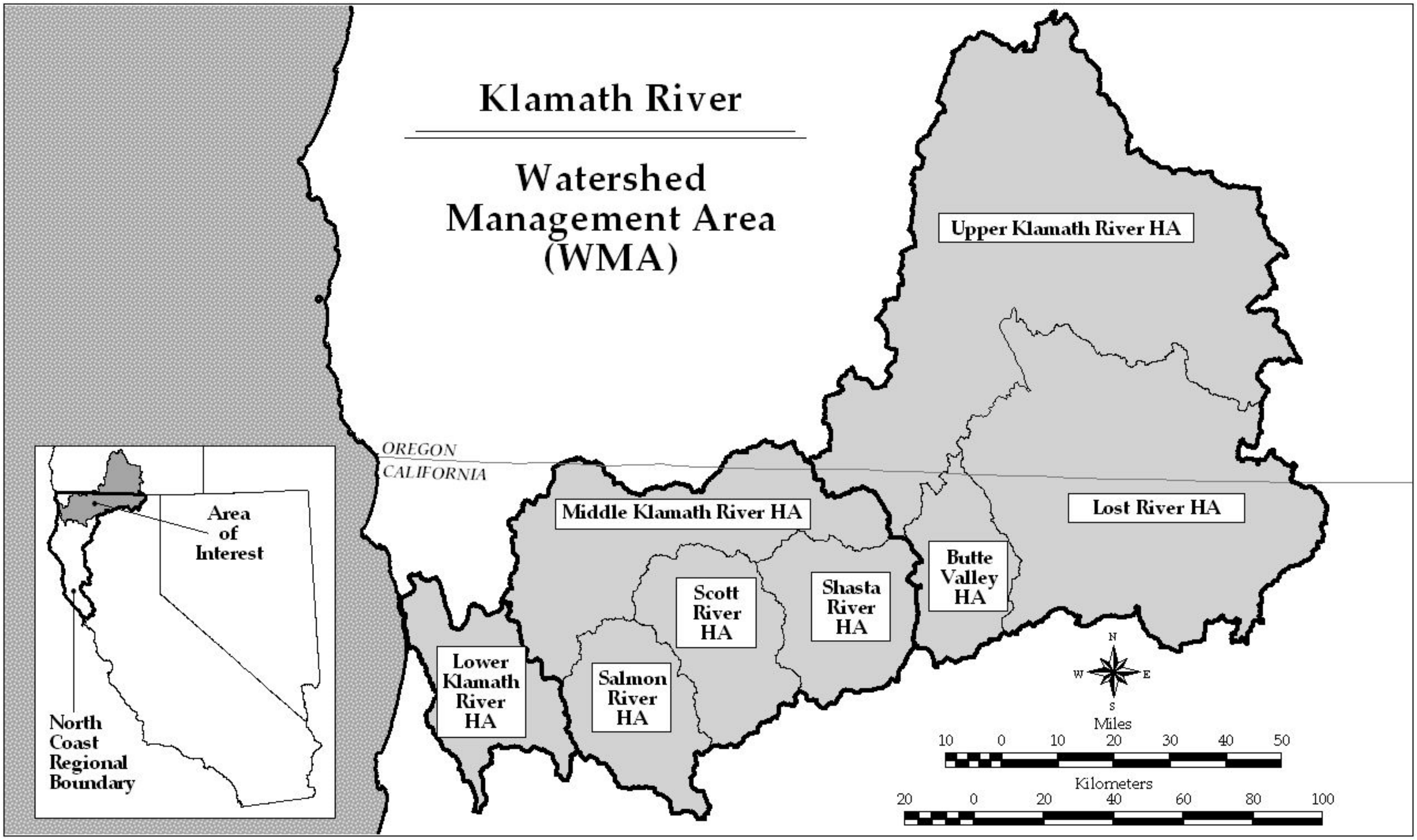

Figure 2. Hydrologic Areas of the Klamath River WMA

2.1.1. Overview

The Klamath River WMA is divided into three sub-basins: Lower Klamath, Middle Klamath, and Upper Klamath. The Trinity River HU (106.00) lies within the overall Klamath River basin but is not included in the Klamath WMA; it is its own WMA. The Klamath River WMA includes several hydrologic areas (HAs) within HU 105.00: Lower Klamath River HA (HA (105.10), Salmon River HA (HA (105.20), Middle Klamath River HA (HA (105.30), Scott River HA (HA (105.40), Shasta River HA (HA (105.50), Upper Klamath River HA (HA (105.60), Butte Valley HA (HA (105.80), and Lost River HA (HA (105.90) (see Figure 2).

The Klamath River, which starts in Oregon, travels for approximately 250 miles through Oregon and California before flowing into the Pacific Ocean near Crescent City. The Klamath River WMA HU (105.00) covers ~12,100 mi^2 in southern Oregon and northern California and is home to six federally-recognized tribes and several National Wildlife Refuges, Parks, and Forests. Roughly 53% of the watershed lies in California and 47% lies in Oregon. Major tributaries to the Klamath include the Shasta, Scott, Salmon, and Trinity rivers. The Klamath River has historically been the third-largest producer of salmon on the West Coast, following closely behind the Sacramento and Columbia rivers. In 2002, a massive fish kill occurred in which over 33,000 adult Chinook and coho salmon died (California Department of Fish and Game [CDFG] 2004).

The Human population in the Klamath River basin was estimated in the 2000 US Census to be about 114,000 (United States Census Bureau [USCB] 2000). The largest population concentrations lie in the upper Klamath agricultural area, the Shasta River valley, and Scott Valley. The largest population center is Klamath Falls in Oregon (population 19,462) followed by Yreka, CA (population 7,290).

More than two thirds of the Klamath River watershed is in federal ownership including lands managed as National Forests, National Wildlife Refuges, National Parks, and Bureau of Land Management (BLM) land. The largest blocks of private ownership are agricultural areas in the upper Klamath watershed, agricultural and timber properties in Shasta and Scott Valleys, Tribal lands, and privately owned land in the Klamath River valley near the mouth.

2.1.1. Climate

The geographic extent and topographic relief of the Klamath River watershed combine to produce a wide variety of climate. On average, the climate is characterized by dry summers with high daytime temperatures and wet winters with moderate to low temperatures. The mean annual precipitation ranges from more than 80 inches in the high elevations to 10 inches in the broad inland valleys. About three quarters of the annual precipitation falls between October and March, producing a snowpack in the higher mountain ranges that feeds streamflow in many lower areas through the summer. The Klamath River watershed is characterized by patterns of floods and droughts. During a drought in 1976-77, precipitation was only 20 percent of normal in the Scott

River watershed and 40 percent of normal in the upper Klamath River basin. The largest floods occurred when relatively warm storm systems melted a pre-existing snow pack such as occurred in 1861, 1955, 1964, 1974, and 1997.

2.1.3 Water Resources

The Klamath River basin is intensely managed with respect to water resources. Federal, state and local agencies store and distribute water in the Klamath River and Lost River watersheds. The Klamath is impounded by five dams, which create reservoirs for water delivery and hydroelectric generation. More than 1,400 miles of canals and drains provide service to water users. The waters are used for agriculture, logging, transportation, hydroelectric generation, and wildlife refuge management interests, and by tribes and municipalities.

Water movement within the Klamath River basin is complex. For example, the Lost River Diversion Canal carries water in either direction between Klamath and Lost Rivers, while the Klamath Straits Drain carries water in either direction between Klamath River and Lower Klamath Lake. The standing water bodies, especially Upper Klamath Lake in Oregon, are eutrophic and undergo wide variations in dissolved oxygen concentration and pH.

The Klamath watershed supports an active recreational industry, including activities that are specific to the Wild and Scenic portions of the river designated by both the state and federal governments in both Oregon and California. Additionally, the watershed continues to support what historically were once significant mining and timber industries.

2.1.4. Fishery

The upper Klamath River basin above Iron Gate Dam is home to four species of suckers; shortnose, Lost River, Klamath smallscale, and Klamath largescale. The shortnose and Lost River suckers are large, long-lived, late-maturing fish that live in lakes but spawn primarily in streams. Historically, shortnose and Lost River suckers were present in the Lost River and Klamath River and their tributaries above Iron Gate Dam, though their current distribution and numbers have decreased significantly. These fish were a primary food source for the Klamath and Modoc Indians throughout historic times until the 1980s, when severe declines in the fish populations caused the Klamath Tribes to close their fishery. Both species are currently on the federal, Oregon, and California endangered species list.

Redband trout persist in the basin above Iron Gate Dam because of their ability to thrive in lake and stream conditions that would be lethal to most salmonids. Currently, redband trout numbers are high in both lakes and rivers of the upper Klamath River basin, and these trout support a highly productive and self-sustaining summer fishery.

Bull trout have been extirpated, or are at risk of extirpation, from most of the areas where they once existed in the Klamath River basin. Current distribution of bull trout is limited to headwaters upstream of Upper Klamath Lake. Populations are listed as threatened by the federal government, critical by Oregon, and endangered by California.

Anadromous salmonids in the Klamath River basin are limited to the area of the basin within California below Iron Gate Dam, which is a barrier to anadromy. Anadromous salmonid runs currently utilizing this portion Klamath River basin include spring and fall Chinook, coho salmon, and spring/summer, fall, and winter steelhead. All six salmonid runs in the Klamath River basin have experienced declines in populations and distribution since the early 1900's. The decline of anadromous species in the basin can be attributed to a variety of factors including over harvest, land-use practices, mining, stream habitat alterations, agriculture, and changes in water quality and temperature. Significant effects are also attributed to water allocation practices and dam construction, which has altered flow regimes.

Historically, anadromous species within the basin extended above Upper Klamath Lake in Oregon, and into the Sprague and Williamson River systems and other tributaries. Chinook salmon historically migrated into tributaries of Upper Klamath Lake, and steelhead were found in the Klamath River basin above Iron Gate Dam as well. Coho salmon distribution extended at least to the vicinity of Spencer Creek in Oregon.

Spring/summer steelhead were once widely distributed in the Klamath River and Trinity River basins and were present in the headwaters of most larger tributaries. Their numbers have declined from historic levels, and the National Marine Fisheries Service (NMFS) considers stocks depressed and in danger of extinction. Fall and winter steelhead are currently widely distributed in the basin below Iron Gate Dam. Current population estimates for steelhead in the Klamath River basin have not been conducted on a regular basis, though their numbers are believed to be declining from historic levels. Although NMFS considers winter steelhead to be in low abundance and at some risk of extinction, they are not currently on the state and federal endangered species list.

Historic and current records reflect that Chinook salmon were, and continue to be the most abundant anadromous species in the Klamath River basin. Spring and fall run Chinook populations and distribution have decreased dramatically since the early 1900's.

Fall Chinook population estimates from the late 1800's and early 1900's range from 300,000 to 500,000 fish annually. For the years 2004-2006, the estimated number of fall Chinook natural spawners in the basin has fallen below the Pacific Fishery Management Council goal of a minimum of 35,000, with returns averaging 28,800 per year.

Spring Chinook historically were found in tributaries throughout the Klamath River basin, although they are now only present in the Salmon and Trinity Rivers. In the early 1900's as many as 100,000 spring Chinook were found in the basin, but current populations range from 100 to 1000 fish.

Coho were once abundant and widely distributed in the Klamath River and its tributaries. Current population estimates for coho in the Klamath River basin have not been conducted, although combined adult coho return numbers to the Iron Gate Hatchery, Trinity River Hatchery, and Shasta River Fish Counting Facility have averaged 5,949 fish during the last 42 years. Coho in the Klamath River basin are currently on the state and federal endangered species lists due to the long-term decline in numbers and distribution.

Other Anadromous species present in the Klamath River basin below Iron Gate Dam include pink and chum salmon, coastal cutthroat trout, eulachon, white and green sturgeon, and Pacific lamprey.

- Pink salmon probably once existed in the Klamath River, although they appear to be extirpated from all areas in California and only occasionally stray into streams along the California coast.
- Chum salmon are periodically observed in the basin, and maintain a small population in the Klamath River. Historically chum were more abundant than present, although their numbers were never very large.
- Coastal cutthroat trout mainly occur in smaller tributaries in the lower 22 miles of the Klamath River.
- Eulachon were historically present in large numbers in the lower 8 miles of the river. However, since the 1970's their numbers have been too low to support the once flourishing tribal fishery.
- It is estimated that 70-80% of all green sturgeon are produced in the lower Klamath and Trinity Rivers where several hundred are taken every year by the tribal fishery. There is some evidence that green sturgeon numbers in the basin below Iron Gate Dam have decreased in recent years. At the present time they are listed as a species of special concern by the federal government.
- The historic distribution of Pacific lamprey is unknown, however it is certain that they have entered the area above Klamath Falls, Oregon in the basin above Iron Gate Dam at least occasionally. Today Pacific lamprey populations are declining in all coastal rivers, and they are listed by the federal government as a species of concern.

Non-anadromous species common in the Klamath River below Iron Gate Dam and its low gradient tributaries include speckled dace, Klamath smallscale suckers, lower Klamath marbled sculpin, threespine stickleback, and Klamath River lamprey. Dace, stickleback, sculpin, and suckers probably utilize nutrients brought into the streams by anadromous species, and may suffer heavy predation by juvenile salmonids.

2.1.5. Topography and Geology

Elevations range from sea level at the river mouth to 14,179 feet at the summit of Mount Shasta. The Klamath River watershed crosses four recognized geomorphic provinces, each of which is defined and shaped by its unique geologic history. From east (upstream) to west (downstream), these provinces are the Modoc Plateau, Cascade Range, Klamath Mountains, and Coast Ranges.

Headwaters of the Klamath gather in the Modoc Plateau, an area of flat valleys punctuated by volcanic cones. The rolling valley bottoms are at about 4000 to 5000 feet in elevation and the volcanic cones rise a thousand feet higher. Although rainfall is low, the flat and rolling valley bottoms of rich volcanic and organic soils combine with an abundance of water entering from higher surrounding country to create historically vast freshwater wetlands. Much of this wetland area has been converted to productive farmland. The volcanic soils are naturally rich in phosphorus, and the conversion of wetlands to farmland and other landuses has exposed the nutrient and organic rich soils to oxidation, resulting in the release to the water column of nitrogen and phosphorus previously stored in the soil and wetland vegetation.

The Cascade Range is a belt of mainly volcanic rocks that are younger than rocks of most of the Modoc Plateau and form higher relief. The border between the Cascade province and the Klamath Mountains province is spanned by the Shasta Valley. The Klamath Mountains province is very steep and rugged for the most part and in the Klamath River watershed consists of several irregularly oriented ranges – the Trinity Alps, Scott Bar Mountains, Siskiyou Mountains, and Marble Mountains. Shasta and Scott Valleys have broad flat valley bottoms that support agriculture, while other valleys are narrower and steeper and therefore less developed. Most of the land in the Klamath Mountains province is in federal ownership, and this rugged landscape lends itself more to timber harvest and cattle grazing than to crops.

The Coast Ranges form about 20 miles of the lower Klamath River valley and part of the west side of the valley of the lower Trinity River and South Fork Trinity River. The Coast Ranges are steep, but are generally more rounded and not as high as the Klamath Mountains.

2.1.6. Hydrologic Areas of the Klamath River WMA

2.1.6.1.______Upper Klamath River HA (HA (105.60)

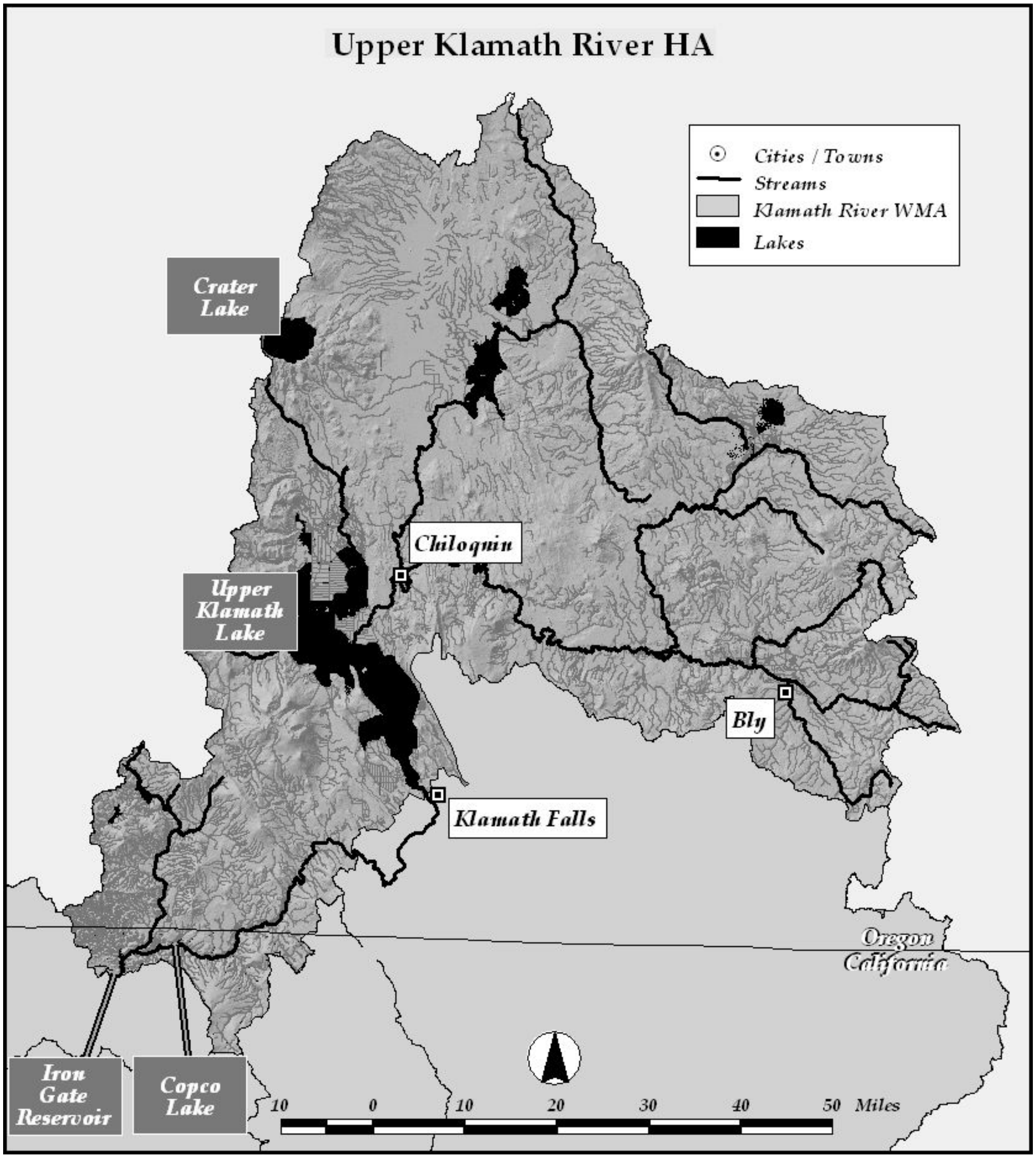

Figure 3. Map of the Upper Klamath River HA

2.1.6.1.1.____Overview

The Upper Klamath sub-basin covers roughly 7,438 mi^2, extending from the headwaters of the Klamath River in Oregon, above Upper Klamath Lake, to Iron Gate Dam in California (see Figure 3). Approximately 75% of the sub-basin is in Oregon, encompassing the Lost River sub-watershed and areas upstream of Iron Gate Dam in

California. Water is released from Klamath Lake through hydropower systems and a modified natural channel known as the Link River. The Klamath River then enters Lake Euwana, the outflow of which is controlled by Keno Dam. Below Keno Dam, the river flows through rugged canyon areas into California passing through the John Boyle hydropower structures along its way.

Upon entering California, the Klamath River flows into Copco Reservoir, through its hydropower system and then into Iron Gate Reservoir. Dams created these reservoirs for power generation and to regulate flow regimes down stream. Permanent residences and cabins dot the shoreline of Copco Lake. Both cold- and warm-water fishing are popular in the nutrient-rich waters. Iron Gate Dam blocks upstream salmon migration at this point in the Klamath River. Iron Gate Hatchery is located just downstream of the dam.

Above Iron Gate Dam, the Straits Drain contributes un-ionized ammonia and nutrient-rich suspended particulate materials to the Upper Klamath. The Straits Drain contains water that has been used and retained in the Lower Klamath Wildlife Refuge in diked-off cells to benefit resident and migratory waterfowl. The cells are shallow areas of water that may sit for long periods of time. Because of the differences in timing of waters routed through the Klamath River/Lake Euwana system versus the Straits Drain system and the concentrating processes that occur before water is pumped from the Straits Drain, this drainage discharge is usually of much lower quality than the river. This discharge combined with summer heat contributes to robust algal growth (eutrophication) in areas downstream. Water in Copco and Iron Gate reservoirs becomes thick with algae in the summer months, leading to complaints about aesthetic conditions from the public, and to health related concerns regarding the abundance of blue-green algae. The Straits Drain discharge contributes to the non-attainment of desired water quality conditions in the river and is an issue to be addressed by Oregon in a TMDL process pursuant to Clean Water Act section 303(d).

Many natural and human-altered watershed elements above Iron Gate Reservoir in California and Oregon affect the quality and quantity of water that exits Iron Gate Reservoir to supply the Klamath mainstem flow, and affect (both support and jeopardize) the beneficial uses of the river within California. The complexity of this sub-basin is magnified by jurisdictional issues associated with water delivery/utilization infrastructures (including the Federal Klamath Project), irrigation, hydropower, endangered species, tribal rights, lake-level-management demands for Upper Klamath Lake, the waters criss-crossing the California-Oregon border, and minimum flow requirements in the Klamath river below Iron Gate Dam. Hydromodifications (dams, levees, irrigation diversion, and drain-water removal works) that have been constructed since 1860 in the Klamath River basin upstream of Iron Gate Dam have resulted in:

- Diminished river flow rates in the dry season.
- Increased summer/fall water temperatures and impairments to WARM and RARE beneficial uses.
- Arrested migration of anadromous fish.
- Endangerment of fish species native only to this basin.

- Development of an extensive agricultural community in Oregon and California, including the development of extensive private property on once underwater lake/marshes and once inhospitable canyon lands.
- Development of extensive hydropower resources.
- Preservation of managed migratory waterfowl refuges.
- Ground water augmentation of surface flows.

2.1.6.1.2.____Lost River HA (HA (105.90)

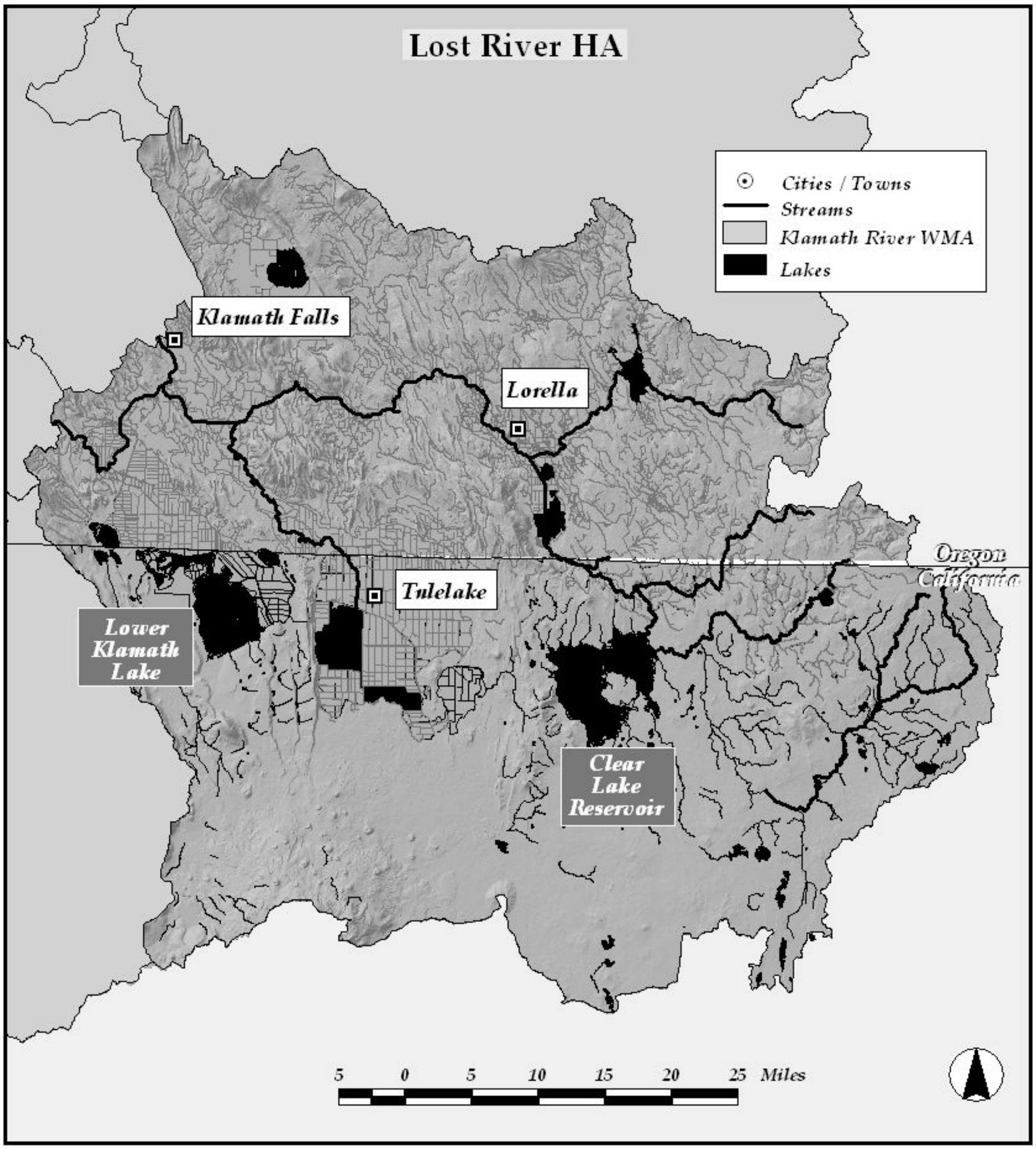

Figure 4. Map of the Lost River HA

The Lost River HA covers ~3000 mi^2 in southern Oregon and northern California. Roughly 56% of the watershed lies within the boundaries of California while the remaining 44% lies in Oregon. The upper Lost River watershed encompasses Clear Lake Reservoir and its tributaries. The area is characterized by high desert stream systems and is sparsely settled. Agricultural activities in the area adversely affect water quality. Cattle grazing on both United States Forest Service (USFS) and private lands have free access to streams that flow into Clear Lake. The livestock trample stream banks causing increased sediment discharge and accelerated loss of riparian vegetation, which in turn leads to increased nutrient release, increased water temperature. Un-shaded, sediment laden eutrophic streams are poor-to-unsuitable habitat for RARE species.

The severity of degradation to Clear Lake tributaries varies by location, but Boles, Willow, and Mowitz Creeks have been assessed and are receiving remedial efforts. Lost River below Clear Lake Dam in California is substantially impaired. Land uses in the lower Lost River basin are primarily crop agriculture such as grains, potatoes, and onions, along with grazing and lands administered for the National Wildlife Refuge. Land use in Oregon is predominantly agricultural. Ground water is now part of the surface water system, since numerous high production wells were brought online in 2001 to augment surface flows.

Land uses and associated hydrologic and water quality factors in the Klamath basin change dramatically moving downstream through the watershed areas. Drainage from agricultural lands and wetlands conveys nutrient-rich suspended particulate and dissolved materials into waterbodies that are long standing nutrient traps. Evaporation and isolation cause these waters to have very high nutrient levels, support very high phytoplankton (algae) populations, and have large diel fluctuations in dissolved oxygen, pH, and ammonia levels. For example, the Tule Lake sump system is highly eutrophic with concomitant low dissolved oxygen levels, high pH levels, high un-ionized ammonia levels, and high water temperatures. This water quality is perceived as impaired and may become or remain toxic to and uninhabitable by native fish species, including the FESA listed shortnose sucker and Lost River sucker. Whether irrigated agriculture and lake wetland modifications have exacerbated this eutrophic condition to a measurable degree such that water quality beneficial uses are impaired is yet undetermined.

2.1.6.2.______Middle Klamath River (HA 105.30)

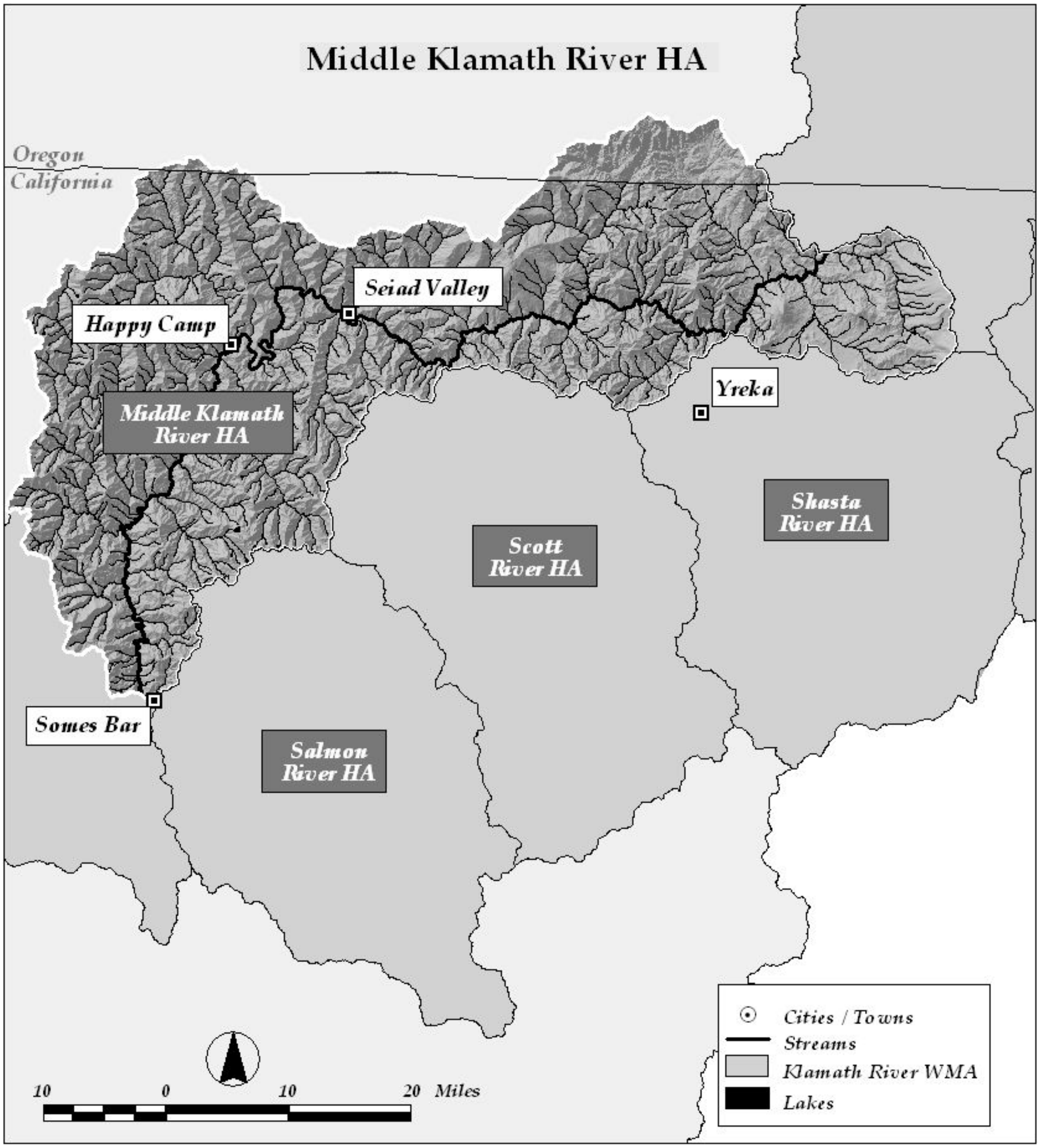

Figure 5. Map of the Middle Klamath River HA

The Middle Klamath River HA begins at Iron Gate Dam and extends to the confluence of the Klamath and Salmon Rivers. The sub-basin is 1,537 mi^2 and includes the mainstem of the Klamath River and is bordered to the south by the watersheds of the three major tributaries – the Shasta HA (HA (105.50), Scott HA (HA (105.40) and Salmon Rivers HA (HA (105.20) (see Figure 5).

2.1.6.3.______Shasta River HA (HA (105.50)

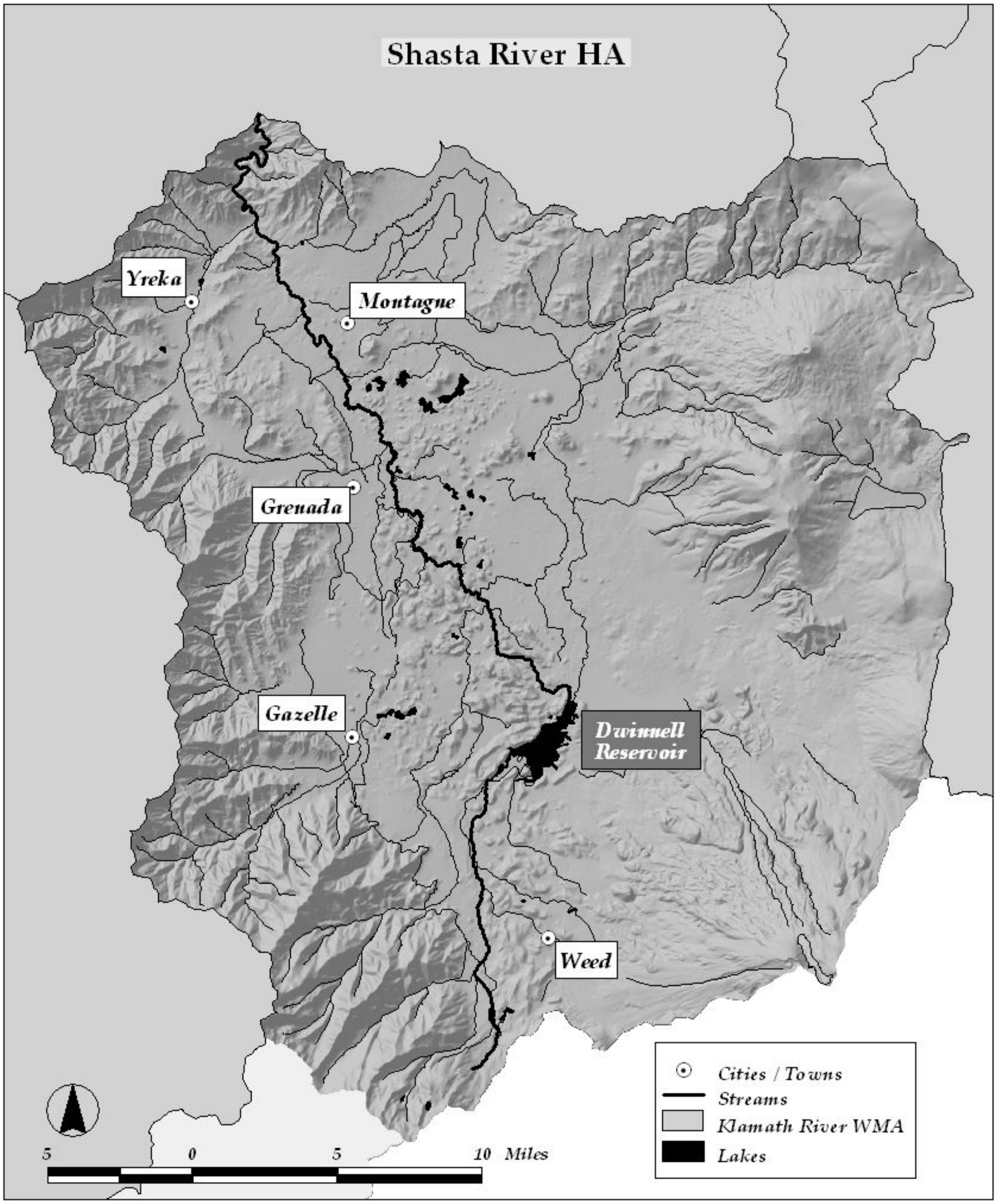

Figure 6. Map of the Shasta River HA

The text presented within this section includes information that has been previously published by North Coast Regional Water Quality Control Board 2006 (Staff Report for the Action Plan for the Shasta River Watershed Temperature and Dissolved Oxygen Total Maximum Daily Loads) and references included therein.

2.1.6.3.1.____Overview

The Shasta River HA drains a 795 mi^2 watershed in northern California within Siskiyou County. The Shasta River originates within the higher elevations of the Eddy Mountains lying southwest of Weed and flows for approximately 50 river miles in a northerly direction, passing through the Shasta Valley. After leaving the valley, it enters a steep-sided canyon where it flows for seven river miles before emptying into the Klamath River, 176.6 river miles upstream from the Pacific Ocean (SSRT 2003). The Shasta River watershed is bounded to the north by the Siskiyou Range, to the west by the Klamath Mountains, to the east by the Cascade Range, and to the south by Mt. Shasta and Mt. Eddy. The watershed shares divides with the Scott River to the west, Butte Creek to the east, and the Trinity and Sacramento Rivers to the south.

The population of the Shasta River basin is estimated at about 16,000 people. The majority of the population in this basin is centered around the towns of Yreka, Weed, Montague, Grenada, and Gazelle. Because of its geology, vegetation, and climate, the Shasta River Watershed is considered part of the Great Basin, with conditions similar to those typical of Eastern Washington, Eastern Oregon, Northern Nevada, and those parts of California east of the Sierra Nevada (SSRT 2003).

2.1.6.3.2.____History and Land Use

The Shasta Nation ancestral territory included much of the Shasta Valley. The first European exploration of Siskiyou County and the Shasta basin was in the late 1820's, when fur trappers from the Hudson's Bay Company entered the area in search of pelts. These explorers were soon followed by cattle drovers, bringing cattle from the Sacramento Valley to the Oregon settlements. With the exception of small military missions, these were the only explorers to the area until the 1849 gold rush, which established the first permanent settlers in the basin. The first discovery of gold in Siskiyou County was near the town of Yreka in 1851, and in a few months there were over 2,000 miners working in the area. Mining for gold in Yreka Creek and the lower 7 miles of the Shasta River continued through the 1930s. In addition to gold, gravel was extracted along the mainstem Shasta. Many ranchers, farmers, and businessmen followed the gold rush settling in the area. With the increased population came an increased need for food, supplies, and lumber. Both agriculture and mining activities were dependent on the development of water diversion systems to meet their needs. By the early 1900's, farming, ranching, and timber harvest were the dominant land uses within the basin.

Today the economy of the Shasta River basin is mainly supported through agriculture and ranching, although lumber mills in the Shasta Valley also contribute. Cattle operations extend throughout much of the Shasta basin, supported by irrigated pasture and hay fields, as well as dry upland grazing lands. Due to local springtime flooding and a short growing season, crops grown in the Shasta Valley are limited to alfalfa and small grains and a small selection of row crops.

Timber harvest and associated road building were widespread and intense in parts of the watershed into the 1960's. Today only limited timber harvest occurs in parts of the watershed on both USFS and private lands. Currently two sawmills are active within the watershed, though much of the logs milled are harvested outside the watershed.

Recreation has become an important industry for the area. Mount Shasta is popular for downhill and cross-country skiing during the winter and for hiking and mountain climbing in the summer. Lake Shastina, mountain lakes, and streams are kept stocked with trout, and wildlife is abundant.

Though still dominated by agricultural land and open space, the Shasta Valley is experiencing increased residential development and associated urbanization. Urbanization is most evident within established urban areas such as the City of Yreka, but is also occurring in lower elevation areas throughout the basin, along the Interstate 5 corridor, and around Lake Shastina. Lot splits and subdivision of agricultural land are increasing.

2.1.6.3.3. Vegetation

The vegetation of the Shasta River watershed is heterogeneous and reflects the climatic differences in the watershed. Conifers are the most abundant vegetation in the mountains. Herbaceous plants, including agricultural crops, dominate the valley region. Woody riparian vegetation along the Shasta River varies both in its extent and location, ranging from areas completely absent of woody vegetation to areas where woody riparian vegetation forms roughly continuous rows of trees lining the riverbanks; these rows are not very deep however. Although some reaches of the river have continuous vegetation, it generally occurs in intermittent areas and on one side of the river or the other. In the area of the Shasta River between Highway A-12 and Montague-Grenada Road, woody riparian vegetation is generally absent.

2.1.6.3.4. Climate

The Shasta River basin is predominantly a low rainfall, high desert environment characterized by hot, dry summers and cool winters. Temperatures range from above 100°F in the summer to below freezing in the winter. Annual precipitation ranges mostly from 13 to 69 inches, with much of the winter precipitation falling as snow. Average annual precipitation is as high as 45 inches in the Eddy and Klamath Mountains and reaches 85-125 inches on Mt. Shasta; however, moist air masses are stripped of their water as they move eastward from the Pacific and climb over the Klamath Mountains. Thus, the Shasta Valley is in the rain shadow created by these mountains and receives a mean of only 9-18 inches of precipitation annually. Some low-lying areas of the Valley receive less than 9 inches annually.

2.1.6.3.5.____Water Resource Management

From its origin in the Scott Mountains, the Shasta River flows north and northwestward for approximately 60 miles before entering the Klamath River at Klamath RM 176.6. At Shasta RM 40.6 Dwinnell Dam impounds Lake Shastina (also called Dwinnell Reservoir) to provide water storage for agricultural use, municipal supply for the town of Montague, and recreational use.

Shasta River basin water resources are highly managed and controlled. Uses include irrigation and stock watering, municipal drinking water supply, and small hydropower generation. The first hydroelectric power generation facility was built in the Shasta canyon in 1892. One small hydro facility is in operation today. Agricultural use of water in the Shasta River basin began with the settlement of miners in the early 1850s. By the 1940s, gold mining had diminished in the basin, and agricultural development became the economic focus, resulting in increased irrigation and water use. In the early 1900s, four water service agencies were formed in the Shasta basin to manage water supply for municipal and agricultural use. The Shasta River is fully appropriated from May 1 through October 31. Since 1934, the Department of Water Resources (DWR) Watermaster Service has managed the delivery of the adjudicated water rights, apportioning available water in order of priority of right, based upon the flows at the weir located at RM 15.5. Water users along the riparian zone of the Shasta River below Dwinnell Dam and groundwater withdrawals are not subject to the adjudication.

The Construction of Dwinnell Dam, which forms Lake Shastina on the upper Shasta River, was completed in 1928 as part of a water supply project for the Montague Water Conservation District (MWCD). MWCD owns 60 miles of canals (the main canal is approximately 35 miles long) and lateral ditches to serve water rights owners during the irrigation season. Although a relatively small reservoir, with a capacity of approximately 50,000 acre-feet, the reservoir fills only in above-normal runoff years due to the relatively modest yield from upstream watershed areas, seasonal water use, and appreciable seepage loss (6,500 to 42,000 acre-feet) from the reservoir.

Relatively high precipitation in the area of the watershed above Lake Shastina creates precipitation-based flow in Dale and Eddy Creeks and the Shasta River. Spring flows from the flanks of Mount Shasta to Boles Creek, Beaughton Creek, and Carrick Creek account for much of the inflow to Lake Shastina. Flows can be flashy in Dale Creek, Eddy Creek, and the Shasta River, while flows in the spring fed creeks tend to be more stable and provide reliable base flows in wet and dry years. Parks Creek is spring fed from Mt. Eddy, and flows are diverted into the Shasta River above Dwinnell Dam for storage in Lake Shastina under a MWCD water right.

Between Dwinnell Dam (RM 40.6) and the canyon (RM 7.3) the Shasta River meanders along the Valley floor and is slow moving and sluggish with much of the shoreline characterized as cattail marsh. Numerous accretions from tributaries (including Big Springs, Parks, Willow, Julian, and Yreka Creeks, and Oregon Slough and the Little Shasta River), springs, and agricultural diversions, and return flows in this portion of the river contribute to a complex flow regime. During summer months, Big Springs Creek inflow accounts for up to 50% of the flow in the river below Big Springs Creek.

2.1.6.3.6.____Fishery

Anadromous fish populations currently utilizing the Shasta River watershed include fall Chinook (Oncorhynchus tshawytscha), coho salmon (O. kisutch), and fall and winter steelhead trout (O. mykiss). Historically, summer steelhead and spring Chinook runs utilized the Shasta River, but those runs no longer occur. Considered together, under various life stages, fall Chinook, coho, and fall and winter steelhead are present year-round in the Shasta River basin.

The Shasta River was once one of the most productive streams of its size for anadromous fish in California. Historically, the spring Chinook run in the Shasta River was estimated to be at least 5,000 fish and was one of the largest runs in the Klamath basin. However, by the early 1930s increased summer water temperatures caused by the effects of Dwinnell Dam and habitat degradation resulted in the disappearance of the spring Chinook run in the Shasta basin.

In the Klamath River basin, the fall Chinook salmon are the predominant run and are the only Chinook run believed to currently exist in the Shasta River basin. However, this population has also experienced a sharp decline since the 1930s. Fall Chinook spawning populations, as measured at the Shasta River Fish Counting Facility located near the mouth of the Shasta River, have ranged from a high of 81,848 fish in 1930 to fewer than 750 fish in 1990-1992. Fall Chinook numbers have since rebounded. In 2000 and 2001 fall Chinook numbers were over 11,000 fish, but declined again in to fish 6,818 in 2002 and 4,289 in 2003.

Available data for coho and fall and winter steelhead runs are not entirely reliable for determining long-term trends, but both species are considered to have experienced dramatic declines from historic numbers throughout the Klamath River basin. Known problems for coho in the Shasta River include degradation and loss of spawning and rearing habitat, barriers to passage, high water temperatures, turbidity, agricultural diversions, and low in-stream flows (SSRT 2003). Similarly, an estimated 8,513 fall steelhead migrated up the Shasta River in 1932, and the estimated average annual population of fall and winter steelhead in the Shasta River basin from 1959 to 1963 was 6,000. However, in 1970 the fall population was estimated to be 860 adult fall steelhead, though this number is probably an underestimate.

The Shasta River watershed hosts numerous populations of non-migratory fish species. Native fish persisting in the river include a variety of sculpin species, including marbled sculpin and speckled dace. Introduced species include yellow perch, brown bull, blue gill, largemouth bass, mosquito fish, green sunfish, and brook and brown trout. Populations of both native and introduced non-anadromous species persist in the Shasta River basin above Dwinnell Dam. The California Department of Fish and Game (CDFG) regularly plants rainbow trout in Lake Shastina and Boles Creek, and brown trout brood stock is occasionally placed in Lake Shastina.

2.1.6.3.7. Topography and Geology

The watershed consists of two major types of topography, the low-gradient floor of the Shasta Valley, and surrounding steep mountains, punctuated by Mt. Shasta at the southern border of the basin. The river drops about 220 feet in elevation in the valley. In the canyon section of the watershed, downstream of the valley, the Shasta River descends approximately 370 feet in approximately 7 miles to its confluence with the Klamath River. Watershed elevations range from approximately 2020 feet at the confluence with the Klamath River to a peak elevation of 14,179 feet at the summit of Mt. Shasta.

The Shasta River watershed spans the junction between two major geologic/geomorphic provinces. Mount Shasta and the mountains on the east side of Shasta Valley are formed of relatively young Cenozoic volcanic and intrusive rocks and are part of the Cascade Range volcanic province. The mountains on the west side of the watershed are older Franciscan rocks of the Klamath Mountains province. The valley floor between these major provinces consists of deposits that are mostly alluvium. However, a single area stands out as unique: a gigantic landslide deposit that covers about 180 mi^2.

A large area along the axis of Shasta Valley is hummocky with many closed depressions and little integrated drainage in many parts. It is underlain by unsorted rocky debris. This area is the result of the deposit of a gigantic debris avalanche, or avalanches, that originated on the north slope of Mount Shasta in Pleistocene time (Crandell 1989). The deposit extends northward to where the Shasta River meets the Klamath. The implication of the underlying geology of the Shasta basin is that much of the soil in the basin is of volcanic origin, and therefore can have high levels of phosphorus. These natural sources of phosphorus contribute to relatively high concentrations of inorganic phosphorus in the Shasta River.

2.1.6.4.______Scott River HA (105.40)

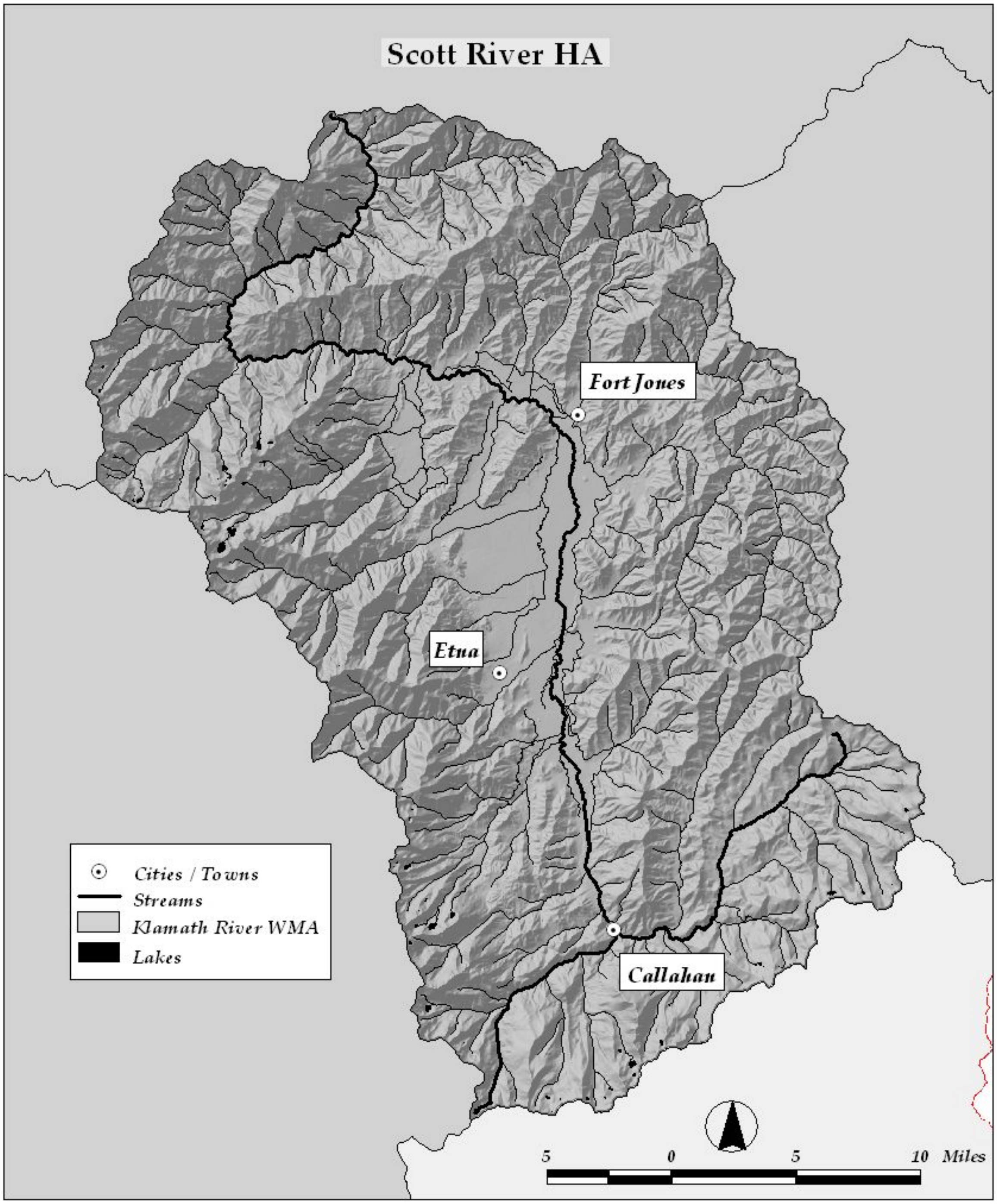

Figure 7. Map of the Scott River HA

The text presented within this section includes information that has been previously published by North Coast Regional Water Quality Control Board 2005 (Staff Report for the Action Plan for the Scott River Watershed Sediment and Temperature Total Maximum Daily Loads) and references included therein.

2.1.6.4.1.____Overview

The Scott River HA drains an 813 mi^2 watershed in the Klamath Mountains in Siskiyou County in California, flowing generally northward into the Klamath River at river mile 143. The watershed shares divides with the Shasta River to the east, the Trinity River to the south, and the Salmon River to the west. The total resident population in the Scott River watershed in the 2000 census was estimated at approximately 8,000. Four population centers in the watershed from north to south are Fort Jones (pop. 670), Greenview (pop. 175), Etna (pop. 790), and Callahan (pop. 200) (SRWC, 2004; NationMaster.com, 2005).

2.1.6.4.2.____History and Land Use

The Scott River watershed's longest standing residents are Native Americans. The Quartz Valley Indian Community, federally recognized in 1983, includes members of the Shasta, Karuk, and Upper Klamath tribes. Tribal trust lands include the Quartz Valley Indian Reservation.

The hydrology and surface conditions in the Scott River watershed have been affected over time by several intense human activities. From about 1820 into the 1850s, systematic trapping removed a large population of beavers in the watershed. Beaver ponds provided lag time in runoff and sources of infiltration to recharge groundwater.

Rich placer gold deposits beneath the streams and floodplains, and in the gravels of river terraces, led to extensive placer mining beginning in 1850. Riparian areas along the mainstem Scott River, the South Fork, the East Fork, Oro Fino Creek, and many tributaries to the west and south of Scott Valley were greatly disturbed by placer mining. Large areas adjacent to streams were stripped of vegetation and the stream deposits hydraulically or mechanically worked to retrieve gold. These techniques left behind un-vegetated, worked river and terrace deposits, many of which persist today as piles of boulders and cobbles that still lack soil and harbor little vegetation. Water from virtually all tributaries was diverted for use in mining. Much of the resulting ditch system has remained in use, and parts have been expanded as agriculture developed.

Agricultural activities have cleared land and created a large demand for diverted stream water and shallow ground water. Once-dense riparian vegetation has been radically reduced, except in areas where riparian fencing excludes stock from the riparian area and stream channel. By the early 20th century, most of the floor of Scott Valley, and tributary valleys that were not too steep had been cleared and converted to agriculture. There is approximately fifty square miles of irrigated land in the watershed. To protect farmland from bank erosion and reduce flooding, the mainstem Scott River has been straightened, rip-rap placed along the channel through much of the valley, and the river further constrained by levees along some stretches.

Timber harvest began along with mining, but large-scale timber harvest for export from the area has been ongoing only since 1950. The extensive network of roads, skid trails, and landings, along with other associated timber harvest activities, have led to increases in sediment contributions to the stream system. Large areas underlain by decomposed granite soil are particularly prone to chronic raveling when disturbed, and produce large amounts of sand-sized sediment.

Current land-use activities in the watershed include timber harvest on both private and public lands, irrigated agriculture (primarily alfalfa, pasture, and grain), and livestock grazing. Irrigated agricultural lands comprise about 32,000 acres, or 6%, of the watershed area. In the basin, one or more of these activities have the potential to affect water quality through increased sediment loads to streams, increased solar radiation from loss of near-stream shade warming water, consumptive water use, and loss of large woody debris in streams.

2.1.6.4.3. Vegetation

The vegetation of the Scott River watershed is heterogeneous and reflects the climatic variation in the watershed. Conifer tree species are the most common vegetation in the mountains of the north, west, and southern areas of the watershed. The southwestern area of the watershed is known to have the greatest diversity of conifer species in the world. The eastern areas of the watershed reflect the drier climate, with most conifers primarily found on north-facing slopes. However, western Junipers are found scattered throughout the eastern areas of the watershed.

Hardwood tree species, such as oak and madrone, compose a small portion of the vegetation of the watershed and are most common in the northern and eastern areas of the watershed. Grassland and agricultural crops compose just over ten percent of the watershed, and are primarily found in Scott Valley and areas in the East Fork Scott River watershed.

2.1.6.4.4. Climate and Hydrology

The Scott River watershed has the typical hot, dry summers and cool, wet winters characteristic of Mediterranean climates. However, because the watershed lies at the northern extreme of the Mediterranean climate zone, and is located in a mountainous region, the watershed has colder winters than the average Mediterranean region. The Scott River watershed mainly falls within the Mediterranean highland climate region with much of the winter precipitation falling as snow.

The Scott River hydrology depends largely on precipitation stored as snow at higher elevations in the mountains to the west and south of Scott Valley, where annual precipitation ranges from 60-80 inches. Streams leaving the mountains emerge into the valley and recharge the high capacity aquifer of sand and gravel that underlies the valley. Many of the streams entering from the west form alluvial fans where they enter the valley. These alluvial fans are areas where groundwater recharge occurs, and the streams often go completely dry as water percolates into the permeable gravels.

In the mountains of the east side of the watershed precipitation ranges from 12-15 inches. This eastern area is much drier because it lies in the rain shadow of the mountains to the south and west. Many of the eastside streams are ephemeral for most of their length, flowing only during precipitation events. However, in the headwater reaches, many of the streams flow perennially.

The hydrologic conditions of the Scott River watershed vary widely from year to year, experiencing both floods and droughts regularly. The largest floods occur when relatively warm storm systems melt a pre-existing snow pack. The Scott River watershed is susceptible to these rain-on-snow events due to the topographic characteristics of the basin. A significant portion of the basin is between 4,500 and 5,500 feet in elevation, which is the range of elevation most susceptible to rain-on-snow. The largest floods of record (1861, 1955, 1964, 1974, and 1997) were associated with rain-on-snow events. Drought years have occurred in 1944, 1955, 1977, 1990, 1991, 1992, 1994, 2001, and 2002.

2.1.6.4.5. Fishery

Anadromous fish populations currently utilizing the Scott River basin include coho salmon, fall and winter steelhead trout, and fall Chinook salmon. Historically, there were summer steelhead and spring Chinook runs in the Scott River. Those runs no longer occur in this basin, although a few random summer steelhead have been observed. In the early 1960s, the California Department of Water Resources (CDWR) estimated populations of 2,000 coho and 20,000-40,000 steelhead in the Scott River basin. In the absence of additional quantitative data, it is assumed that the trends in coho and steelhead within the Scott River basin are similar to the declining population trends within the larger Klamath basin.

Fall Chinook salmon are the only Chinook run currently observed in the Scott River basin. Data indicate that the fall Chinook population within the Scott River basin has experienced a decline since at least the 1960s. CDFG estimated that there were 8,000 fall Chinook in the Scott River basin in 1965. Fall Chinook spawning escapement has been monitored by the CDFG annually since 1978, and spawning populations have ranged from a high of 14,477 fish in 1995, to a low of 445 fish in 2004.

2.1.6.4.6. Topography and Geology

The Scott River watershed consists of two major types of topography. The gently graded floor of Scott Valley, about 75 mi^2, is traversed by some thirty miles of the mainstem Scott River and the lower reaches of tributaries. Surrounding this valley are steep mountains incised by steep-sided valleys carrying rushing streams. Elevations range from above 8,542 feet at China Mountain in the Scott Mountains on the southern boundary of the watershed, down to the 2,500-3,200 foot range in the floor of Scott

Valley. In the canyon section, downstream of Scott Valley, the Scott River descends to 1,600 feet in elevation where it enters the Klamath River.

The valley of the mainstem Scott River can be divided into two major reaches. The lower Scott River, from River Mile (RM) 0 to RM 21, known as the "canyon section," flows mostly on bedrock and is confined in a steep-sided, rocky canyon at a gradient in the range of 45-55 ft/mi. From RM 21 to about RM 50 – through flat, open, agricultural Scott Valley – is the "valley section" of the river, which flows across the gentle plain of the floor of Scott Valley. Through this section, the gradient is in the range of 4-8 ft/mi.

The Scott River watershed is underlain by complex, highly deformed rocks intruded in places by granite. The deformed bedrock is greatly varied and includes high and medium grade metamorphic rocks, slightly metamorphosed sedimentary rocks and volcanics, granite and diorite, mafic and ultramafic rocks that are largely altered to serpentine, and small amounts of limestone. Scott Valley has been down-dropped and broken by faulting during late Tertiary and Quaternary time. In consequence, bedrock under the middle part of the valley is several hundred feet below bedrock near the downstream end of the valley. This great depression has been filled by sediments, mostly gravel and sand, that have been washed in and deposited by streams during the subsidence. This basin-fill deposit is a high capacity aquifer that carries a large amount of ground water that allows the abundant irrigation that supports much of the agriculture in Scott Valley.

2.1.6.5.   Lower Klamath River HA (105.10)

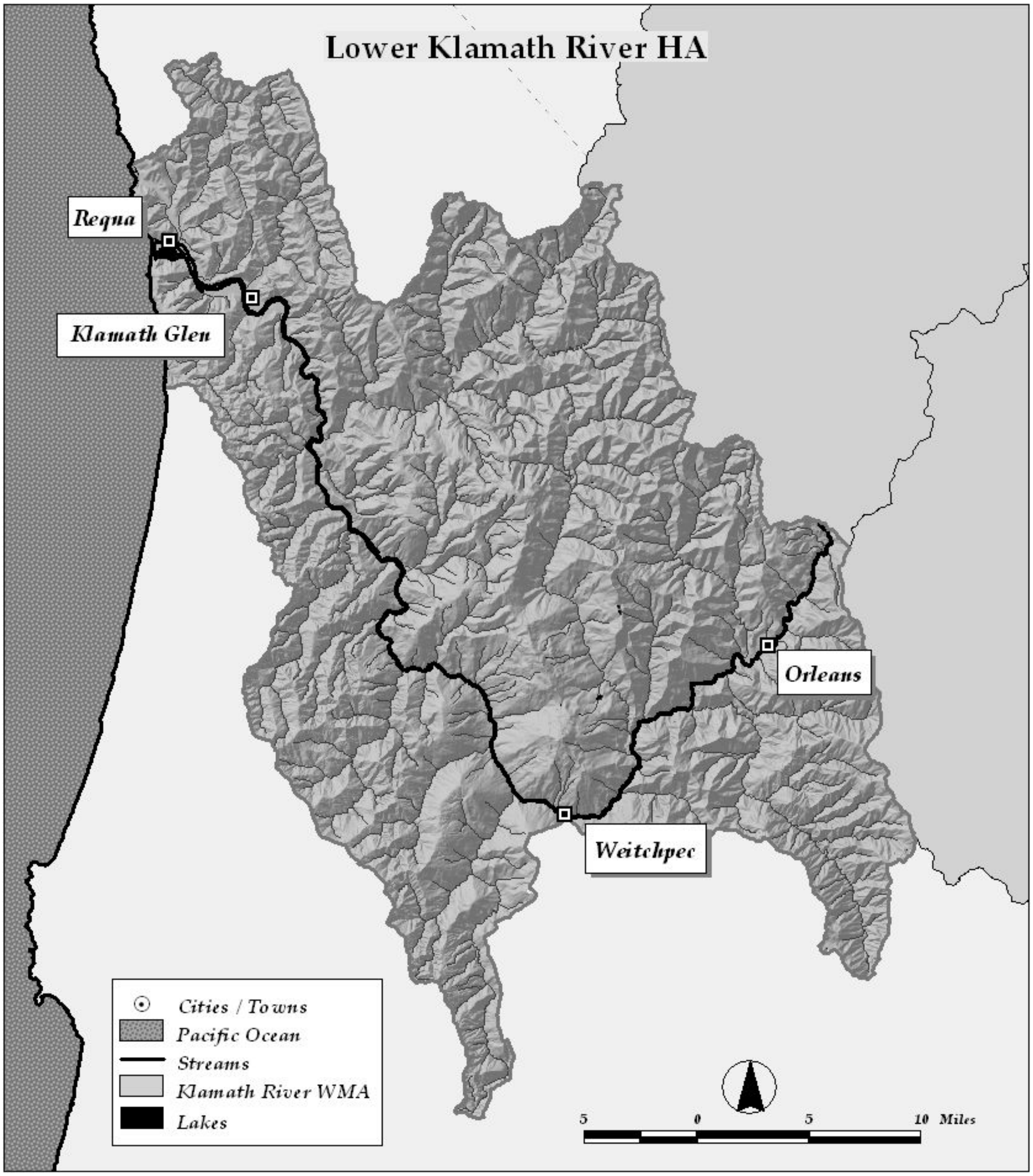

Figure 8: Map of the Lower Klamath River HA

The Lower Klamath River HA is the portion of the Klamath River and its tributary watersheds downstream from the confluence of the Salmon River to the Pacific Ocean (excluding the Trinity River), and is 771 mi^2. Included in the watershed are Salmon River, Blue Creek, numerous smaller perennial streams, and the Klamath River delta/estuary. The area is characterized by mountainous terrain and rugged, steep forestland with highly erodible soils. Silviculture occurs on both USFS and private lands. Timber sales occur in the Klamath National Forest, and logging is particularly heavy on private corporate lands in the redwood region of the lower basin. The population of the area is small and scattered and communities along the Klamath are almost all timber-based. The Hoopa and Yurok Tribes live along the lower Klamath River, with fishing being an important part of their cultures. The Lower Klamath River is an active and popular recreational salmon fishery.

2.1.7. Water Quality Issues in the Klamath River WMA

2.1.7.1. Klamath River Mainstem

Many natural and human-altered watershed elements above Iron Gate Reservoir in California and Oregon affect the quality and quantity of water that exits Iron Gate Reservoir, supply the Klamath River mainstem flow, and both support and jeopardize the beneficial uses of the river within California. The complexity of this basin is magnified by jurisdictional issues associated with water delivery/utilization infrastructures including not only the Federal Klamath Project, but also:

- Irrigation
- Hydropower
- Endangered species
- Tribal rights
- Lake-level-management demands for Upper Klamath Lake
- The waters crossing and re-crossing the California-Oregon border
- Minimum flow requirements in the Klamath river below Iron Gate Dam

Hydromodifications – dams, levees, irrigation diversion, and drain-water removal works – that have been constructed beginning in 1860 in the Klamath River basin upstream of Iron Gate Dam have resulted in the following changes:

- Diminished dry season river flows.
- Increased summer/fall water temperatures and impairments to WARM and RARE beneficial uses.
- Arrested the migration of anadromous fish.
- Endangerment of fish species native only to this basin.
- Development of an extensive agricultural community in Oregon and California, including the development of extensive private property on once underwater lake/marshes and once inhospitable canyon lands.
- Development of extensive hydropower resources.
- Preservation of managed migratory waterfowl refuges.
- Ground water augmentation of surface flows.

The Klamath River is the second largest river by volume in California, flowing southwestward from the Cascade Mountains for approximately 263 miles through Oregon and California to its final four river miles within the California coastal zone. Primary uses of this river include domestic, agricultural, and industrial water supply; cold and warm water fisheries; and recreation.

The quality of water from Iron Gate reservoir is a chief concern in the basin; the low DO and high nutrient concentrations of water released from Iron Gate Dam can be considered detrimental to salmonids. Agricultural land use contributes nutrients (primarily from grazing, dairies, and irrigated agriculture in the upper watershed), bacteria, and sediment. Unauthorized discharges and inadequately treated residential sewage have also likely contributed to these issues. In the middle to lower watershed, historic and current timber harvesting is a source of increased sedimentation. Active and inactive mines may also contribute metals.

The NCRWQCB is currently developing TMDLs for the Klamath River basin for impairment due to low dissolved oxygen, elevated temperature, and organic enrichment.

Primary water quality issues in the Klamath WMA include:

- Salmonid habitat destruction
- High water temperatures
- Sedimentation of streams
- Soil erosion
- Mass wasting
- Hydromodification
- Forest herbicide applications
- Low flows
- High nutrient levels
- Low dissolved oxygen

As in many of the North Coast watersheds, the beneficial uses associated with coldwater fishery appear to be the most sensitive of the beneficial uses in the watershed because of the sensitivity of salmonid species to habitat changes and water quality degradation. Accordingly, protection of these beneficial uses is presumed to protect any of the other beneficial uses that might also be harmed by sedimentation and high water temperatures.

2.1.7.2. Shasta River

Elevated water temperatures and low dissolved oxygen levels in the Shasta River and its tributaries produce impairment of designated beneficial uses of water and non-attainment of water quality objectives, specifically those associated with the cold water fishery. These beneficial uses include the migration, spawning, reproduction, and early development of cold water fish including coho and Chinook salmon and steelhead. The coho salmon population in this watershed is listed as threatened under FESA and the California Endangered Species Act. Elevated water temperatures and low dissolved oxygen levels also affect recreational uses, and elevated water temperatures may contribute to impairment of the municipal and domestic water supply beneficial use.

The Shasta River Valley has a substantial cattle grazing industry on private lands irrigated extensively by streams in the watershed. Cattle grazing affecting riparian habitat and bank stability, along with flood irrigation return flow that is warm are the primary causes of high water temperatures and low dissolved oxygen at times during the summer. Restoration of riparian habitats and reuse of irrigation return flow may alleviate these problems.

Other water quality issues are related to surface water and groundwater contamination from treatment plants and toxic chemical discharges in the Weed and the Yreka areas. Treatment plants at Yreka, Weed, Montague, Shastina, and Granada use a combination of oxidation and percolation ponds. In Weed, the Roseburg Forest Products and the J.H. Baxter Paper Company are Superfund sites where treated groundwater is used to water log decks and adjacent fields.

In 2007, the NCRWQCB established TMDLs for the Shasta River basin to address the impairment of beneficial uses and non-attainment of water quality standards due to elevated temperature and low dissolved oxygen.

2.2.________Trinity River WMA HU (106.00)

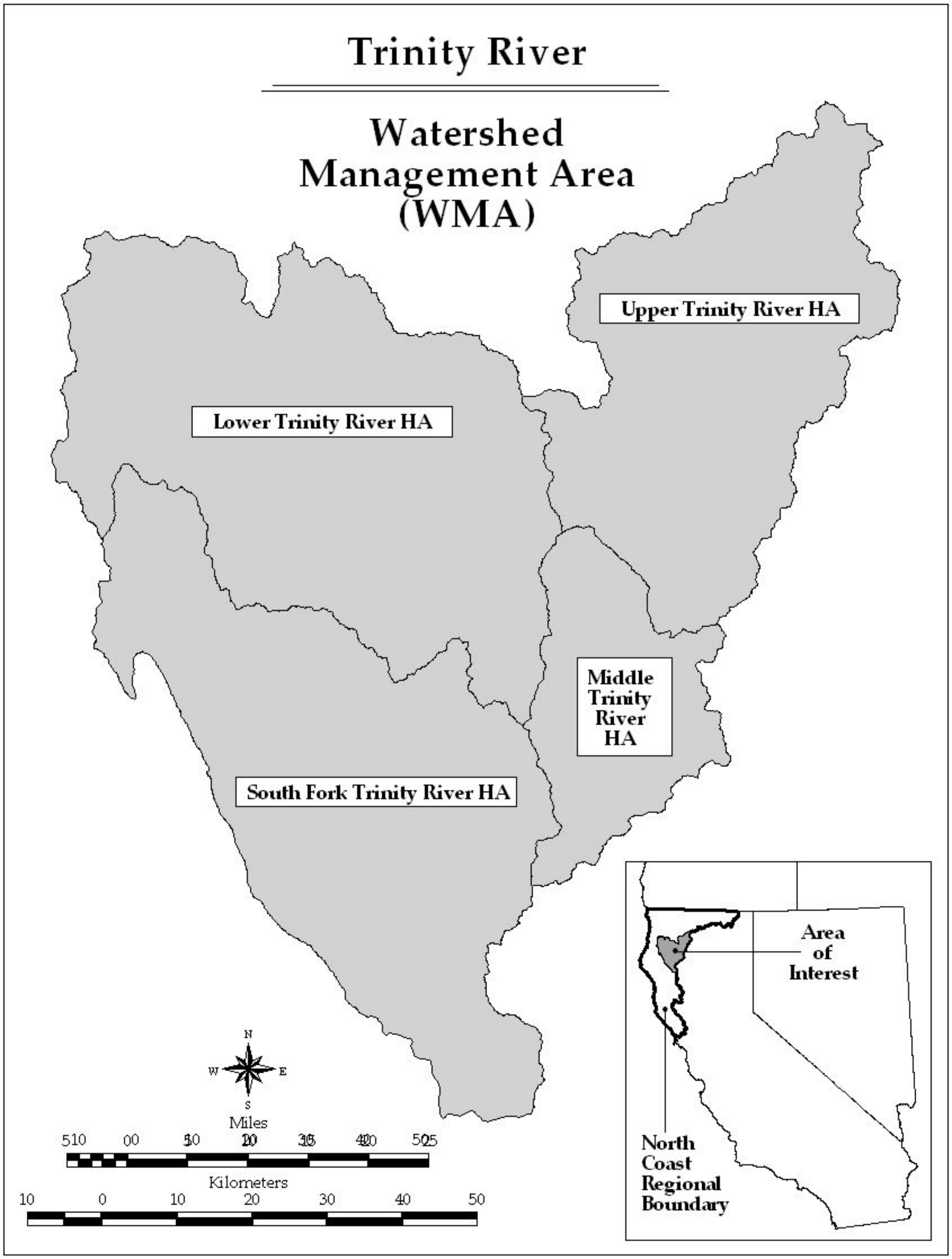

Figure 9. Hydrologic Areas of the Trinity River WAM/HU

The text presented within this section includes information that has been previously published by BLM 1995 (Mainstem Trinity River Watershed Analysis), USEPA 1998 (South Fork Trinity River and Hayfork Creek Sediment Total Maximum Daily Loads), USEPA 2001 (Trinity River Total Maximum Daily Load for Sediment), USFS 2003(Mainstem Trinity Watershed Analysis), and references included therein.

2.2.1. Overview

The Trinity River WMA HU (106.00) lies within the overall Klamath River basin but is not included in the Klamath WMA; it is its own WMA. The Trinity River WMA includes four hydrologic areas (HAs) within HU 106.00: Upper Trinity River HA (HA (106.40), Middle Trinity River HA (106.30), Lower Trinity River HA (106.10), and South Fork Trinity River HA (106.20), (see Figure 9).

The Trinity River WMA is approximately 2900 mi^2 in northwestern California; the Trinity is the largest tributary to the Klamath River. It originates in the Klamath and Coast Ranges and flows 172 miles south and west through Trinity County, then north through Humboldt County and the Hoopa Valley Indian reservation. The confluence with the Klamath River at Weitchpec is about 43 miles upstream from the Pacific Ocean. Lewiston Dam and Trinity Dam form Lewiston Reservoir and Trinity Lake, on the Trinity River. The entire mainstem of the Trinity River was designated a National Wild and Scenic River in 1981. The mainstem is also classified as recreational and scenic under the California Wild and Scenic Rivers Act. Bald eagles and northern spotted owls, both federally listed threatened species, are found in the WMA.

Approximately 80% of the Trinity River basin is under public ownership by the USFS and BLM, including the Trinity Alps Wilderness areas, the Shasta-Trinity National Forest, and the Six Rivers National Forest. The Hoopa Valley Tribe occupies 144 mi^2 of the lower basin, and the remainder of the watershed is privately owned by three timber companies, and individuals for residences and agricultural operations, particularly in the Hayfork Valley.

2.2.2. History and Land Use

The discovery of gold in the Trinity River watershed at Reading Bar, near Douglas City, in 1848 led to a massive influx of miners and settlers and the eventual demise of Native Americans. There were extensive mining operations—in-stream gravels were dredged and the river was often diverted entirely out of the channel. Huge hydraulic mining operations for gravel at the confluence of the South Fork and mainstem Trinity River in the 1930-40s introduced enormous amounts of sediment into the river. These operations resulted in the first long-term impact to the salmonid habitats of the Trinity River. Today, gold mining is limited to suction dredging in the streambed and is predominately recreational. Placer mining occurs in a few tributary watersheds.

The timber industry began in the mid-1850s when numerous small sawmills began operating sporadically, usually in conjunction with mining activities. Timber harvest at that time was very selective, taking only the largest and most easily accessible trees for the supply of a local market. Logging was an important industry by the mid-1940s, but significant volumes were not taken until after WWII, when modernization and improved technologies occurred. Most of the forested areas have been cut at least once and many areas twice. In the South Fork sub-watershed, logging began in 1949 and intensified in the 1960s, probably exacerbating the detrimental effects of the 1964 flood. Of the 80% of the South Fork basin originally occupied by forest, about half had been logged by 1977. Today, timber is harvested on federal lands but production is considerably less than in the past. About 10% of the watershed is currently used for industrial timber harvest. However, historical and current road building and logging on steep slopes has accelerated erosion and sedimentation.

The Trinity River basin is mostly undeveloped and has only the small scattered towns of Trinity Center, Weaverville, Lewiston, Hayfork and Hyampom. Land use, in addition to timber and mining, includes recreation, such as fishing, tourism, and agriculture. Agricultural activity consists of cattle grazing, small produce farms, orchards, and vineyards. Crops grown include peaches, pears, grapes, corn, tomatoes, peppers, squash, melons, flowers, herbs, oat hay, and alfalfa.

2.2.3. Vegetation

The Trinity River basin is on the southern boundary of a biologically complex area, the Klamath Mountain Province. It supports a wide range of flora and fauna, and is one of the most diverse river ecosystems on the west coast. The highest elevations in the Trinity WMA, above the treeline, are steep, bare mountains. Below about six thousand feet, the landscape is dominated by conifer forests and mixed conifer/hardwood forests. Common tree species include tanoak, Douglas fir, white fir and red fir. Complex riparian vegetation, evergreen brush, rangeland, meadows, and chaparral are present at the lower elevations. Shrubs dominate many south-facing slopes.

2.2.4. Climate

Precipitation is highly seasonal, with 90 % falling between October and April. Overall, average rainfall is 57 inches/yr but can vary from 15-100 inches in extreme years. At higher elevations, a portion of the annual precipitation falls as snow. Annual precipitation ranges from 37 inches in Weaverville and Hayfork to 75 inches in Trinity Center and 85 inches in the Hoopa Mountains and on the west side of the South Fork sub-watershed. Occasional summer thunderstorms produce extensive runoff to streams and the river and can start wild fires. The wildfire frequency interval of 7 to 35 years is relatively high.

2.2.5. Water Resources

In the early 1950s, construction of Lewiston Dam and Trinity Dam began above RM 112 and the community of Lewiston. The dams were completed in 1963 and formed Lewiston Reservoir and Trinity Lake. These dams and reservoirs are known collectively as the Trinity River Diversion (TRD) of the Bureau of Reclamation's Central Valley Project (CVP). There are 719 mi^2, about 25% of the watershed, upstream of Lewiston Dam. Water stored and released from Trinity Lake is used for power-generation, and a majority of the upper-basin's water yield is diverted out of the basin at Lewiston Reservoir for multiple uses, including agriculture, throughout the Central Valley of California. The TRD determines stream flow in the Trinity River. Before the dams were built, the average annual stream flow of this watershed from 1912 to 1960 was about 1.2 million acre feet. In 1995, the maximum annual flow allocation from Lewiston Dam was 340,000 acre feet; 800,000-1,000,000 acre feet are diverted annually to the CVP.

The TRD had a major impact on the flow, function, and use of the Trinity River. Historically, flow in the Trinity River fluctuated seasonally, resulting in a channel with extensive gravel bars and little established riparian vegetation. Seasonal flushing flows moved fine-grained sediment downstream, removed emerging riparian vegetation, and created a diverse habitat of pools, riffles, runs, and point bars that provided high quality salmonid and amphibian habitat. Flow regulation at Lewiston Dam reduces the highest peak-flows and generally increases summer and fall flows above naturally low background levels. Overall, streamflow, sediment transport, and channel complexity have been substantially reduced. The current flow regime neither mobilizes sediment sufficiently in the channel nor prevents the establishment of dense, mature riparian vegetation. Acres of riparian vegetation along the main stem Trinity River increased by 282% between 1960 and 1989 as an indirect result of the dams. Open water and gravel bar habitats have decreased by 45% and 95% respectively. In-channel habitat diversity for salmonids and other aquatic species has been greatly simplified. Control of the river's flow has allowed residential and commercial developments to encroach onto the historic floodplain, bringing sources of sediment and pollution closer to the waterways and limiting potential increases in flow releases from the dam for salmonid population restoration purposes.

2.2.6. Fishery

The Trinity River has historically been recognized as a major producer of Chinook and coho salmon and steelhead trout. The fishery sustained the Hoopa people for several thousand years. Five known stocks and runs of anadromous fish utilize the South Fork Trinity River watershed: spring and fall Chinook, coho, and summer and winter steelhead.

Populations of coho, Chinook, and steelhead have declined significantly from historical levels due in part to habitat degradation caused by the TRD. Prior to dam construction, Chinook runs from 1944-1956 ranged from 19,000 to 67,115, with a mean of 38,154, and the annual fall Chinook salmon run averaged 45,600 fish in the 1960s. From 1982-2000, natural runs varied from <5,000 to >50,000 but averages of 11,932 and 13,465 were reported. The average run of natural spring Chinook salmon from 1982-1999 was 2,370. Coho runs from the 1990s varied from 0 to ~1,000 and averaged 390 fish. Steelhead runs averaged 1870 fish from 1992-1996; current native stock populations are well below restoration goals. Coho salmon are currently listed as threatened under FESA, though Chinook and steelhead are not

The TRD changed the distribution of the fish as well. The dams blocked access to approximately 59 miles of Chinook habitat, 109 miles of steelhead habitat, and an undetermined amount of coho salmon habitat. Before dam construction, an estimated 5,000 coho salmon spawned above Lewiston; winter steelhead spawners ranged from 6,900 to 24,000 and summer steelhead averaged 8,000. Annual natural steelhead escapement above Lewiston from 1980-1999 averaged 4,400 fish. However, tributaries from the North Fork upstream to Deadwood Creek appear to be supporting stable or recovering populations of salmonids. Chinook, coho, and steelhead are also known to inhabit the lower portions of Mill Creek, Horse Linto Creek, and Sharber/Peckham Creek. Summer steelhead are found in the North Fork, South Fork, Canyon Creek, and the New River. In the 1990s, 307-804 summer steelhead were counted in the New River, making it one of the larger populations in California.

A hatchery was built at Lewiston to mitigate the loss of anadromous salmonid habitat upstream blocked by the dam. This hatchery produces spring and fall Chinook, coho, and steelhead. However, a significant portion of the hatchery-produced fish stray and spawn with the naturally-produced fish in the river and tributaries below the dam. These hatchery-produced fish compete with the natural fish for the available spawning and rearing habitat. Crossbreeding of hatchery and wild fish reduces the genetic integrity of wild populations, which can lead to loss of fitness in local populations and loss of diversity among populations.

The flood of 1964 also contributed to the decline of salmonids. This can be seen clearly in the South Fork, which is not dammed. Heavy rainfall, unstable geology, and erosion-causing land use practices contributed to the many mass wasting events triggered by that flood that resulted in dramatic in-stream changes including channel widening, aggradation, deposition of fine sediment, loss of deep pools, and associated increases in temperatures, all of which adversely affected the fishery. In 1963 and 1964, before the flood, the spawning spring Chinook population was estimated at >10,000 fish; complete surveys were not conducted in the 1960s following the December 1964 flood, but in the 1970s and 1980s estimates were as low as a dozen in some years. Fall-run Chinook spawners were estimated at over 3,300 in 1963. Later counts estimated <500 fish in the late 1980s. Steelhead also declined in number. The Chinook salmon spawning runs increased slightly in the 1990s suggesting the beginnings of a recovery. From 1988-1997, spring Chinook spawners averaged 400-700 annually and the fall spawners averaged 800-1,400 annually.

Other fish found in the Trinity River WMA include white and green sturgeon, anadromous Pacific lamprey, rainbow trout, speckled dace, three-spined stickleback, Klamath small-scale sucker, sculpins, and introduced eastern brook trout, Brown trout, American shad, brown bullhead, golden shiner, and green sunfish. Green sturgeon migrate upstream in late February and spawn in spring and early summer. Similar to salmon, they require deep pools and suitable substrate quality for spawning, and their reproductive success can be impeded by excessive fine sediment. Pacific lamprey populations have probably also declined dramatically over the last several decades. Brown trout compete directly for food and cover with all native salmonids in the river. They become territorial and the larger fish tend to dominate areas of suitable salmonid habitat. Brown trout also prey on juvenile salmon and steelhead. Trinity Reservoir supports a trophy smallmouth bass fishery and provides sport fishing for largemouth bass, rainbow trout, kokanee salmon, landlocked Chinook salmon, and other gamefish.

2.2.7. Topography and Geology

The Trinity River watershed is steep, mountainous, and highly erodible. Elevations range from 250 feet at the confluence of the Trinity and Klamath Rivers near Weitchpec to 9,000 feet in the Trinity Alps. Much of the Trinity WMA is prone to seismically induced landslides due to rapid ground acceleration from local and coastal seismic activity, especially during winter months when slope soils are saturated. Valley inner gorges, which are over-steepened slopes adjacent to stream courses, are commonly highly unstable. Areas of granitic soils are productive but highly erosive; granitic soils contain a high percentage of sand, which embeds gravel in stream beds. Ground water resources are relatively plentiful throughout the geologic systems, but are not well defined.

The South Fork Trinity River drains an area containing steep, unstable slopes. The South Fork basin straddles the boundary between the Coast Ranges and the Klamath Mountains geologic provinces. The Coast Ranges are underlain by the Franciscan Assemblage, a highly deformed, faulted and sheared complex of partly metamorphosed marine sedimentary and volcanic rocks. Geologic units in the Coast Range Province include the South Fork Mountain Schist, which is highly erodible. The Klamath Mountains geomorphic province contains major rock units ranging from 330 to 125 million years in age from the Devonian to Jurassic. Areas to the east of the South Fork, including most of the Hayfork Creek sub-basin, are generally more stable than the steep slopes of South Fork Mountain and the lower basin. The west side of the South Fork is dominated by more erodible and unstable geologic terranes, which occupy 32 % of the South Fork basin land area but generate 89 % of the total mass wasting in the basin.

2.2.8. Sedimentation

Sediment load in the Trinity River watershed varies with area, from the highest average annual yield of 2,963 t mi^{-2} yr^{-1} in the lower portion of the watershed to less than half that in the upper middle section (1,332 t mi^{-2} yr^{-1}). The relative contributions from natural background sources and land management activities also vary with area. The natural background contribution to total sediment production varies from 43% in the upper middle section to 81% in the lower middle section. In the lower watershed, half the sediment input is natural and half is anthropogenic. The majority of management associated inputs is from roads and timber harvesting; mining and agriculture are not significant sources.

In the South Fork, annual sediment production averaged 1,053 t mi^{-2} yr^{-1} from 1944-1990; within the South Fork watershed, sediment production varied with sub-basin area from 361 t mi^{-2} yr^{-1} to 2,385 t mi^{-2} yr^{-1}. Throughout the whole basin, mass wasting contributed 64% of the sediment, most of which was not associated with management activities, and natural background processes contributed 65% of the total sediment load. Roads were responsible for 18% of the total sediment yield, timber harvest contributed 9%, and another 8% came from unspecified management-related processes. Road-related sediment delivery has continued to increase from 1944 to the present.

2.2.9. Hydrologic Areas of the Trinity River WMA

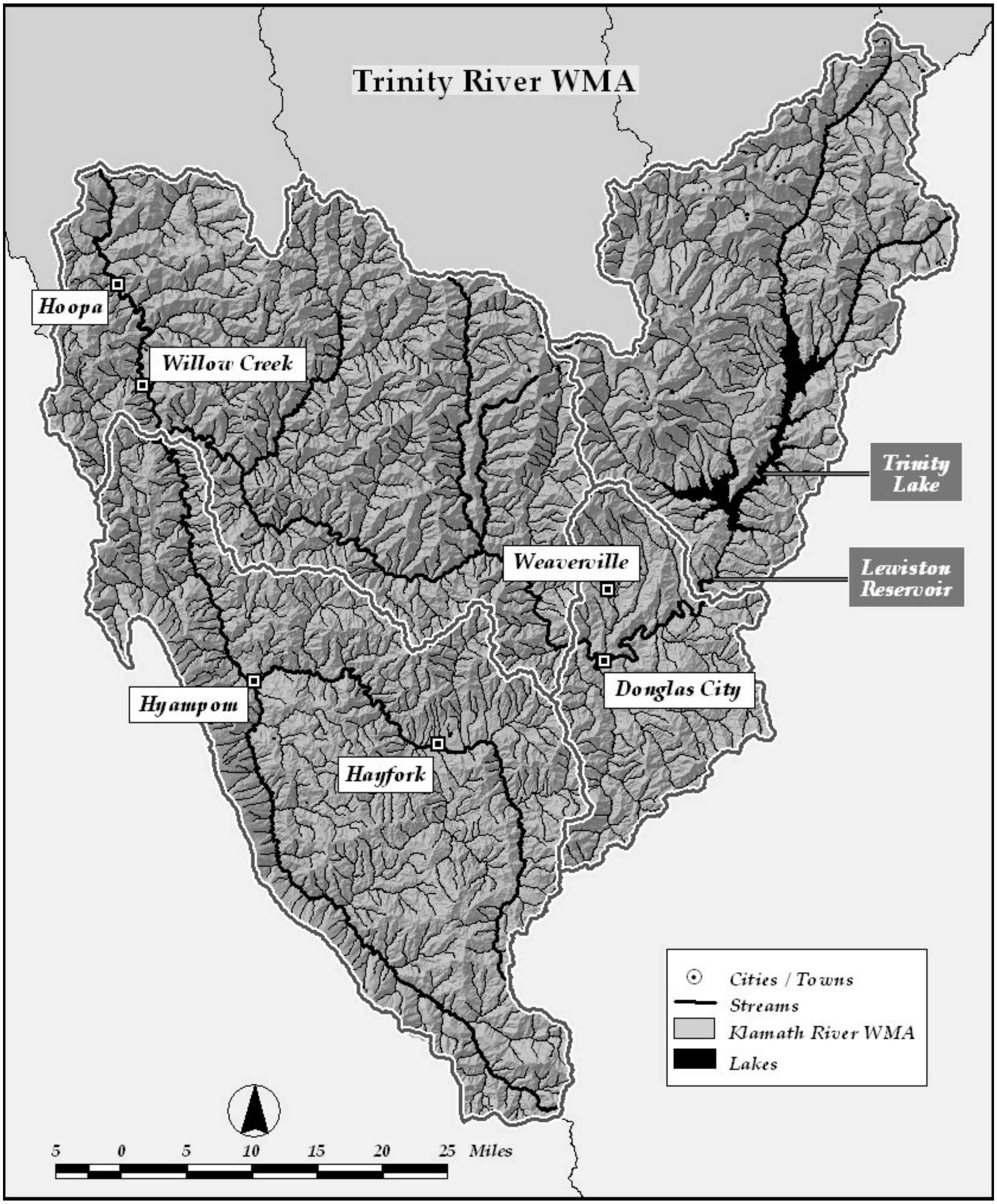

Figure 10. Map of the Trinity River WMA/HU

2.2.9.1. Upper Trinity River HA (106.40)

The upper Trinity HSA includes the area upstream of Weaverville (including Trinity and Lewiston Lakes). About half of this area is designated as wilderness area. The USFS controls the wilderness area where some grazing is still allowed. Logging on both private and USFS land causes erosion of many areas and sedimentation in the streams and lakes. Several of the tributaries west of Trinity Lake are important for spawning of kokanee salmon and resident trout. In the 1970s, these tributaries provided relatively good habitat, having largely recovered from the impact of hydraulic mining that occurred until 1939. The Trinity River Diversion (TRD) decreases the amount of water in the Trinity River basin by diverting water to the Sacramento Valley and the Bureau of Reclamation's Central Valley Project (CVP). This diversion leads to increases in the temperature of the remaining water in the river and disrupts physical cues for migration and spawning of salmon. The Trinity River Fish Hatchery was constructed at the base of Lewiston Dam to help mitigate the loss of fish habitat resulting from the project, but the hatchery has not been effective in sustaining fish populations.

2.2.9.2. Middle Trinity River HA (106.30)

This area extends from Junction City to the Lewiston Dam and is the area of highest human population in the Trinity WMA (Weaverville). The terrain in this area is relatively flat and as such is an area of sediment deposition. Logging operations and road building and use have caused erosion, sedimentation, and elevated turbidity of streams and the river. Many tributaries have also been subject to historic hydraulic mining and water diversion. The most abundant salmonids in the tributaries are steelhead, followed by Chinook then coho.

2.2.9.3. Lower Trinity River HA (106.10)

2.2.9.3.1. Overview

The Lower Trinity HSA contains the sub-watersheds of the New River, North Fork Trinity River, Canyon Creek, and the canyon area and lower portion of the mainstem Trinity River. The Hoopa tribe, which is recognized as a sovereign nation, is located in this area. The Horse Linto Creek sub-watershed is relatively un-impacted compared to other sub-watersheds in the area. It is a Key Watershed in the Northwest Forest Plan and is intended to provide high quality water and critical refugia for at-risk fish species and stocks; Chinook, coho and steelhead are found in its lower reaches. Historically, hydraulic mining occurred in the Lower Trinity River, while current mining practices consist of small placer sluicing and hard rock milling operations.

2.2.9.3.2. New River HSA (106.14)

The New River sub-watershed is 74 mi^2 of mostly undeveloped, forested land that drains into the mainstem Trinity River near the community of Hawkins Bar. Approximately half of the area is designated as wilderness and half is USFS land. The New River is designated as a Wild and Scenic River and is refugia for summer steelhead. It is a Key Watershed in the Northwest Forest Plan. The New River has had a significant summer steelhead population since the 1970s; in the 1990s, 307-804 summer steelhead were counted in the New River, making it one of the larger populations in California. In-stream and riparian habitat in the New River are considered good to excellent, despite the high level of historic mining activity and the fact that 5-44 % of the gravel and cobble in the New River and tributaries is embedded more than 50%. There is a history of lightening-caused wild fires in the area; in 1999, 53% of the watershed burned, but the aquatic ecosystem did not appear to suffer significant negative impact. On USFS land there are limited timber sales and roads that contribute to erosion and sedimentation. Intensive mining occurred historically and suction dredge mining occurs today, causing unstable channel and gravel conditions.

2.2.9.3.3._____Helena HSA (106.15)

The Helena HSA includes the North Fork Trinity River sub-watershed which is 15.8 mi^2 of largely undeveloped, forested land that drains into the main Trinity River near the community of Helena. The area contains rugged terrain with stream reaches of relatively steep gradient. The North Fork is identified as a Key Watershed in the Northwest Forest Plan. The North Fork has had a significant summer steelhead population since the 1970s; the 1990s population was estimated at 300-800 fish, similar to the New River. Most of the area is designated as wilderness and little timber harvesting is conducted. Some mining occurs in the lower part of the sub-watershed. Wild fires also occur in this sub-watershed.

The Canyon Area lies along both sides of the mainstem from the Trinity/Humboldt County line east to Junction City. Most of this area is under the jurisdiction of the USFS. The flow of the river keeps sediment from depositing on the streambed. Along this corridor are homes, mills, the ranger station, and Highway 299. Timber harvest is limited, but chronic landslides block the highway and create the problem of soil deposition in the river. Logging and roads create erosion hazards and potential sedimentation to the streams and the river. This area has been subjected to placer and hydraulic mining in the past.

2.2.9.4.______South Fork Trinity River HA (106.20)

The South Fork Trinity sub-watershed is ~1,000 mi^2 and constitutes 31% of the Trinity River sub-basin and 6% of the Klamath basin. The South Fork Trinity River is the largest un-dammed river in California and the watershed is a Key Watershed in the Northwest Forest Plan. The South Fork originates in the North Yolla Bolly Mountains about 50 miles southwest of Redding and runs northwest for approximately 90 miles before reaching its confluence with the Trinity River near Salyer. Elevations range from more than 7,800 feet in the headwater areas to less than 400 feet at the confluence with the Trinity. It flows mostly through Trinity County, forming the boundary between Trinity and Humboldt Counties in its lower 12 miles. The 56-mile stretch from Forest Glen to the mouth is protected by the California Wild and Scenic Rivers Act.

The South Fork Trinity is primarily mountainous, forested land, with two broad agricultural valleys occupied by the towns of Hayfork and Hyampom. This area is a mix of private and USFS administered public land. It was extensively harvested for timber in the past, which caused erosion and sedimentation of streams and the river. In addition, the area is susceptible to naturally occurring landslides and other mass-wasting events because of steep terrain, loosely consolidated soils (decomposed granite) and heavy precipitation. There is a history of wild fires and the subsequent erosion and salvage logging issues. Hayfork Creek is the largest tributary to the South Fork. Historically, it was the spawning area for steelhead and spring and fall Chinook salmon. However, in the South Fork Trinity, past and present land use practices have accelerated erosion, resulting in increased sedimentation and decreased salmonid habitat; the spring Chinook salmon run has declined by 90% and the fall run by 50%.

2.2.10. Water Quality Issues in the Trinity River WMA

The quality of water in the basin ranges from the highest-quality pristine waters that emerge from the Trinity Alps wilderness into the northern mainstem tributaries, to various degrees of human-caused impairment in the mainstem and southern tributaries, which contributes to the degradation of fish habitat. Natural events and multiple land uses are responsible to varying degrees for sediment contributions. The causes of accelerated erosion and mass wasting include timber production and harvest, road construction, road use and maintenance, grazing, and gravel mining.

Impacts of accelerated erosion on water quality in the South Fork sub-watershed are not equally distributed throughout the basin. The worst effects have been found in the upper and lower sub-basins, which are more erodible, particularly west of the mainstem, and in areas where land management practices are most intense. Generally, smaller tributaries have been less affected than the mainstem lower gradient reaches. The impacts have been most intense in the Hyampom Valley, with most of the sediment being delivered from South Fork Mountain tributaries, where heavy logging has occurred since the 1940s.

Increased water temperatures in some parts of the watershed are also an issue. Temperatures in the lower South Fork and selected tributaries, particularly the lower portion of Hayfork Creek, may be too high to fully support aquatic habitat. Average daily summer maximum water temperatures of the Trinity River at Hoopa from 1964-1983 were 66.6-73.3°F; in some years temperatures were >75°F, which is lethal to salmonids. More recently, summer maximum temperatures in Willow Creek in the lower portion of the watershed in 2001 ranged from 61-69°F, which exceeds optimal ranges but can be considered adequate or marginal. Aside from direct effects on fish, high water temperatures can have secondary effects. In 2002, there was a spring Chinook fish kill in the Trinity River. The fish were infected with bacteria and protozoan parasites that caused increased fish mortality at higher temperatures, and water temperatures as high as 72°F were measured. The cause of high temperatures may include natural conditions, but anthropogenic factors included water diversions (particularly in Hayfork Creek), loss of riparian vegetation in selected locations, and excess sedimentation resulting in channel widening and decreased water depths.

The hydrologic changes wrought by the TRD project and the geologic conditions of the basin have resulted in altered stream-channel conditions and fish habitats for many miles below Lewiston. The once diverse channel was converted into a structurally uniform channel, in some places choked with sediment and in other places deprived of sediment, thereby eliminating or modifying critical habitat elements for anadromous salmonids. The dams block the supply of coarse sediment needed by salmon for spawning in the mainstem below Lewiston Dam. The channel has degraded two feet in this area. In other areas, due to inadequate flood flows, sediment has not been mobilized. This lack of sediment movement produces sediment accumulation at the deltas of tributaries, decreased substrate complexity, and reduction in the number and quality of alternate bar sequences. Alternate bar sequences are the successions of bars and riffles with associated pools that provide cover from predators and cool resting places for juvenile and adult salmonids. Also missing are gravelly riffles where adults typically spawn; open gravel/cobble bars that create shallow, low-velocity zones important for emerging fry; and slack water habitats for rearing juveniles.

Other factors, taken singly and in combination, degrade the quality of habitat as it relates to salmonid survival and success:

- Sediment has filled in mainstem pools, eliminating deep pool habitat important for adult salmonids holding over the summer. Before the TRD, the bottom waters of deep pools were as much as 7°F cooler than the surface, providing thermal refugia for both migrating adult salmonids and rearing juveniles. The change in channel morphology due to the altered flow regime has decreased or eliminated the temperature stratification in pools, particularly in the summer and early fall months.
- Spring Chinook and summer steelhead compete for pools now that the spring Chinook can no longer use the areas above the dams during the summer.
- Fine sediments interfere with egg and fry development, and sedimentation has reduced the dynamic nature of the riparian zone.
- Changes in channel structure and substrate quality have reduced total habitat areas suitable for the production of food organisms, primarily benthic macroinvertebrates.

Additional concerns include:

- Recreational in-stream suction dredging for gold especially in the mainstem and canyon area
- Acid mine drainage from abandoned mines.
- Mercury from historic gold mining.
- Sediment inputs from subdivisions and eroded roads in areas with unstable soil and decomposed granite.
- Septic tank use.
- Releases from aboveground and underground tanks.
- Lumber mills.

Specifically, drainage discharges from the Kelly Mine on McCovey Gulch in Hayfork in the South Fork watershed contain chromium and arsenic, affecting domestic diversions downstream. The Trinity County Health Department has posted the creek for metals contamination and notified homeowners not to drink the water. Releases from underground storage tanks have occurred at 12 sites in the Hoopa/Willow Creek area, 14 sites in the South Fork watershed, 21 sites in Weaverville, and 12 sites upstream of Weaverville. In Weaverville, the releases resulted in significant gasoline contaminant plumes, some containing MTBE.

Additionally:

- In the Hyampom area, several domestic wells were contaminated with MTBE from an underground fuel tank release.
- Heavy metals, fuels, and wood treatment chemicals were discharged from an abandoned mill site near Douglas City.
- Trinity and Lewiston Lakes are heavily used for recreational boating and personal watercraft and are at risk for releases of fuels and fuel oxygenates, especially MTBE.
- Mineral oil containing PCBs may have been released from PG&E electrical substations in Hoopa, Willow Creek, Weaverville, Hyampom, and Wildwood, and storm water discharges from these facilities are also of concern.
- In the Lower Trinity River, the Copper Bluff Mine continues to emit toxins in the form of acid.
- Celtor chemical works, located on the Hoopa Valley Reservation, is a USEPA Superfund site. Groundwater and surface water contamination are suspected at former and existing mill sites that historically used wood treatment chemicals.

The USEPA developed and adopted a TMDL for sediment in the South Fork Trinity River in 1998. The sediment TMDL for the Trinity River watershed (Upper, Middle, and Lower) was adopted by USEPA in December 2001.

The primary water quality issues in the Trinity River WMA are:

- Sedimentation of streams
- High water temperatures
- Mercury contamination in fish
- Historic wood treatment facility contamination

The primary adverse impacts associated with excessive sediment in the Trinity River pertain to anadromous salmonid fish habitat. Beneficial uses impaired by excess sediment in the Trinity River are primarily those related to fish habitat. As in many of the North Coast watersheds, the most sensitive beneficial uses appear to be those associated with coldwater fishery, because salmonids are very sensitive to habitat changes and water quality degradation. Accordingly, protection of these beneficial uses is presumed to protect other beneficial uses that might also be harmed by sedimentation and high water temperatures.

2.3.________Humboldt Bay WMA

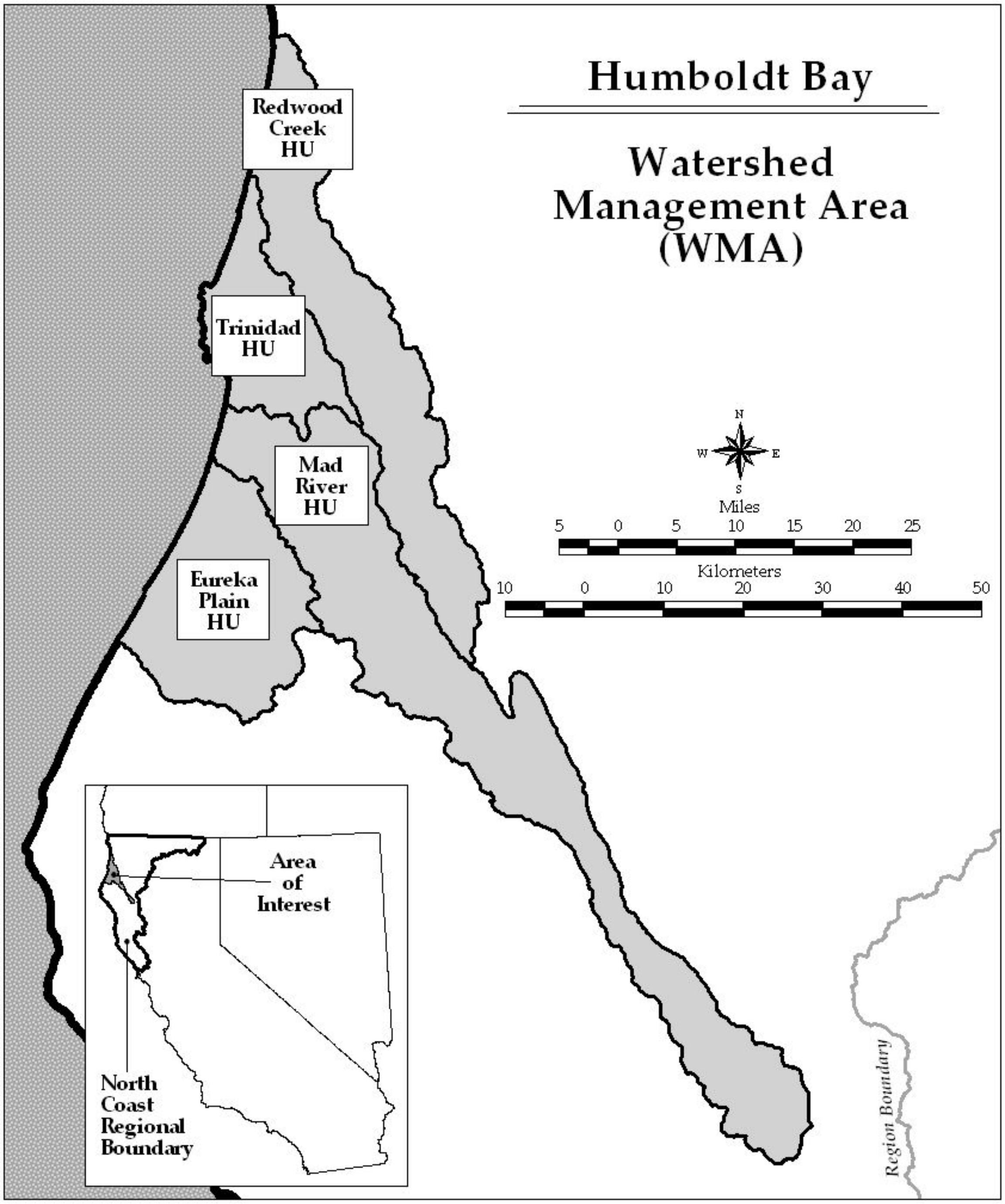

Figure 11. Hydrologic Areas of the Humboldt Bay WMA

The text presented within this section includes information that has been previously published by USEPA 1998 (Total Maximum Daily Load for Sediment Redwood Creek, California), Humboldt Watersheds Independent Scientific Review Panel 2003 (Phase II Report: Independent Scientific Review Panel on Sediment Impairment and Effects on Beneficial Uses of *the Elk River and Stitz, Bear, Jordan and Freshwater Creeks), North Coast Regional Water Quality Control Board 2000 (Staff Report for Proposed Regional Water Board Actions in the North Fork Elk River, Bear Creek, Freshwater Creek, Jordan Creek and Stitz Creek Watersheds), and references included therein.*

2.3.1. Overview

This management area encompasses tributaries to the Pacific Ocean from Humboldt Bay north to Redwood and Prairie Creeks and all groundwater within that area. Major drainage systems in this area are Redwood Creek (HA107.00) and the Mad River HA (109.00). Other major waterbodies include Humboldt Bay and Mad River Slough, numerous coastal lagoons (Big Lagoon, Stone Lagoon, Freshwater Lagoon), and coastal streams (Elk River, Freshwater, Jacoby, and Maple Creeks, and Little River).

Urbanized areas include Trinidad on the ocean, McKinleyville and Blue Lake on the Mad River, and Arcata and Eureka on Humboldt Bay. Rural residential developments are scattered throughout the timber/grazing interface. The majority of the population in this WMA lives in the Humboldt Bay area, which has a population of about 65,000. Suburban growth is occurring in the unincorporated community of McKinleyville, north of Arcata. A small population lives in Orick near the mouth of Redwood Creek.

The terrain is elevated hillslope in the east with coastal plain to the west. Vegetation consists of redwood and Douglas fir interspersed with some hardwoods and meadows. The climate and soils in the region promote high redwood and Douglas fir production. Precipitation ranges from 32 to 98 inches yr-1 with 70 to 80 inches as rain. The area is underlain by bedrock units that uplift periodically. In combination with the high level of precipitation, this contributes to significant sediment generation even in the absence of human activity.

Waterbodies in the Humboldt Bay WMA support many different uses. Fresh water streams throughout the Humboldt Bay WMA support production of anadromous salmonids, including Chinook and coho salmon and steelhead trout which are listed as threatened under the FESA. The Mad River supplies drinking and industrial water for the Humboldt Bay Area, and other coastal streams provide drinking water for local communities and individual homes. Humboldt Bay is a deep-water port and a major shipping center for the North Coast as it is the largest such center between San Francisco, California and Coos Bay, Oregon. Humboldt Bay is also a valuable ecosystem that supports a significant commercial oyster industry and is popular for recreational shellfishing. The deltas of the Elk River and Mad River Slough also support commercial and sport shellfish production and harvesting.

2.3.2. History and Land Use

Timber production and harvest are primary land uses in the Humboldt Bay WMA. An estimated 25% of the timber harvesting along the North Coast occurs in this WMA. Coast redwood is the most harvested species. PALCO, the largest of many timber companies in the area, owns approximately 211,700 acres of forestland in Humboldt County, encompassing lands within 22 watersheds including the Bear Creek, North Fork Elk River, Freshwater Creek, Jordan Creek, and Stitz Creek watersheds. PALCO owns 77-100% of each of these watersheds, and they were harvested heavily from 1987-1997. Forty miles of new roads were constructed in Freshwater Creek between 1995-1998, at a rate of 10 mi yr-1. Current road density in Freshwater Creek watershed is approximately 6.0 mi mi-2.

A sediment budget for Freshwater Creek for 1988-1997, a period during which 35% of the 31 mi^2 watershed was harvested, indicated that 56% of the sediment inputs to streams were from management sources, 37% were from natural background sources and 7% were due to legacy situations. Of the management related sources, roads were responsible for 88% of the sediment load (59% from surface erosion and 29% is from road related landslides). Shallow landslides in harvest units accounted for another 9% of the management-related input, and the rest was due to surface erosion from harvest units and other effects.

During the winter of 1996-97, timber harvest and related activities caused significant volumes of sediment from landslides and road networks on timber company lands to enter Freshwater Creek, Elk River, Jordan Creek, Bear Creek, and Stitz Creek. There were significant cumulative adverse impacts to beneficial uses of these waterbodies including filling of stream channel pools, loss of fish habitat, and degradation of water supplies. Bear Creek, Jordan Creek, and Stitz Creek are listed as sediment impaired.

Agriculture, primarily livestock grazing and dairies, occurs in the non-forested areas. Flat land areas around the bay are predominantly pastureland with some limited cultivation, primarily lily bulb farms. Lily bulbs are also grown in the McKinleyville area.

2.3.3._______Redwood Creek HU (107.00)

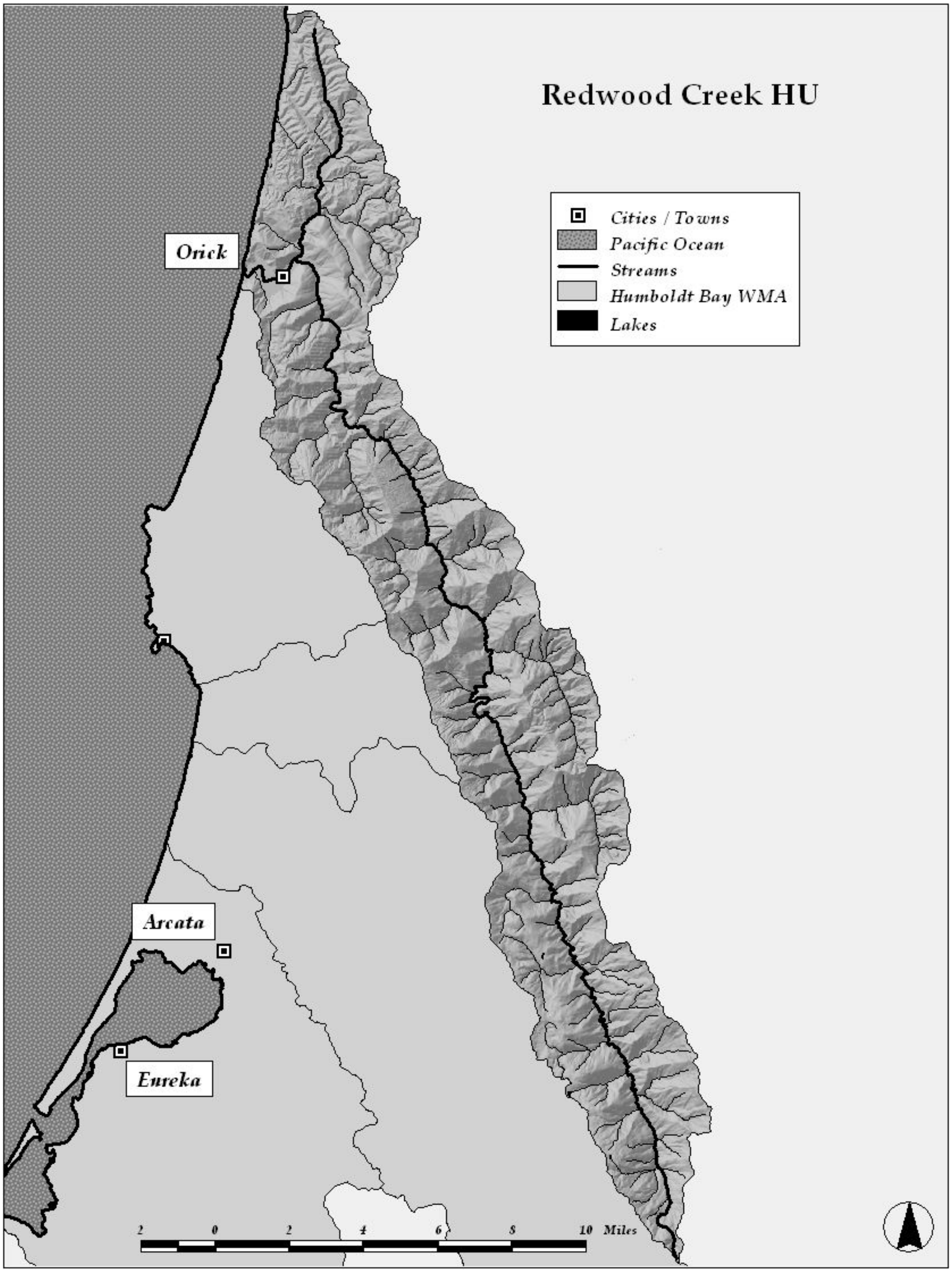

Figure 12. Map of the Redwood Creek HU

2.3.3.1. Overview

The Redwood Creek watershed in the Humboldt Bay WMA has been well studied. It is 285 mi^2 and drains into the Pacific Ocean near the town of Orick. The watershed is about 65 miles long and 4-7 miles wide and consists mostly of mountainous, forested terrain from sea level to about 5,300 feet. Primary land uses in the lower portion, which is part of Redwood National and State Parks, are tourism and fishing; timber management and livestock production dominate in the upper watershed.

2.3.3.2. History and Land Use

Timber harvesting is the most widespread land use in Redwood Creek basin. Over 85% of the basin upstream of the park has been logged, including about 30% that was logged between 1978-1992. About three-quarters of this recently logged area was logged using intensive silvicultural methods that remove all or almost all trees from the harvest area. Substantial areas of the park were intensively logged prior to their inclusion in the park. Timber harvesting of second growth timber in the upper basin is expected to continue in the future. Harvested areas remain at greater risk of increased erosion (principally through landsliding) for at least a year or two following harvest, and possibly for longer periods.

2.3.3.3. Vegetation

The natural vegetation of the Redwood Creek watershed consists mostly of coniferous forest. In 1998, old-growth forest covered 24,315 acres in the watershed, or 14% of its total area. Near the coast, the most common forest tree is the Sitka spruce, but most of the lower basin is dominated by coast redwoods. Farther inland, where summer temperatures are higher and fog is less frequent, Douglas fir is more common than redwood. Several hardwood species grow in association with both redwood and Douglas fir; these include bigleaf maple, red alder, tanbark oak, madrone, and bay. Prairies and oak woodlands occur on south- and west-facing ridgetops and hillslopes on the east side of Redwood Creek.

2.3.3.4. Climate

The Redwood Creek watershed has a Mediterranean climate with mild, wet winters (November to March) and warm, dry summers. Mean annual precipitation is roughly 80 inches, mostly as rain with snow frequently at altitudes above 1,600 feet. Streamflow in Redwood Creek varies annually due to rainfall variations and seasonally due to the highly seasonal distribution of rainfall. Snowmelt can increase streamflow peaks during rain-on-snow events. Winter flood flows can be as much as four orders of magnitude higher than summer low flows. Floods are critical events for the resources of Redwood Creek because they erode hillslopes, reshape channels, and transport large proportions of fluvial sediment loads. Recent large floods occurred in 1953, 1955, 1964, 1972 (two floods), and 1975. The 1964 storm was a regionally significant event that caused significant hillslope erosion and changes in channel morphology—many mainstem pools were filled by sediments.

2.3.3.5. Fishery

Approximately 250 species of fish, amphibians, reptiles, mammals, and birds are known to exist in the Redwood Creek watershed. Thirty-three species are species of special concern (threatened, endangered, or sensitive to human activities). Redwood Creek historically supported large numbers of coho and Chinook salmon and steelhead trout. In 1965, CDFG roughly estimated spawning escapement of 5,000 Chinook, 2,000 coho, and 10,000 winter steelhead. However, anadromous fish populations in Redwood Creek have diminished substantially over the past 40 years, and dropped as much as 90% since the 1990s. In 1994, five fish species found in Redwood Creek were classified as threatened or endangered by U.S. Fish and Wildlife Service (USFWS) and/or CDFG: tidewater goby, coastal cutthroat trout, coho salmon, spring run Chinook salmon, and summer steelhead trout. Other fish species in the watershed include rainbow trout, Humboldt sucker, threespine stickleback, coast range sculpin, Pacific lamprey, and eulachon.

2.3.3.6. Topography and Geology

Geologic structure in the Redwood Creek watershed is governed by several parallel north-northwest trending faults. For much of its length, the channel of Redwood Creek closely follows the Grogan Fault. Hillslopes are relatively steep and unstable, and the inner gorge slopes are very steep along much of the mainstem and some tributaries. Most of the watershed has undergone uplift over the past several hundred thousand years. The basin is underlain by the Franciscan complex of un-metamorphosed sandstones, mudstones, schists, and scattered blocks of other rock types. In general, slopes west of Redwood Creek are underlain by schist, and slopes east of the creek are underlain by sandstones and mudstones. The schists and mudstones that underlie much of the basin are relatively weak and susceptible to erosion and mass soil movements. Remaining areas of the watershed that are underlain by more competent rock types, such as interbedded sandstone/mudstones, are somewhat more resistant to erosion, but they form steep slopes that are susceptible to rapid, shallow landslides.

2.3.3.7. Sedimentation

Redwood Creek is particularly prone to storm-induced erosional events and would probably be subject to extensive erosion under natural conditions. However, land management activities have accelerated this natural process, overwhelming the stream channel's ability to efficiently move the delivered sediment. Streamside landsliding and fluvial hillslope erosion may be the most important sediment-generating processes in the watershed. Much erosion is associated with a dense road network (7.3 mi/mi^2) on private lands, improperly designed and maintained roads and skid trails, and timber harvesting. Roughly 1,400 miles of forest roads and over 5,000 miles of skid trails have been built within the basin, of which about 445 miles of roads and 3,000 miles of skid trails were included within the national park boundaries. About half the roads and a very high percentage of skid trails upstream of the park are not properly maintained or have been abandoned.

The long term average annual sediment delivery in the Redwood Creek watershed from 1954-1997 was about 4,750 t mi^{-2} yr^{-1}, which is almost twice the amount for more pristine "reference" watersheds for this time period. In Redwood Creek, 54% of the sediment load was from fluvial and surface erosion, and 46% was associated with mass wasting processes. Road-related erosion accounted for approximately 50% of the total load, and roughly 10%-20% was associated with timber harvesting (not including harvest related roads and skid trails). Thirty to forty percent was naturally occurring, or at least were not associated with specific land management causes. Therefore, about 60% of the erosion in the Redwood Creek basin was controllable.

The volume of stored sediment in Redwood Creek has increased, and consequently:

- The frequency of deep pools has increased.
- Overall stream depth has decreased.
- Channel width has increased.
- Recruitment and volume of LWD has been reduced.
- Increased deposition of fine sediments covering the bottom and embedding spawning gravels.

The mainstem lacks adequate pool-riffle structure and cover. Coarse sediment deposited in the mainstem allows a large proportion of summer base flows to infiltrate and flow subsurface, thereby limiting the surface water available to fish and increasing surface water temperatures. Aggraded sediments have formed large deltas at the mouths of some tributaries, blocking tributary mouths and preventing fish migration. A lack of suitable rearing habitat in the mainstem and tributaries has forced juvenile fish to inhabit the estuary, where they are subject to the impacts of sudden, extreme changes in salinity resulting from breaching of the sandbar by ocean waves and currents.

2.3.4._______Mad River HU (109.00)

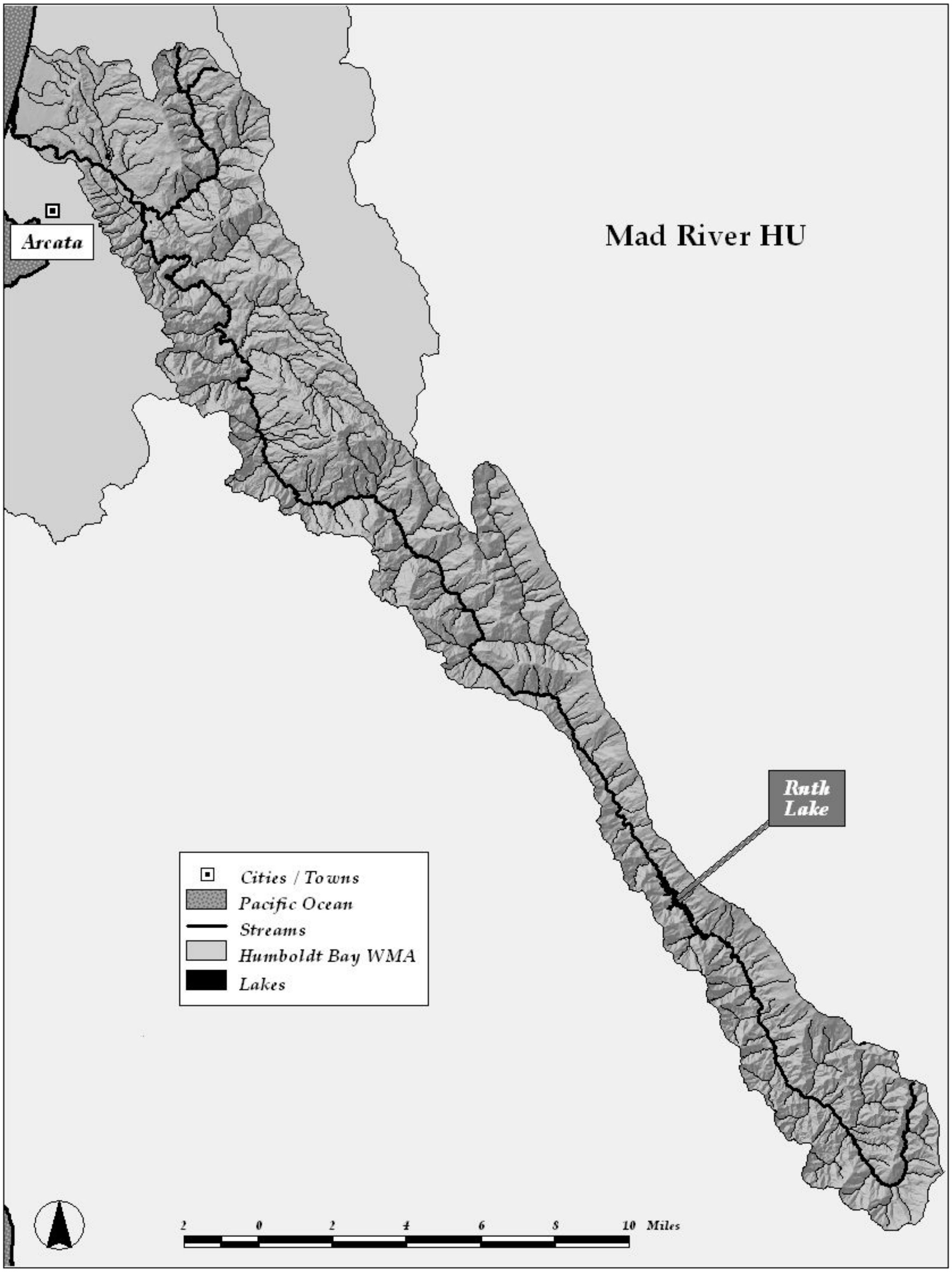

Figure 13. Map of the Mad River HU

The Mad River is located just north of Arcata in Humboldt County. Its watershed extends inland about 100 miles to the southeast and is a mix of private and USFS timberland with a long history of timber harvest. Other major land uses in the watershed include agricultural grazing lands, gravel extraction, and rural-residential/urban development. Gravel mining, which impacts channel morphology, occurs in the lower portions of the watershed. The Mad River supplies water for municipal and industrial use in the Humboldt Bay region.

For the Mad River and its tributaries, discharge of waste is allowed only under NPDES permit. Under the NPDES permit, discharge is only permitted during the period of October 1 through May 14 and at 1% of the flow of the receiving water. The McKinleyville Community Services District uses percolation ponds instead of discharging to the river during summer low flows. The City of Blue Lake does not discharge directly, disposing of effluent in percolation/evaporation ponds.

The lower 5.5 miles of the Mad River lies in the coastal zone. Much of the spit separating the Mad River estuary and the ocean has been incorporated into the 150-acre Mad River County Beach. The State manages both the 30-acre Azalea State Preserve on the north side of the river, and the Mad River Fish Hatchery, where anadromous fish are raised for release along the North Coast. A portion of the town of McKinleyville lies within the coastal zone, and much of the coastal zone bottom lands and floodplain that are not in public ownership are grazed. The Mad River and its estuary have problems of sedimentation/threat of sedimentation and threat of fish population decline. The pollutants are siltation and turbidity from industrial and municipal sources, silviculture, and other nonpoint sources.

2.3.5. Water Quality Issues in the Humboldt Bay WMA

The Humboldt Bay WMA is threatened by sedimentation from the effects human activity on naturally unstable substrate. Major activities in the area that generate erosion and mass movement are past and present land use practices including urbanization, roads, agriculture, timber harvest, construction, gravel mining, and industrial site activities. Sedimentation has been documented in Redwood Creek, Freshwater Creek, Elk River, Mad River, and the coastal tributaries between Redwood and Salmon Creeks. Sedimentation is the major cause of salmonid habitat degradation in the Redwood Creek watershed. In Freshwater Creek and Elk River, stream aggradation and sediment discharges have reduced channel capacity, thereby increasing the frequency and magnitude of flooding and impacting domestic water supply. Impairment of tributaries to Humboldt Bay can also impact uses in the bay.

Bacteria from point sources and nonpoint source runoff from urban and rural areas reduce water quality in the bay and impact commercial and sport shellfish resources. Historically, wastewater discharges to the bay impacted the shellfish uses. Recent emphasis on improved treatment methods and reliability of facilities, and the consolidation and relocation of the Eureka wastewater plants, has significantly reduced the problem. Contamination from collection system overflows of raw sewage during high intensity rainfall events is a continued threat to commercial and recreational uses of the bay. Storm water runoff from all watersheds draining to the bay is contaminated with bacteria that impact shellfish harvest. Deleterious effects of nonpoint source runoff cause seasonal and rainfall-based shellfish harvesting closures.

In the past, the Eureka Waterfront was the site of several industrial operations including lumber mills, bulk oil storage and handling facilities, wrecking yards, and railroad yards. These operations produced both soil and ground water contamination with heavy metals, petroleum products, and pentachlorophenols (PCPs). The Waterfront is currently undergoing cleanup and redevelopment. The City of Eureka is coordinating the redevelopment with several responsible parties including Union Pacific Railroad, Simpson Timber Company, Chevron, Unocal, and Tosco oil companies, and a few others. The City is also cleaning up two brownfield sites on the Waterfront.

Activities that threaten surface and ground waters include waste disposal, vehicle and railroad maintenance yard operations, herbicide application, gravel extraction, timber harvesting, dairy operations, automotive wrecking yard or metal recycling activities, wood treatment facilities, publicly owned treatment works, construction activities, and many others. Pesticide and herbicide applications along roadways, in agricultural operations, in urban areas, and in lily bulb farming and forestlands threaten ground and surface waters. Chemical pollutants such as nutrients, petroleum, metals, and organic chemicals are of concern, particularly for groundwater. Potential sources are improper and illegal disposal of waste, spills from leaking underground storage tanks, dry cleaners, grazing and dairy operations, logging activities, industrial and construction sites, auto wrecking yards, fleet maintenance yards, inactive mill sites, and highways. Petroleum products of concern are solvents, MTBE, and gasoline. These pollutants can have adverse effects on all domestic water supply systems as well as other beneficial uses.

The primary water quality issues in the Humboldt WMA are:

- Salmonid habitat degradation
- Sedimentation of streams
- Flooding
- Impaired domestic water supplies
- Bacterial contamination

Overall, concerns about water quality in the Humboldt Bay WMA focus on recovery of threatened and endangered species of coho and Chinook salmon and steelhead trout, and protection of water quality beneficial uses, including domestic water supply and commercial and recreational shellfish uses. Stream sedimentation from various land use activities such as rural subdivisions, grazing, and logging roads limits coldwater aquatic uses. The condition of Redwood Creek estuary is critical because it serves as a nursery for newly hatched salmonids that sometimes stay in the estuary as long as three years before leaving to the ocean. In the Redwood Creek basin, a lack of canopy cover and large woody debris combines with shallow pools and high temperatures to impact spawning and rearing habitat for threatened and endangered salmonid species.

2.4._________Eel River WMA HU (111.00)

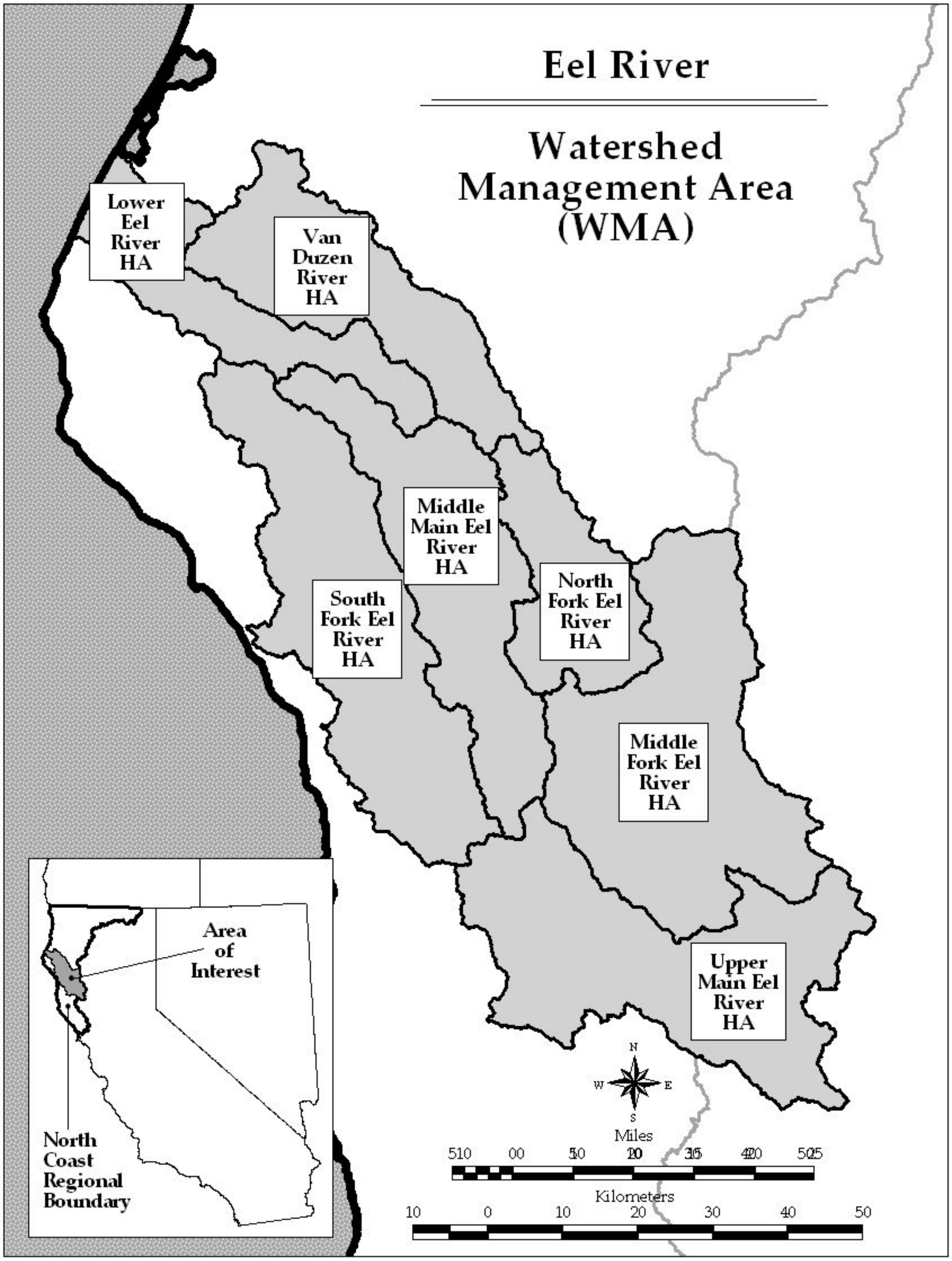

Figure 14. Hydrologic Areas of the Eel River WMA

The text presented within this section includes information that has been previously published by Fuller, et. al. 1996 (North Fork Eel River Watershed Analysis), USEPA (Middle Main Eel River and Tributaries [from Dos Rios to the South Fork] Total Maximum Daily Loads for Temperature and Sediment), DFG 2002 (Status Review of California Coho Salmon North of San Francisco), and references included therein. Other information was synthesized from http://www.eelriver.org/ (2007), and http://www.hits.org/salmon98/ (2007).

2.4.1. Overview

The Eel River WMA is approximately 3,684 mi^2 located in northern coastal California; it is the state's third largest watershed. The Eel River flows over 800 river miles northwest from its headwaters in southeastern Mendocino County and Lake County, through Mendocino and southern Humboldt Counties, to the Eel River Delta 10 miles south of Humboldt Bay. The Eel River has four forks: the North, Middle, South, and Main, which is divided into Middle Main and Upper Main sections. There are also several large tributaries: the Van Duzen River, the Bear River, and Yager, Larabee, Bull, and Salmon Creeks.

The Eel River watershed is characterized by steep coastal mountains with highly erodible soils, and is heavily forested. The upper watershed is vegetated by redwood, Douglas fir interspersed with some hardwoods, and meadows. Toward the coast, the river spreads out on an alluvial plain where the Salt River joins it. The Eel River empties into the Clem Miller State Seashore and is a designated State Wildlife Area. In 1972, sections of the Eel River were designated by the California Wild and Scenic Rivers System. In 1981, the Eel River was designated a National Wild and Scenic River.

Timber production is a major land use activity in the Eel River WMA. Extensive timber harvesting occurs in the lower Eel River and Van Duzen River watersheds including Bear, Stitz, and Jordan Creeks. Cattle grazing on timber-harvested land combine with many poorly maintained roads to contribute sediment to local creeks causing aggradation, flooding, and domestic water supply problems.

The Potter Valley Project (PVP) includes a 9.4-megawatt hydroelectric generating station in the upper Russian River basin, using water from the Eel River to generate power. Scott Dam, constructed in 1921, created Lake Pillsbury, and 12 miles downstream the Cape Horn Dam impounds the Van Arsdale Reservoir. Water from the Van Arsdale Reservoir flows either northwest in the Eel River approximately 150 miles to the Pacific Ocean, or is diverted south through the PVP where it generates electricity and goes on into the Russian River drainage, where it maintains river flow through the summer. An average of about 160,000 acre-feet are diverted annually from the Eel River basin into the Russian River basin

The alluvial plain of the lower Eel River supports livestock grazing, dairies, gravel mining, and residential communities. There are approximately 85 dairies located in the

Eel River alluvial plain and 11 gravel-mining sites within the lower Eel River. The towns of Ferndale, Fortuna, and Loleta are on the alluvial plain. Other population centers in the WMA are Scotia, Garberville, Laytonville, and Willits.

The Eel River WMA is a prime recreational area with many state and private campgrounds; related beneficial uses include water contact and non-contact recreation such as boating and swimming. The Eel River is the third largest producer of salmon and steelhead in the State of California and supports a large recreational fishing industry. Additional beneficial uses include municipal and agricultural supply. Surface and ground waters in the Eel River watershed are closely connected and significantly influence each other.

2.4.2. Fishery

The Eel River supports anadromous populations of steelhead trout, coho and Chinook salmon, and possibly cutthroat trout, though numbers are significantly reduced from historical levels when these fish numbered in the tens of thousands or hundreds of thousands. A commercial salmon industry thrived in the area from 1850-1890, as evidenced by numerous canneries in the Eel River estuary. Eel River salmon production in 1857 is said to have equaled that of the Sacramento River and far exceeded the production of the Columbia River and Vancouver Island combined. An estimated 44,688 fish were taken in 1857 and 585,200 in 1877. In 1964, CDFG estimated the annual spawning escapement in the entire Eel River System at approximately 82,000 steelhead, 23,000 coho, and 56,000 Chinook for a total of 161,000 fish. The most recent estimate of the average annual salmon and steelhead spawning populations in the Eel River system was made in the late 1980s and indicated that steelhead trout had declined to 20,000, Chinook to 10,000, and coho to 1,000, for a total of 31,000 fish. This is an 80% decline from the early 1960s. At the Van Arsdale Reservoir fish ladder in the 2000-2001 winter season, the count of spawners arriving in the upper river was 303 Chinook, 651 steelhead, and 1 coho; in 2001-2002, the count was 955 Chinook, 311 steelhead, and 4 coho. Coho, Chinook and steelhead in the Eel River WMA are each listed as threatened under FESA.

Salmonids are threatened by many factors including sedimentation and elevated stream temperatures. Many stream channels were greatly damaged during the 1964 flood. Streams were filled with sediment, channels were widened and many areas lost riparian vegetation. The Eel River is one of the highest sediment producing rivers in the world, carrying 15 times as much sediment, in tons of sediment per square-mile of drainage area, as the Mississippi River (Brown & Ritter, 1971).

Physical barriers to fish migration limit their habitat as well. Cape Horn Dam has upstream and downstream fish passage facilities, enabling salmon and steelhead to use the reach between Cape Horn Dam and Scott Dam. However, Scott Dam has no fish passage facilities so that fish are prevented from accessing prime spawning and rearing habitat above the dam. Split Rock, on the North Fork Eel River downstream of Hull's Creek, is a partial barrier to anadromous fish, depending on the flow and the species of fish. In addition, the invasive predatory pikeminnow, *Ptychocheilus grandis*, found throughout the watershed, may negatively impact salmonid populations by preying on juvenile fish. *P. grandis* may be thriving in the warm waters of Lake Pillsbury. *P. grandis* is not found in the North Fork above Split Rock; Split Rock may be a barrier preventing pikeminnow from preying on anadromous fish in the North Fork, which contains much of the best remaining fish habitat and lowest water temperatures in the Eel River basin.

2.4.3.______Upper Main Eel River HA (111.60)

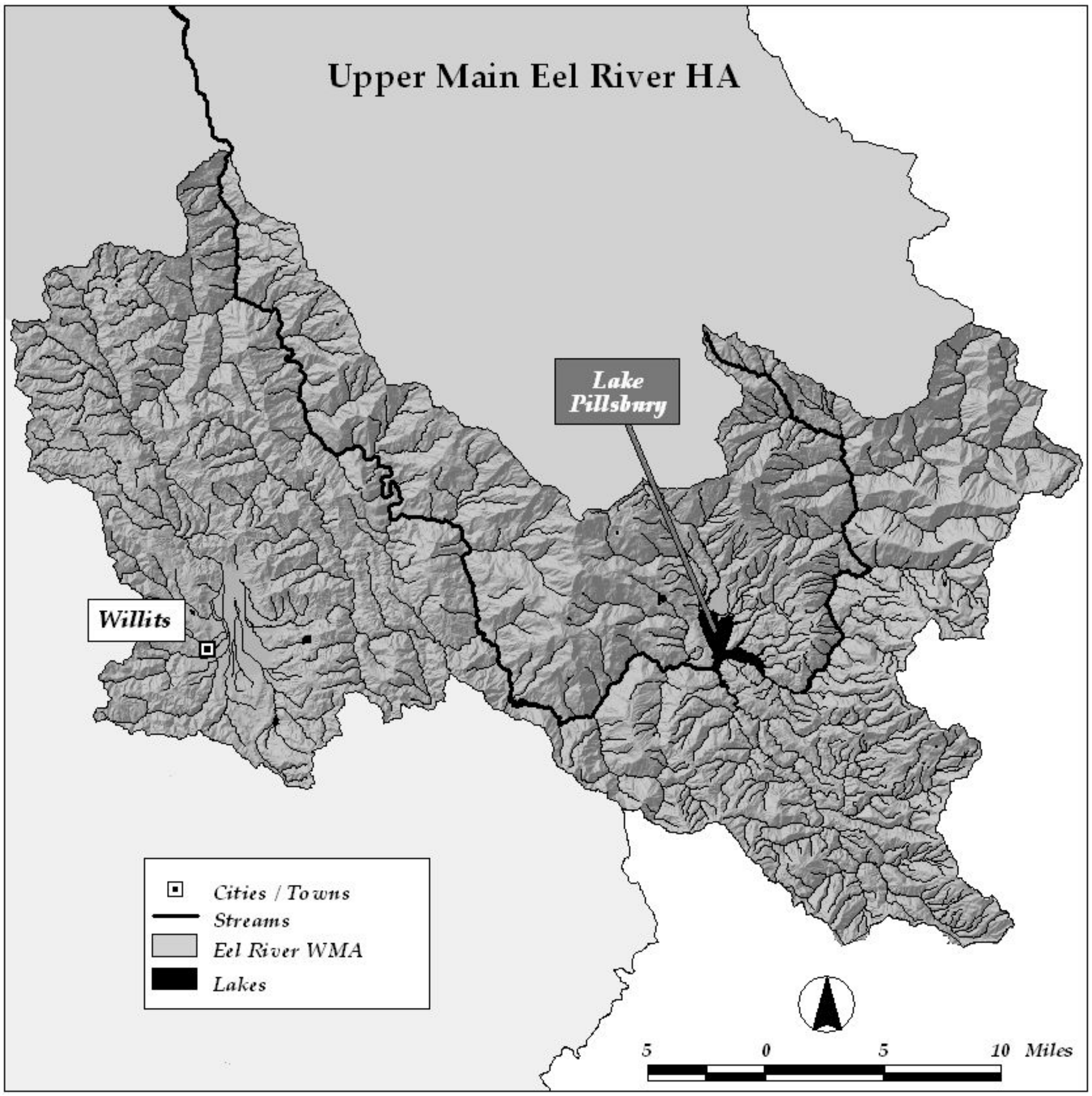

Figure 15. Map of the Upper Main Eel River HA

The text presented within this section includes information that has been previously published by USEPA 2004 (Upper Main Eel River and Tributaries (including Tomki Creek, Outlet Creek and Lake Pillsbury)

Total Maximum Daily Loads for Temperature and Sediment), and references included therein.

2.4.3.1.______Overview

The Upper Main Eel River HA is 688 mi^2 located primarily east of Highway 101 in Mendocino and Lake Counties and includes the town of Willits (see Figure 15). The sub-watershed is defined as the area from the headwaters of the Eel River in Mendocino National Forest above Lake Pillsbury down to Dos Rios, where the Middle Fork meets the mainstem Eel River. The main tributaries to the upper mainstem are Tomki and Outlet Creeks. The Potter Valley Project (PVP) and its two dams are located in the Upper Eel River sub-watershed. Scott Dam is the larger dam and impounds Lake Pillsbury. Twelve miles downstream, the smaller Cape Horn Dam impounds Van Arsdale Reservoir, from which water is diverted for hydroelectric generation at the power station in Potter Valley and then discharged to the East Fork Russian River.

Land ownership in the Upper Eel River sub-watershed is about half Mendocino National Forest, and half private. Land use activities include rural development, ranching, recreation, timber production, agriculture, and some urbanization in the Willits area. Riparian zones on public land are managed according to the Northwest Forest Plan, which limits timber harvest and promotes natural riparian vegetation. On private lands, riparian vegetation can be removed or altered by grazing, vineyard development, housing development or timber harvest.

2.4.3.2.______History and Land Use

Historical land use activities have contributed to erosion and sedimentation. Many roads were built in the 1930s and are part of the current transportation network in the watershed. Road building accompanied increases in logging operations as well, but many of the roads were not designed to withstand heavy precipitation. Grazing and fire both reduced vegetation, thus making soil available for erosion. Grazing controls have been in place since 1907 with the creation of the Mendocino National Forest; however, fire has increased erosion in several sub-watersheds, especially during the 1987 fire season. During the 1964 flood, over one-half of all the sediment transported during a 10-year period upstream of Scott Dam was mobilized.

2.4.3.3.______Climate

The Upper Main Eel watershed is inland, away from the influence of coastal fog, and is relatively dry and warm. Annual average rainfall is 40 inches, and most of it occurs between November and April. The flow of the Eel River and its tributaries above Lake Pillsbury is unregulated and highly influenced by rain events. Many of the smaller tributaries dry up in late summer.

2.4.3.4.______Fishery

Historically, there may have been more than ten thousand Chinook salmon and steelhead trout in the Upper Eel River sub-watershed. Present populations are reduced from historical levels but recent Chinook and steelhead returns to Cape Horn Dam show increases in populations, some of which may be due to hatchery plants. Chinook are found throughout the watershed below Scott Dam, particularly in Outlet and Tomki Creeks. They are excluded from areas above Scott Dam, which are estimated to contain 30-150 miles of potential habitat. Chinook spawners may have been more abundant before the 1964 flood. Steelhead are widely distributed throughout the watershed, except above Scott Dam where rainbow trout are resident. Juvenile steelhead are found in tributaries to Outlet Creek, Tomki, and Cave Creeks, in streams in the Mendocino National Forest, and in the area between Lake Pillsbury and Van Arsdale Reservoir. Juvenile steelhead were also more abundant before the 1964 flood. Coho salmon are only found in a few locations in the sub-watershed, such as Outlet Creek and its tributaries, and are not seen consistently year to year. Populations are small, but coho may not have been abundant historically.

Salmonid abundance in the Upper Eel River is affected by excess sediment, elevated temperatures, a lack of LWD, and possibly pike minnow predation. Excessive sediment limits salmonid habitat in the Upper Eel River sub-watershed. Stream conditions for salmon vary, from good in two of 18 streams to poor or completely unsuitable for spawning in three streams, depending on the degree of embeddedness. The majority of streams were in between.

The most critical period for water temperature in the Eel River is the summer, when stream temperatures are highest and young salmonids rear before migrating to the ocean. The Upper Main Eel River is relatively warm compared to other reaches of the river. In the main channel of the Eel River below Van Arsdale, the point at which water is diverted for the PVP, summer temperatures can be as high as 24-28°C. Low flows resulting from the diversion contribute to these high water temperatures, which can be lethal to juvenile salmonids. Within this reach, steelhead can be found in the cool water refugia created by cool springs, stratified pools, and inputs from cooler tributaries. Increased water temperatures may also be due to less shade over stream channels since the 1964 flood, which destroyed significant amounts of riparian vegetation and widened streams.

The PVP's influence on stream temperature and cold water habitat is complex. Lake Pillsbury currently provides cold water habitat for rainbow trout and does not appear to be temperature impaired, however, Scott Dam blocks access to many miles of summer cold water habitat for steelhead, and to spawning habitat for Chinook and steelhead. Lake Pillsbury is vertically stratified over the summer and its cool bottom water is released into the Eel River during the summer; temperatures in the 12 mile stretch between Scott Dam and Van Arsdale Reservoir are approximately 2-4°C cooler than those upstream of the lake. Summer flow between Lake Pillsbury and Van Arsdale Reservoir averages about 100 cfs, and this large block of water resists heating. Below

Cape Horn Dam, however, only about 7 cfs was released until the summer of 2004, and stream temperatures quickly became lethal. As of 2004, flow below Van Arsdale Reservoir ranges from 9-30 cfs depending on the amount of rainfall that occurred during the water year. Higher flows should decrease stream temperatures.

2.4.3.5. Topography and Geology

The area is underlain by the Franciscan Complex, which dominates most of California's North Coast. This is a region of recent and ongoing uplift, and the Franciscan forms steep and unstable slopes in this environment. Consequently, slopes are generally sensitive to human disturbance. Much of the bedrock in the Upper Eel River sub-watershed is sedimentary and metamorphic rock along with ultramafic and volcanic rocks of Jurassic age. Weathering, which is impacted by slope, aspect, wind, rainfall, temperature, bedrock composition, and biological activity (including decomposition of organic matter), produces soils that may be subject to landslides and erosion. Soils with a high tendency to slump or slide cover about 40 % of the watershed, and slides, slumps, and erosion are fairly common in the watershed.

2.4.3.6. Sedimentation

The long-term (1940-2004) annual sediment production rate for the Upper Main Eel River watershed is 462 t mi-2 yr-1 (67% natural, 33% management-related). Sixty-seven percent of the sediment delivered to the Upper Eel River system from 1940-2004 occurred before 1970. Most of the natural background sediment-delivery was from landslides, which had a higher rate of delivery on public lands than on private lands. Post-1970 sediment yields are considerably lower, and natural background processes account for roughly two thirds of the sediment load on both private and public lands. One third of the total sediment load is related to human activity, primarily from roads and timber harvest. Upstream of Van Arsdale Reservoir, there are over 175 miles of trails (including about 100 miles of designated off-highway vehicle trails) and over 760 miles of road (about 3,900 road/stream crossings) that facilitate the transport of sediment to streams. Decreases in sediment yield after 1970 may reflect differences in the frequency and magnitude of storms as well as improvements in land management practices.

Much of the sediment that erodes from the most northern portion of the Upper Eel River sub-watershed is trapped in Lake Pillsbury. The lake's storage capacity decreased at least 14 % from 94,400 acre-feet in 1921 to 86,780 in 1959 and 80,700 in 1984. Loss of storage capacity in Lake Pillsbury can be used as a surrogate measure of the amount of sediment delivered to the upstream tributaries over time. Lake Pillsbury has chronic turbidity problems due to fine-grained clays that stay in suspension for extended periods. Coarse materials are trapped in the reservoir, resulting in the lack of gravel delivery to downstream areas.

2.4.4. Middle Fork Eel River HA (111.70)

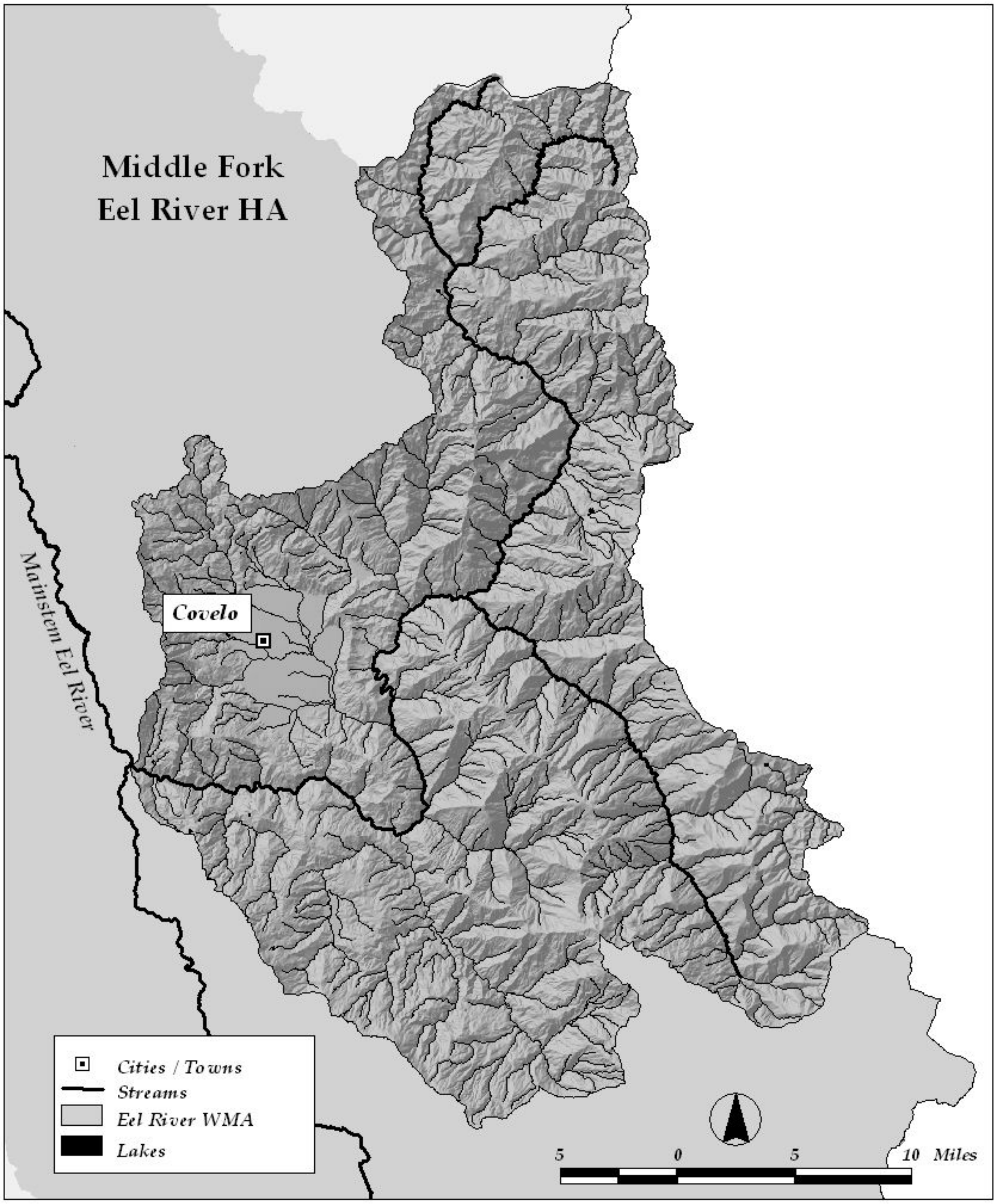

Figure 16. Map of the Middle Fork Eel River HA

The text presented within this section includes information that has been previously published by USEPA 2003 (Middle Fork Eel River Total Maximum Daily Loads for Temperature and Sediment), and references included therein.

2.4.4.1. Overview

The Middle Fork Eel River HA encompasses 753 mi^2 in northeast Mendocino County and southern Trinity and Glenn Counties. It lies east of Highway 101, approximately 150 miles north of San Francisco, and includes the town of Covelo. The Middle Fork is the Eel River's largest tributary. It begins in the Yolla Bolly Mountains in Trinity County, is joined by Black Butte River just east of Covelo in Round Valley, and travels 70 miles to the west through some of the most rugged wilderness in the state to join the mainstem Eel River at Dos Rios. The Middle Fork sub-watershed encompasses all tributaries of the Middle Fork and Upper Middle Fork Eel, including the Black Butte watershed, and 16% of the Yolla Bolly Middle Eel wilderness. The Upper Middle Fork Eel is sometimes referred to as the Wilderness Fork. Additional tributaries are Mill, Short, Williams, Thatcher, and Elk Creeks.

About half the sub-watershed is public land (Mendocino National Forest and BLM land), 4% is owned by the Round Valley Tribe, and 45% is privately owned. Most of the 2,000 residents in the watershed live in the Round Valley area in the town of Covelo and surrounding Round Valley tribal lands.

2.4.4.2. History and Land Use

Human activities in the Middle Fork sub-watershed have contributed to:

- Increased erosion and sedimentation.
- Direct removal of riparian vegetation.
- Secondary impacts resulting from bank erosion and decreased vegetation in the watershed.

Human activities causing a great increase in sediment contribution began with severe overgrazing by sheep and cattle in the late 1800s and early 1900s. This caused significant damage including permanent soil loss and vegetation changes. Recovery has been limited, despite the cessation of sheep grazing and reduced intensity of cattle grazing. Small-scale logging near Covelo began about 1862, and continued until after World War II, when private lands were extensively cut and burned. Timber harvest on lands of the Mendocino National Forest began in 1958. It is estimated that 46 % of the timbered land in the basin (23 % of the basin) was logged by either clear-cut or partial cut from 1950-1981. Past timber harvest practices that would not meet current standards were used on intermittent and perennial streams, resulting directly and indirectly in increased stream temperatures. Current land uses in the Middle Fork sub-watershed include light grazing and other agriculture, timber harvest, recreation, and residences.

2.4.4.3. Climate

The Middle Fork Eel watershed is inland, away from the influence of coastal fog, and is relatively dry and warm. The mean maximum temperature in July in Covelo is in the mid 90's. Annual average rainfall is 40 inches with significantly more rainfall at the higher elevations, and most of it occurring between November and April. In the winter, there is often snow at the higher elevations. Many smaller tributaries dry up in late summer.

2.4.4.4. Fishery

Historically, the Middle Fork Eel River had populations of fall-run steelhead, which enter the watershed shortly before spawning in the fall, and summer steelhead and spring Chinook, which enter the watershed in the spring and summer, waiting until fall to spawn. Fall steelhead were found spawning in most of the Middle Fork Eel River tributaries in the 1960s, and in 1963 CDFG estimated the annual spawning population in the Middle Fork watershed at 23,000 individuals though they did not distinguish between the summer and fall runs. In the 1980s steelhead appeared to avoid downstream sites that were open and had high water temperatures, but they were abundant in cool, well-shaded sites in the upper reaches of the sub-basin. Compared to historical levels, fall steelhead distribution appears to have been stable for the last few decades.

The Wilderness/Upper Middle Fork Eel River is home to one of the few populations of summer steelhead in California; however, the current population is much smaller than historical estimates. Prior to 1955, the mainstem Middle Fork Eel provided summer habitat for summer steelhead, and before the 1964 flood there were thought to be 3,500 adult summer steelhead. Following the 1955 and 1964 floods, summer steelhead were confined to the uppermost reaches of the mainstem and cool tributary streams or well-shaded streams. Since 1966, the greatest estimated population was 1601 fish and in the period 1998-2007 the estimated population has ranged from 306-771 individuals.

Spring Chinook in the Middle Fork Eel River have also experienced declines. They spawned in the lower Middle Fork Eel and at least as far upstream as the confluence of the Black Butte River, and in the lower reaches of Mill, Short, Williams and Elk Creeks. There are anecdotal reports of thousands of Chinook in these tributaries in the first half of the 1900s. Prior to 1955, spring Chinook and summer steelhead inhabited the mainstem Middle Fork Eel, but following the 1955 and 1964 floods the spring Chinook were extirpated. The streams around Round Valley may have had 5,000 Chinook migrants in the early 1960s, and in 1963, CDFG estimated the annual spawning population in the Middle Fork watershed at 13,000 individuals. In 1998, however, Chinook populations were estimated at only 40 adults in Elk Creek, 20 in Thatcher Creek, 40 in Mill Creek, and 20 in Williams Creek. Similarly, only small populations (~100 adults) were thought to exist in the Black Butte and Wilderness/Upper Middle Fork watersheds in 1998.

In 1996-1998 and 2002, stream temperatures in the Middle Fork Eel River and tributaries were generally marginal (>17°C) to inadequate (>19°C) for summer rearing salmonids, although a few tributaries had good (<15°C) or adequate (<17°C) conditions. Temperatures in much of the length of the exposed main channels are close to lethal during the hottest part of the summer, when young salmonids are growing before migrating to the ocean and are most sensitive to increased temperatures. Current main channel temperatures are not different from those measured in the 1960s and 1970s, but less thermal refugia may be available today, limiting the opportunities for salmonids to escape high temperatures.

The 1964 flood caused large morphological changes to stream channels and may be the primary cause of today's higher sedimentation rates and stream temperatures. Although the rainfall that caused the flood was natural, its effects were exacerbated by management activities in the basin. After the flood, the area used by summer steelhead on the Wilderness/Upper Middle Fork Eel River was filled with 3-12 meters (10-40 feet) of rock, gravel, and sand. Pools previously used by summer steelhead were almost entirely obliterated. This area began to recover as early as the 1970s and much of it had recovered by 2003. In the Black Butte River, sediments have fluctuated but there has been net aggradation since 1964. Recovery from the 1964 flood has not been complete; channels show wider gravel bars, more meandering due to less channel gradient, and less riparian vegetation than in 1961.

2.4.4.5. Sedimentation

The majority of sediment production in the Middle Fork sub-watershed is natural and mostly from landslides. Over 4,000 landslides occurred from 1940-2000, with 77% of the number and 81% of the volume occurring prior to 1969. Most of the sediment probably was generated from the 1964 flood, which is known to have caused significant changes in the watershed. Sediment production from human disturbance in the basin is associated mostly with cattle grazing and road networks. The recent (1985-2002) annual sediment production rate for the Middle Fork sub-watershed is 656 t mi-2 yr-1 (88% natural, 12%management-related). Overall, the basin is less disturbed by anthropogenic sediment than most other watersheds in the North Coast region, probably because there is little land management activity in the basin.

2.4.5.________North Fork Eel River HA (111.50)

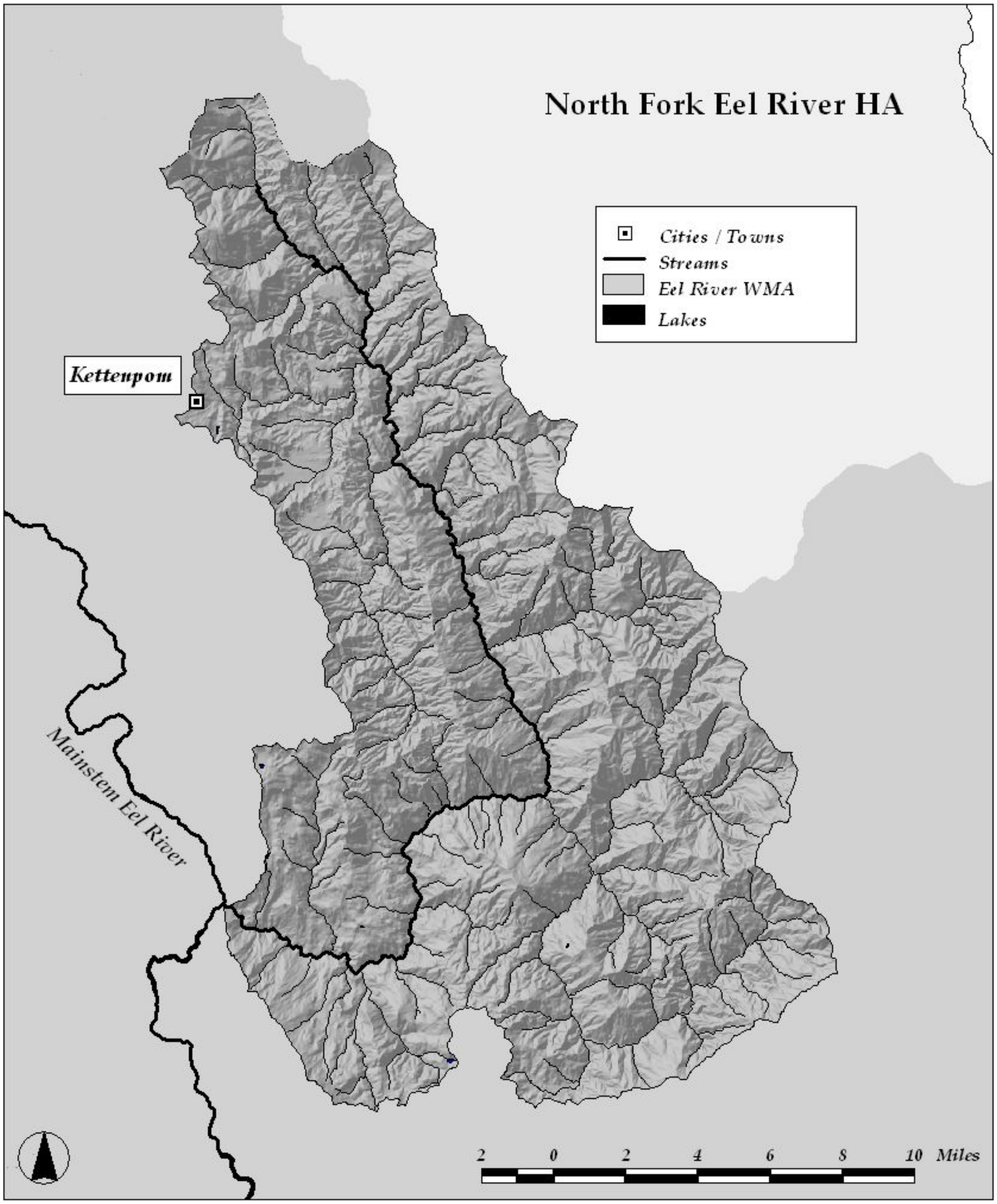

Figure 17. Map of the North Fork Eel River HA

The text presented within this section includes information that has been previously published by Fuller, et. al. 1996 (North Fork Eel River Watershed Analysis), USEPA 2002 (North Fork Eel River Total Maximum Daily Loads for Sediment and Temperature), and references included therein.

2.4.5.1. Overview

The North Fork Eel River HA covers 289 mi^2 in northeast Mendocino County and southern Trinity County and is the smallest of the Eel River sub-basins. The North Fork is about 35 river miles in length. Half of the North Fork sub-basin is owned by USFS and BLM and the other half is owned by the State, Tribes, or private parties. Elevations range from 600 feet at the mouth of the river to 5,900 feet in the Yolla Bolly Wilderness.

2.4.5.2. History and Land Use

Large numbers of sheep, possibly as many as 60,000, grazed in the North Fork Eel River sub-watershed between 1860 and 1900, and cattle have grazed the watershed since the 1900s. Historically, livestock impacts on riparian vegetation decreased stream channel shading and may have impeded re-growth after storm events removed vegetation, thereby opening the channel to more solar radiation and increasing water temperature. Stream bank trampling increased sedimentation and decreased bank stability. Large amounts of animal waste caused an increase in nutrients to the stream system, which, along with warm water temperatures, increased algal growth and resulted in oxygen depletion.

Current land uses in the North Fork sub-basin include grazing, timber harvest, recreation, and scattered residences. Grazing pressure is much less than it was historically. There are few paved roads, with only 1.7 mi/mi^2 on public lands. Timber harvest on public lands was relatively light prior to 1964, and logging peaked on USFS lands during the 1970s when approximately 1200 acres were clear-cut. Today, much of the public land is protected and there has been relatively little disturbance in the last few decades. However, the degree of disturbance on privately owned land is not known.

2.4.5.3. Vegetation

The North Fork Eel River sub-watershed contains forested areas, oak woodlands, oak savannahs and grasslands. There are many conifer and hardwood forests consisting of mixed hardwood-conifer stands, Douglas-fir, Klamath mixed conifer, white fir, and pines, including ponderosa pine, Jeffrey pine, and closed cone pine, and cypress. The hardwoods are white oak and black oak. Herbaceous plants, which include annual grasses, cover three percent of the area. Other plant communities in this watershed include chaparral, live oak, gray pine, and western juniper.

2.4.5.4. Climate

The North Fork Eel watershed is inland, away from the influence of coastal fog, and is relatively dry and warm. Annual average rainfall is 50 inches, and most of it occurs between November and April. In the winter, there is often snow in the higher elevations. Many smaller tributaries dry up in late summer, and the mainstem North Fork is intermittently dry in some summers.

2.4.5.5. Fishery

The native fish assemblage of the North Fork Eel River is comprised of Chinook salmon, steelhead and rainbow trout, Sacramento sucker, and Pacific lamprey. There is no indication that there were native stocks of coho salmon in the North Fork, and none are currently present. While there are little quantitative data on salmon populations in the North Fork, it is generally accepted that populations have declined since the 1940s. Steelhead are found throughout the sub-basin today and Chinook are found in the lower five miles below Split Rock, a possible natural fish passage barrier under low flow conditions. California roach (an introduced species) is quite common in the North Fork mainstem.

The most sensitive period for salmonids is the summer when young salmon are growing before migrating to the ocean. Summer stream temperatures in the mainstem from 1996-1998 and 2001 were very high (>19°C) and almost lethal (>24°C) for rearing steelhead. The North Fork Eel does not have discharges of water from industries, large water diversions, agricultural return flows, nor dams. Changes in riparian vegetation and increases in stream width have decreased shade and increased solar radiation, leading to increased water temperatures. There is evidence of thermal refugia produced by intra-gravel flow, pools, springs, or groundwater seeps, as juvenile steelhead are often only found in pools in the North Fork in the summer. The tributaries of the North Fork Eel provide better habitat with regard to temperature. Good summer stream temperatures (<15°C) were measured at several locations.

2.4.5.6. Topography and Geology

The landscape of the North Fork Eel River sub-watershed consists of an older, subdued upland terrain that has been well-dissected by steep river canyons. Inner gorges are moderately well-developed in the middle and lower canyon sections. The basin is underlain by three main types of Franciscan rocks. Competent greywacke typically forms sharp ridges and steep, eroding hillslopes with shallow to moderately deep, poorly developed soils. Less competent greywacke forms deeply weathered in-place soils and inter-bedded sandstone/shale that typically form moderately-steep, forested slopes and deep, gravelly loam to clay loam soils with good drainage and good water-holding capacity.

Mélange areas typically have hummocky topography related to chronic instability; soils are mostly deep with somewhat restricted drainage. Minor bedrock types include chert and metavolcanic rocks that generally form small, elongate, resistant outcrops, and ultramafic rocks and associated soils that occur principally around Red Mountain where they support distinctive vegetation and form slopes that are commonly subject to mass wasting. The North Fork sub-watershed has a high rate of mass wasting and erosion because of rapid uplift and the abundance of unstable geologic material. Large deep-seated slides are not common but shallow slides are common, especially on south-facing slopes, perhaps because of the sparser vegetation. Most recent landslides appear to be in canyons away from roads and cutblocks.

2.4.5.7. Sedimentation

Much sediment was deposited throughout the North Fork Eel River in the 1964 flood, but many areas have since recovered. Approximately 30% of the current sediment load is related to human activity and occurs in the form of road- and timber harvest-related land slides. Large amounts of sediment are currently stored in the mainstem and major tributaries. Aggradation of sediments, especially in parts of the mainstem channel, has reduced spawning and rearing habitat, decreased aquatic invertebrate production, and increased water temperatures. There is evidence of recent downcutting through this material in many places. Geologically rapid stream incision in much of the watershed has resulted in relatively narrow riparian zones. Also, there is very little perennial flow in most headwater streams, which limits the extent of riparian vegetation.

2.4.6. Middle Main Eel River HA (111.40)

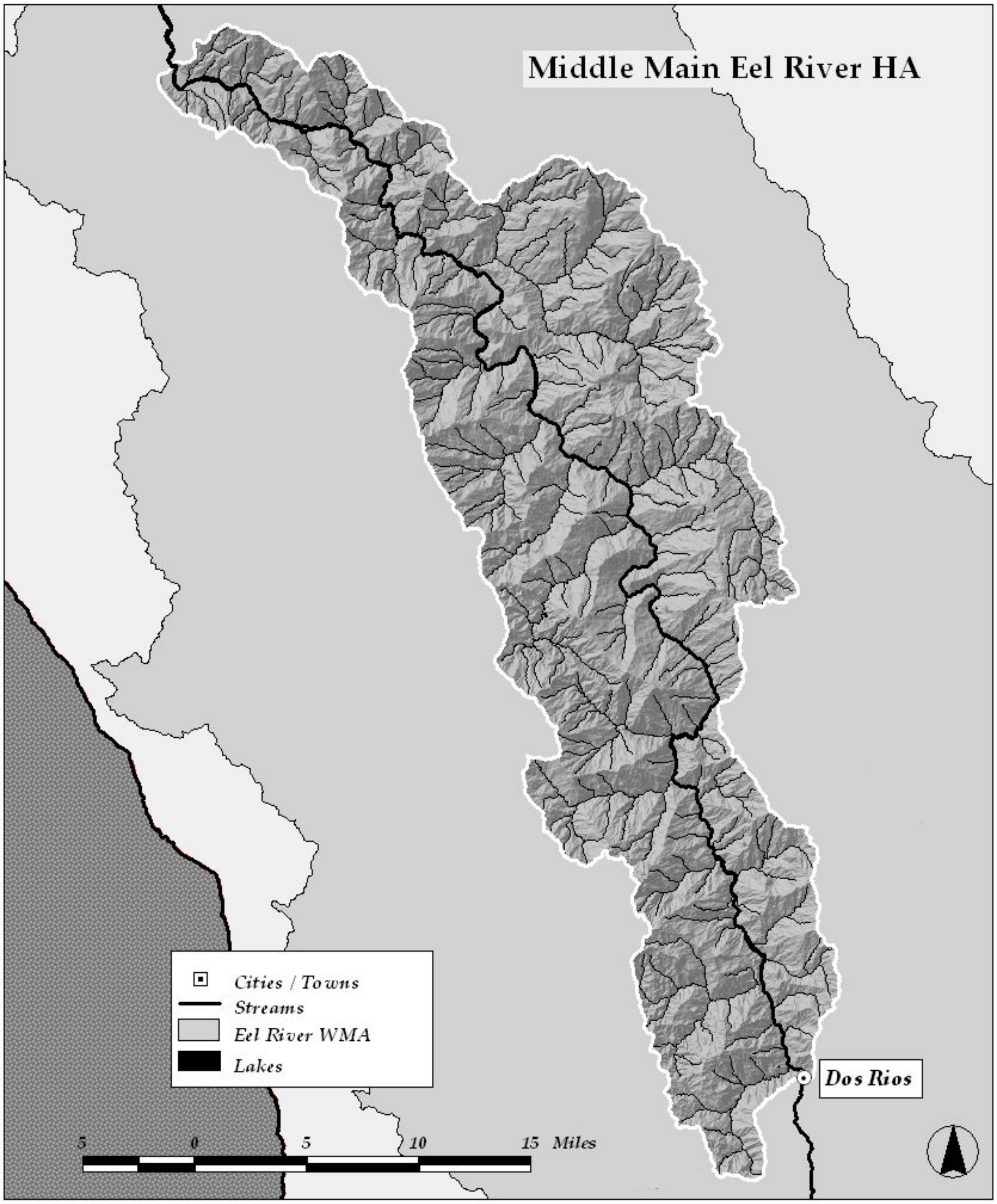

Figure 18. Map of the Middle Main Eel River HA

The text presented within this section includes information that has been previously published by USEPA (Middle Main Eel River and Tributaries [from Dos Rios to the South Fork] Total Maximum Daily Loads for Temperature and Sediment), and references included therein.

2.4.6.1. Overview

The Middle Main Eel River HA covers 521 mi^2 in Mendocino, Trinity, and Humboldt Counties in northwestern California. It lies east of Highway 101, approximately 150 miles north northwest of San Francisco, and includes the towns of Alderpoint and Fort Seward. The Middle Main Eel River HA is defined as the area from Dos Rios to where the Eel River meets the South Fork, and includes all of the smaller tributaries. The reach of river is also often referred to as the lower Eel River or the main Eel River. All but the very downstream portion of the watershed is inland, away from the influence of coastal fog, and is relatively dry and warm.

The Middle Eel River sub-watershed is rural and remote, and much of the land is privately owned. This portion of the river is inaccessible for most of its length. Public roads cross near Dos Rios and Alderpoint, which are 65 river miles apart, but not in between. The land use consists primarily of large ranches and dispersed rural residences and some industrial timber production.

2.4.6.2. Vegetation

Sixty percent of the natural vegetation area is shrub, grassland, and oak woodlands. Conifers dominate only 14% of the landscape, mostly near the coast downstream of Eel Rock, while the rest is mixed conifer and hardwood. The topography of the Middle Eel River sub-basin is steep. The area's geology is underlain by the Franciscan Group that dominates most of California's North Coast. Naturally unstable and prone to landslides, this terrane is sensitive to human disturbance.

2.4.6.3. Fishery

Salmonids are rarely found in the Middle Main Eel River except near cool springs; they are more likely to be found in tributaries. Historically, coho salmon did not reside in the Middle Main Eel but did use scattered, isolated creeks year-round. They also used the Middle Main Eel as part of their migration route to spawning and rearing tributaries further upstream. Coho populations have declined from historical levels and are presently only known to rear in Thompson and Kapple creeks downstream of McCann.

Chinook salmon find valuable habitat in the Middle Main Eel. They are thought to use as much as 123 stream miles. Steelhead trout find critical habitat in 157 miles of the Middle Main Eel River HSA. Juvenile steelhead are not commonly found in the Middle Main Eel but are widely distributed in the tributaries, though isolated groups may exist in the mainstem near cool water tributaries or seeps. California roach and Sacramento suckers are common in the Middle Eel River.

Stream temperatures in many parts of the Middle Main Eel sub-watershed are stressful to lethal to juvenile salmonids. Data from 1996-2003 and 2005 show temperatures >26°C in the main channel, which may kill steelhead within hours. Temperature conditions in the tributaries ranged from good to stressful. Temperatures were highest at the mouths of tributaries and decreased with distance upstream.

2.4.6.4. Sedimentation

Currently, erosion and sediment delivery to streams result from a combination of natural factors combined with human disturbance, such as roads, grazing, and timber harvest. Natural landslides are the dominant erosional process in the Middle Eel River watershed and account for 68% of the total annual sediment production (753 t mi^{-2} yr^{-1}) in the 65 year period from 1940-2005. Human activity contributes 32% of the sediment input, mostly in the form of landslides as well. Considerably less natural and human related sediment has been produced after 1970 than before, probably due to differences in the frequency and magnitude of storms that trigger widespread landslides, road failures, and washouts, and improvements in land management practices.

Along the Middle Main Eel River, the flood of 1964 resulted in large-scale destruction of the Pacific Northwestern Railroad, which parallels the main channel of the river for miles. The railroad sustained significant damage from erosion, landslides, and flooding. North of Alderpoint the tracks were covered with as much as 10-12 feet of sediment, and at McCann huge mudslides wiped out and covered tracks and houses.

2.4.7. South Fork Eel River HA (111.30)

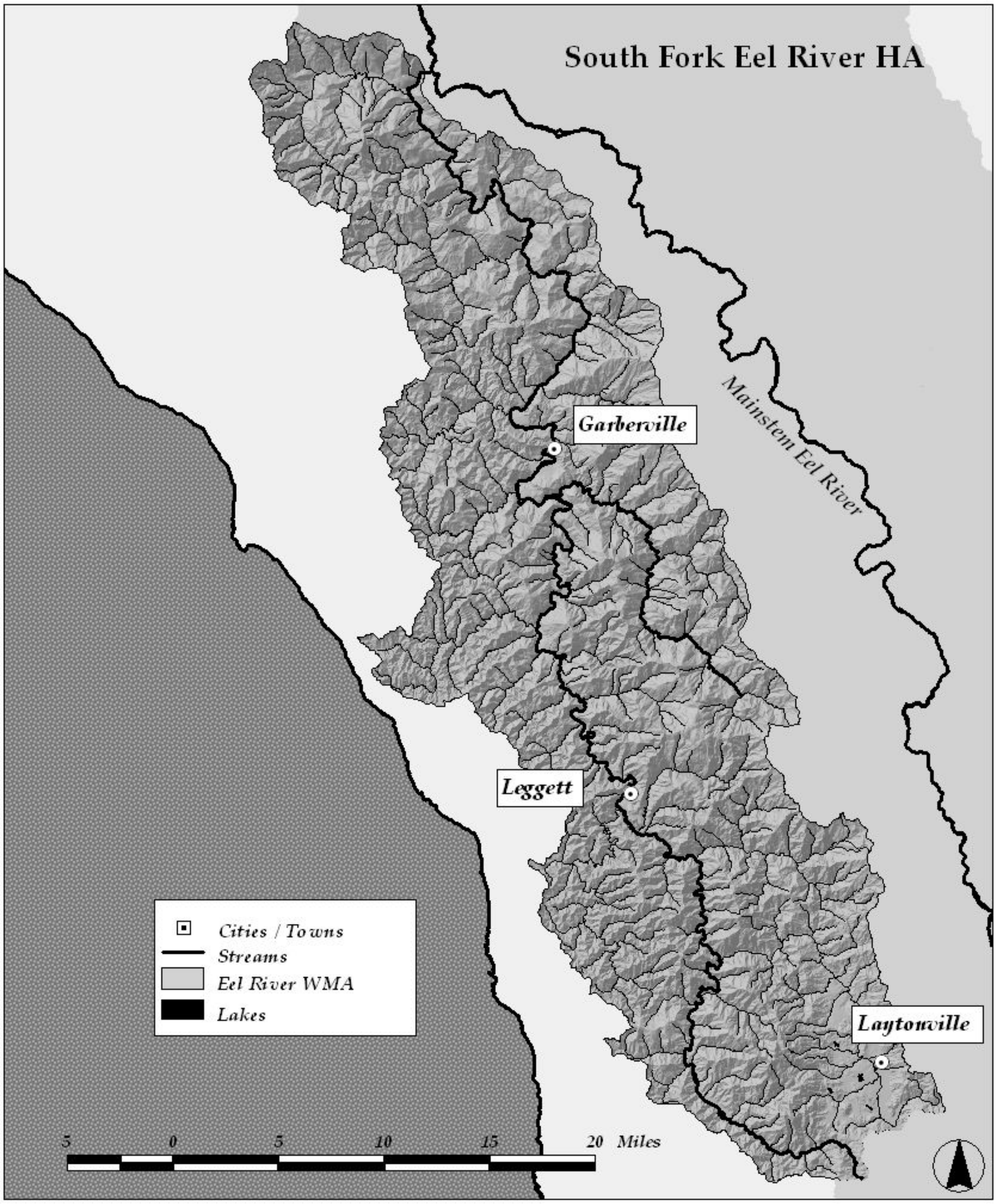

Figure 19. Map of the South Fork Eel River HA

The text presented within this section includes information that has been previously published by USEPA 1999 (South Fork Eel River Total Maximum Daily Loads for Sediment and Temperature), and references included therein.

2.4.7.1.______Overview

The South Fork Eel River HA in northern Mendocino and southern Humboldt Counties covers 688 mi^2 and ranges from 100 to 4,500 feet in elevation. It is the second largest sub-basin in the Eel River watershed and stretches approximately 58 miles from the Laytonville area in Mendocino County up US Highway 101 through Humboldt Redwoods State Park and the famed Avenue of the Giants in Humboldt County. The South Fork flows northward for nearly 100 river miles, joining the mainstem Eel River near Weott, about 40 river miles from the Pacific Ocean. As the closest sub-basin to the coast, the South Fork has the most coastal influence.

About 81 % of the South Fork sub-watershed is under private ownership and is used for intensive timber harvesting, livestock grazing, and dispersed rural development. Large timber companies own a relatively small percent of the watershed compared with many other North Coast watersheds; timber company holdings are concentrated west of Highway 101. State lands make up about 12 % of the South Fork Eel River watershed and mostly lie within Humboldt Redwoods State Park. BLM land makes up the remaining seven percent of the watershed.

2.4.7.2.______History and Land Use

Land management practices, including timber harvesting, road building, and rural development, in combination with the flood events in 1955 and 1964, have exacerbated the high natural erosion rates and resulted in considerable sediment loads. While the South Fork Eel River carries proportionally less sediment than other tributaries, the levels are still substantial. In sections of the main channel of the South Fork, local and upstream sediment inputs have led to increases in streambed elevation of 1.6-11 feet from 1968 to 1998. In tributaries of the South Fork, sedimentation has buried several bridges under more than 30 feet of sediment and widened the channel from 10s to 100s of feet. Increases in stream width and loss of riparian vegetation have increased solar radiation leading to increased stream temperatures. Consequently, many locations in the South Fork Eel River have summer stream temperatures that exceed the tolerances of salmonids.

2.4.7.3.______Fishery

The South Fork Eel River historically was one of the most productive sub-basins in the Eel River watershed for anadromous fish and may have supported about half of the total coho run for the State of California before the 1900s. Salmon abundance in the Eel River just below Garberville at Benbow Dam averaged 20,000 Chinook salmon and 15,000 coho salmon annually in the 1940s. By 1975 coho stocks had declined by 88% to about 1,800 adults annually. Currently, about 1,000 adult coho salmon return annually to the South Fork Eel River. While greatly reduced from historical levels, this population is significant, particularly because it is one of the last remaining coho salmon populations in California that consists of mostly wild stock with little hatchery influence.

Other anadromous fish species found in the South Fork Eel River include steelhead and coastal cutthroat trout, chum salmon, green sturgeon, Pacific lamprey, and American shad. The west side of the watershed has better habitat for salmonids than the east side because the tributaries are larger, and the surrounding slope vegetation provides more canopy and allows less direct afternoon sun exposure.

2.4.7.4. Topography and Geology

The geology of the South Fork sub-watershed is naturally unstable and contributes to high natural sedimentation rates. The watershed is underlain by three types of geological formation. The Yager and coastal belt Franciscan terranes are characterized by moderate to steep slopes and forested hillsides with straight profiles. The vegetation in these areas is dense stands of redwood and fir. Franciscan mélange underlies parts of the eastern portion of the basin and has little, if any, associated timber production; the area primarily consists of rolling hills with open grasslands and oak woodland.

2.4.8. Van Duzen River HA (111.20)

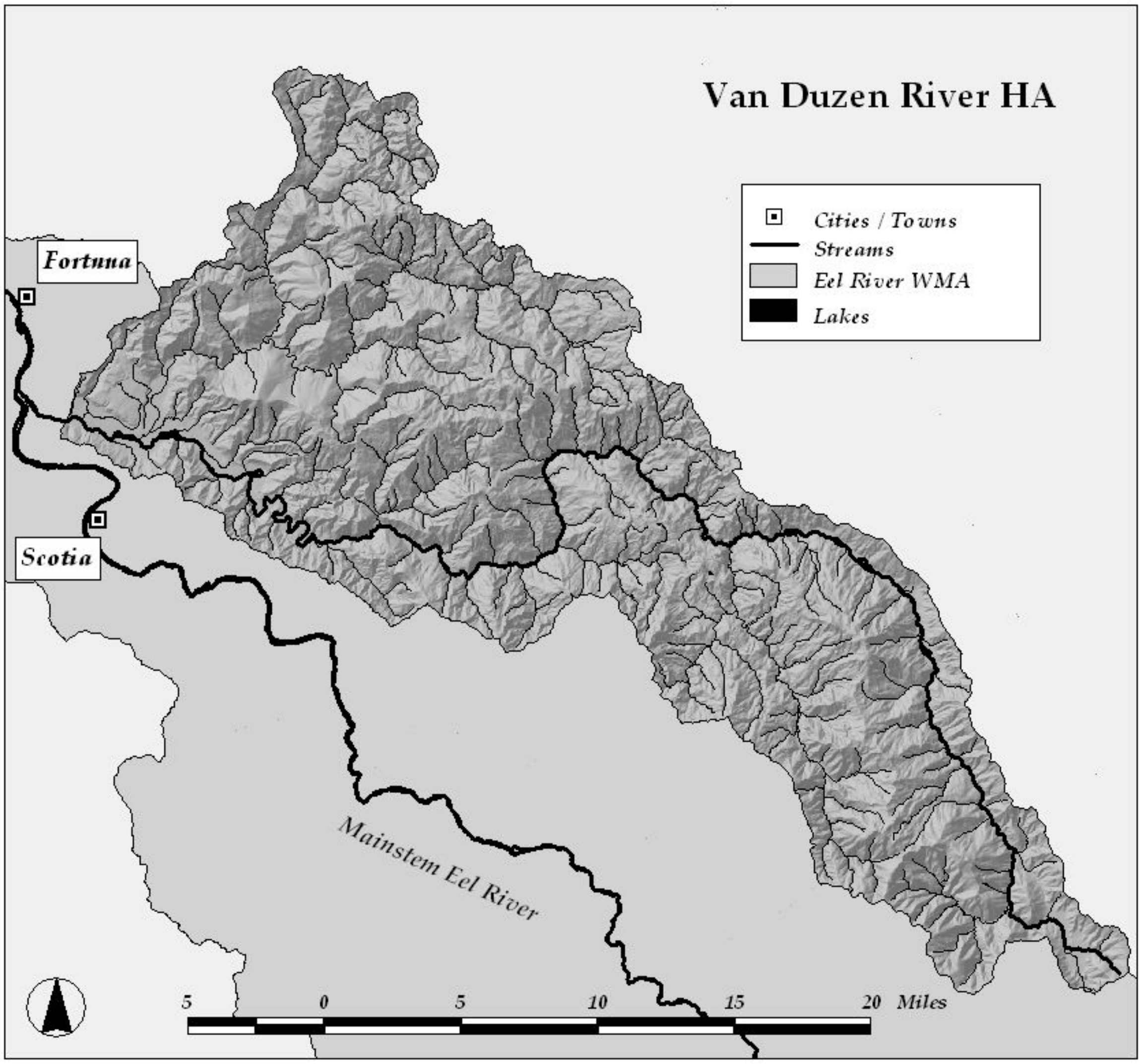

Figure 20. Map of the Van Duzen River HA

The text presented within this section includes information that has been previously published by USEPA 1999 (Van Duzen River and Yager Creek Total Maximum Daily Load for Sediment), and references included therein.

2.4.8.1. Overview

The Van Duzen River HA is 429 mi^2 in California's North Coast Range, southeast of the City of Eureka. The Van Duzen River begins in the northern end of the Hettenshaw Valley and enters the mainstem Eel River just south of Fortuna in Humboldt County. The Van Duzen River is 73.5 miles long and one of the few remaining free flowing rivers in California. Elevations range from 62 feet at its confluence with the Eel River to 5,906 feet at its headwaters at Red Lassic peak. The primary population centers in the watershed include the towns of Hydesville, Carlotta, Bridgeville, and Dinsmore.

Seventeen percent of the watershed is public land managed by USFS, BLM, and State and County Parks; 26% is used for industrial timber production, 31% for non-industrial ranching and timber production, and 26% for rural residential. Industrial timber production is concentrated primarily in the lower basin. Farming, gravel mining, recreation, and residential use also occur in the lower basin; sand and gravel mining do not appear to contribute significantly to sedimentation in the lower basin. Ranching, livestock grazing, and some silviculture occur in the middle basin. The Six Rivers National Forest is located in the upper basin, where the USFS is the largest land manager.

2.4.8.2. History and Land Use

Timber harvesting began in the lower basin redwood zone in the late 1800s and then intensified in the late 1940s, as technology and the demand for lumber increased following WWII. Portions of the lower basin were heavily harvested in the 1990s. In the upper basin, post WWII timber harvesting and road building on USFS land are the most intensive management actions. Timber harvesting of Douglas-fir in the Six Rivers National Forest started in 1960, but harvesting on private lands began much earlier. No logging or road building had occurred in the headwaters of the basin at the time of the 1964 flood. USFS managed most of the upper basin for timber production until the early 1990s.

2.4.8.3. Vegetation

There are three major vegetation zones within the watershed, including redwood forest, oak woodland/prairie, and coniferous forest.

The lower basin harbors Redwood forests, particularly at lower elevations that are influenced by summer fog. Most of the redwood forest is managed for industrial timber production, although a few old growth groves are preserved in Grizzly Creek State Park and Humboldt County Park. The drier upper slopes and ridges of the redwood zone are characterized by Douglas fir and tanoak forests.

The middle basin is primarily grassland and oak woodland including tanoak, madrone, and California black oak, as well as mixed conifer forest. The grasslands have historically been used for sheep grazing and are now used primarily for beef cattle grazing.

The upper basin is characterized by coniferous forests composed of Douglas fir, Jeffrey pine, ponderosa pine, incense cedar and white fir. The coniferous forest is mostly managed by the USFS for multiple-use objectives.

2.4.8.4. Climate

Coastal fog in the lower basin provides cooler temperatures in the summer while the middle and upper basins are warmer and drier. Precipitation throughout the Van Duzen

River basin ranges from 50-100 inches yr-1 and most of it occurs between October and April. Some precipitation occurs as snowfall. Two to six intense rainstorms typically occur each winter, causing widespread flooding and modification of stream channel morphology. The largest recorded floods occurred in 1861, 1955, and 1964.

2.4.8.5.______Fishery

Coho salmon, Chinook salmon and steelhead trout live in the Van Duzen River watershed. There is little quantitative information regarding historical anadromous and resident fish populations in the Van Duzen River watershed. Anecdotal reports indicate that salmonids were more abundant in the late 1800s-early 1900s than the late 1900s, with the most serious declines following the 1955 and 1964 floods. In 1965, CDFG estimated that there were 2,500 Chinook and 500 coho adult salmon in the annual Van Duzen River runs. The summer steelhead run is probably less than 100 fish.

Today, coho, Chinook, and steelhead are found in the lower basin, where stream gradients and aquatic habitat conditions, such as riparian vegetation and temperatures, are naturally capable of supporting a relatively higher diversity and abundance of anadromous fish than the rest of the basin. Chinook and steelhead are present in the middle basin, where channel gradients are generally steeper and more confined than in the lower basin. Chinook salmon are able to utilize portions of lower North Fork and South Fork Yager Creek as well as the mainstem Van Duzen River as far as "Salmon Hole". Juvenile Chinook salmon generally leave the river by June of the year they hatch, which makes them less vulnerable to summer habitat conditions. Winter run steelhead are more widely distributed and populations are more viable; there may be as many as 10,000 winter steelhead. Steelhead are in the upper basin; steelhead are able to migrate throughout areas of the South Fork, while the upper mainstem supports resident trout.

Other resident native fish species in the watershed include rainbow trout, pacific lamprey, West Coast three-spined stickleback, Sacramento sucker, Coast Range sculpin, prickly sculpin, and Coastal cutthroat trout. Introduced species in the watershed include California roach, speckled dace, and Sacramento pike minnow. Western roach and Sacramento pike minnow appear to thrive in the aggraded channel conditions and warmer stream temperatures that have persisted since the 1964 flood. Their presence in much of the lower mainstem Van Duzen River and some lower gradient tributaries may be causing mortality to juvenile salmonids and forcing them to use less suitable habitat.

2.8.4.6.______Topography and Geology

The Van Duzen River basin is approximately 50 miles from the Mendocino Triple Junction where the American, Pacific, and Gorda tectonic plates come together near Cape Mendocino. This is one of the most erodible watersheds in the United States due to relatively weak bedrock units that are easily eroded and subject to mass wasting, high uplift rates in this tectonically active setting, and significant rainfall.

There is a high incidence of landsliding adjacent to stream channels, including large slump-earthflows and extensive zones of debris sliding. In the upper basin the contribution to total historical sediment loads from natural sources were approximately 80%, in the middle basin 84% and in the lower basin 64%. Overall, 77% of the historical sediment load in the Van Duzen River watershed is attributable to natural sources.

2.8.4.7. Sedimentation

The 1964 storm mobilized huge quantities of sediment that had significant and lasting effects on stream channel morphology throughout the Van Duzen River watershed. Widespread debris landsliding in the headwater drainages of the upper basin resulted in substantial aggradation and destroyed riparian vegetation in upper channel reaches of the South and West Forks. Up to 15 feet of sediment was deposited in the upper reaches; much sediment moved downstream, and several feet of sediment was deposited in some stream reaches. Aggradation continued after 1964 due to a continued supply of sediment from aggraded reaches upstream. During the 30 year period from 1968-1998, stream reaches in the lower basin aggraded an additional 2-3 feet. It is estimated that 49% more sediment entered the Van Duzen River basin during 1941-1975 than would have without the 1964 storm, and that no channel aggradation would have occurred without the 1964 storm.

The annual suspended sediment load from 1941-1975 varied two orders of magnitude from 270-26,600 t mi-2 yr-1 with an average of 6,700 t mi-2 yr-1 and a typical range of 2,500 to 9,000 t mi-2 yr-1. Large inputs of sediment, such as those that occurred during the 1964 flood and in other years with high rainfall, have degraded salmonid habitat. Erosion, sedimentation, and aggradation have resulted in the filling of formerly incised channels, channel widening, loss of riparian vegetation and thus loss of LWD, increased bank erosion, loss of deep pools and consequent increased water temperatures. All these changes degrade the quality of the fish habitat.

Sedimentation has decreased the quality and quantity of pools and spawning gravels for salmon and steelhead, particularly in tributaries to the lower basin and the South Fork Van Duzen River. Embeddedness of gravels has been scored at 40-83%; embeddedness < 25% is optimal. Aggradation of coarse material in the lower reaches of the mainstem impedes the migration of anadromous fish to and from spawning sites and reduces channel complexity necessary for rearing. Fish passage problems in the lower mainstem have been observed, particularly during low-flow years in the early 1990s. In the middle basin, recent stream incision in alluvial reaches indicates recovery from earlier influxes of sediment, but sedimentation is still a problem in tributaries to the middle mainstem Van Duzen River. Some stream reaches in the middle basin such as Butte Creek, tributary to South Fork Van Duzen River, presently have relatively suitable habitat, especially for steelhead.

2.4.9. Water Quality Issues in the Eel River WMA

Salmonids in the Eel River WMA are threatened by many factors including sedimentation and elevated stream temperatures. Many stream channels were greatly damaged during the 1964 flood. Streams filled with sediment, channels widened, and many areas lost riparian vegetation. Physical barriers to fish migration limit their habitat as well. In addition, the invasive predatory pikeminnow, *Ptychocheilus grandis*, found throughout the watershed, may negatively impact salmonid populations by preying on juvenile fish.

The watershed is located in steep forested terrain with highly erosive soils and high rainfall. These factors, in combination with timber harvest and associated roads and other land use activities have led to high erosion and sediment delivery rates. Sediment fills in deep pools, making thermal refugia unavailable. Water diversion for the PVP may also be hurting the Eel River cold-water fishery. Overall, salmonid habitat is limited by surface flow, the number and depth of pools, elevated water temperatures, increased sedimentation, low DO, lack of LWD, and lack of rearing habitat.

Water quality issues other than sediment and temperature include ground water contamination, dairies in the delta area near the ocean, and localized contamination of surface and ground waters. These issues vary among different parts of the watershed.

- Based on mercury bioaccumulation in warm water fish in Lake Pillsbury the lake was placed on the 303(d) list of impaired waterbodies for mercury.
- Sedimentation is a problem and storage capacity of Lake Pillsbury is decreasing over time due to silt and sediment from the upper reaches of the watershed.

In the Van Duzen River watershed, certain land-use activities, particularly road construction and maintenance and intensive timber management in sensitive watershed areas, have accelerated sediment delivery. Intensive management activities continue to threaten critical spawning and rearing habitat in lower basin tributaries. There is a lumber mill operated by Louisiana Pacific at Van Arsdale where a cleanup is partially complete, but dioxin and furans are still detected in the mainstem of the river.

The primary water quality issues in the Eel River WMA are:

- Sedimentation of streams
- Salmonid habitat degradation
- High water temperatures
- Ground water contamination

The cold water fishery is the most sensitive of beneficial uses in the watershed. Consequently, protection of these beneficial uses is presumed to protect any of the other beneficial uses that might also be harmed by sedimentation or increased temperature.

2.5.________North Coast Rivers WMA

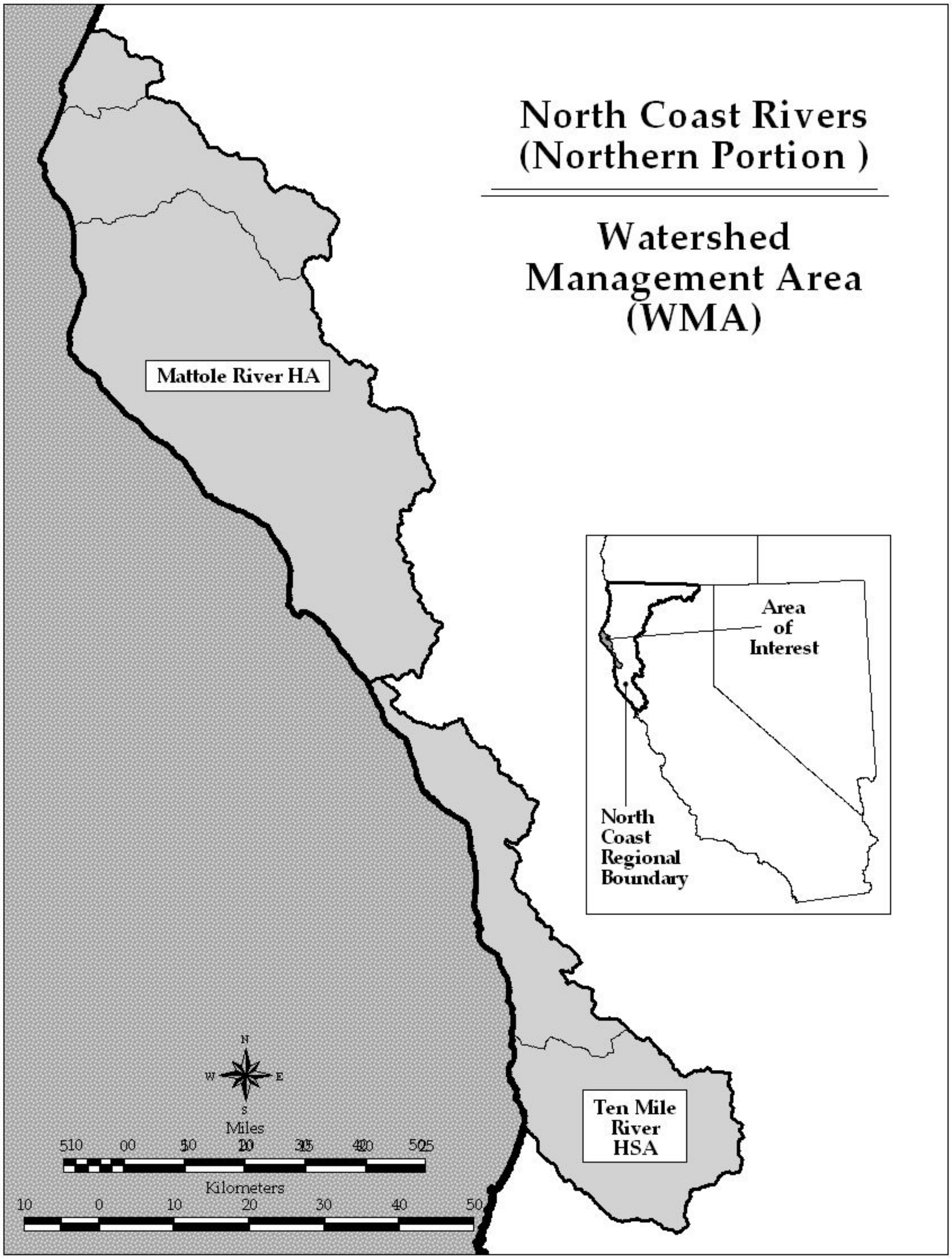

Figure 21. Hydrologic Areas of the North Coast Rivers WMA – Northern Portion

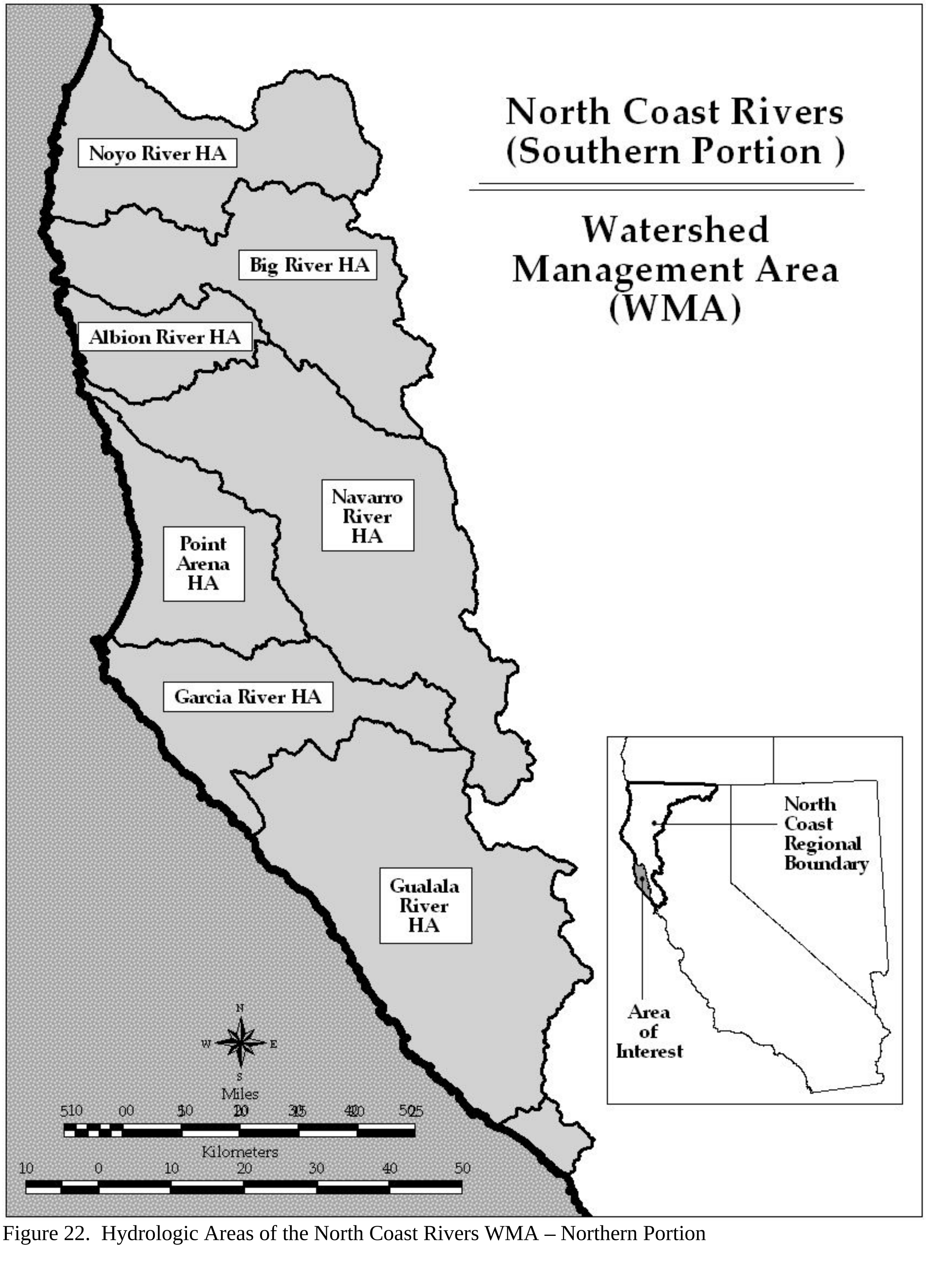

Figure 22. Hydrologic Areas of the North Coast Rivers WMA – Northern Portion

2.5.1._______Overview

This management area includes North Coast rivers not specifically included in other WMAs. The major watersheds from the Oregon border south include:

- Smith River
- Mattole River
- Ten Mile River
- Noyo River
- Big River
- Albion River
- Navarro River
- Garcia River
- Gualala River

Coho salmon (Oncorhynchus kisutch) are a federally listed threatened species in all of the rivers in the North Coast WMA. Coho are state listed endangered species in all rivers in this WMA except the Smith, Bear, and Mattole Rivers. Chinook salmon (O. tshawytscha) and steelhead trout (O. mykiss) are federally listed threatened species in all except the Smith River.

Approximately 25% of the timber harvest in the NCR occurs in Mendocino County, which comprises the majority of the North Coast WMA. Thus, the NCRWQCB is largely concerned with water quality issues tied to logging, such as erosion and sedimentation, and other nonpoint source pollution. Timber harvest plans are inspected to assure compliance with Basin Plan standards, implementation of the Forest Practice Rules and best management practices to ensure protection of water quality and beneficial uses. The primary water quality issues associated with timber harvesting activities are recovery of threatened and endangered species of coho, Chinook, and steelhead. There are also potential impacts of timber harvesting on the water supply for the coastal communities of Elk, Gualala, and Fort Bragg.

The following waterbodies are listed as impaired on the 303(d) list:

- Mattole River (sediment and temperature)
- Ten Mile River (sediment and temperature)
- Big River (sediment and temperature)
- Albion River (sediment)
- Navarro River (sediment and temperature)
- Garcia River (sediment and temperature)
- Gualala River (sediment and temperature)

2.5.2. Smith River HU (103.00)

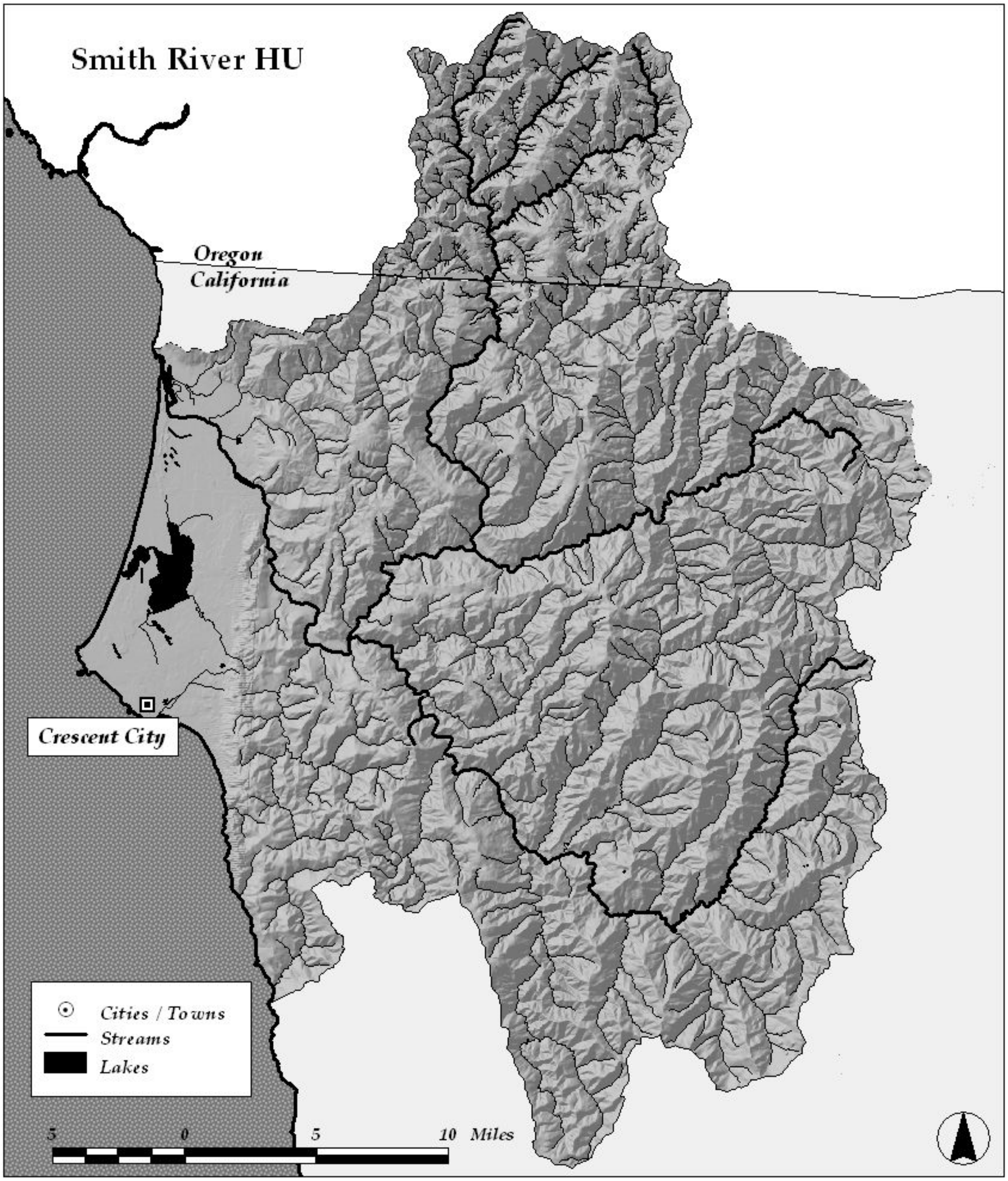

Figure 23. Map of the Smith River HU

The text presented within this section includes information was synthesized from http://www.savetheredwoods.org/protecting/pdf/mp_b_smith.pdf (2006), and http://www.shastacascade.org/forest/sixriver/smithr.htm (2006).

2.5.2.1.______Overview

The Smith River HU drains an area of approximately 703 mi^2 in Del Norte County. This hydrologic area includes the Smith River watershed and the coastal Wilson Creek watershed. The Smith River watershed is a 696 mi^2 basin that reaches the reaches the Pacific Ocean north of Crescent City, approximately 4 miles south of the California-Oregon border. It originates in Oregon and is bounded by Oregon's Rogue River watershed to the north and the Klamath River watershed to the east and south. The Smith River is one of the most "pristine" rivers in the NCR and is a designated Wild and Scenic River.

The North Fork Smith River is considered one of the most beautiful whitewater and wilderness rivers in the country, but it is infrequently visited because access is limited and summer flows are low. The North Fork is known for its outstanding water quality and for its ability to clear quickly following storms. Low turbidity and lack of pollutants contribute to the river's excellent habitat and high fisheries value. The fishery is dominated by trout and salmon including winter steelhead and anadromous cutthroat trout and populations of coho and Chinook salmon, (both fall and spring run). The North Fork provides seven miles of near-pristine steelhead spawning and rearing habitat and is a significant source of the high-quality water on which the anadromous fishery of the Smith River depends. The Middle Fork (32 miles long) is characterized by steep rapids, a scenic rocky gorge, and several clear, deep pools. It is popular with anglers, sunbathers, swimmers, and snorkelers. The South Fork Smith (39 miles long) is popular for canoeing, kayaking, and rafting in winter and spring when the water levels are the best. The Smith River is one of the last un-dammed rivers in California and has exceptional water quality. It provides high quality fish habitat and hosts some of California's strongest salmon and steelhead runs. The estuary remains open year-round, allowing fish passage in all seasons.

Small communities in the watershed include Smith River, Hiouchi, Gasquet, and Big Flat. Crescent City, population 8,805, is located several miles outside the watershed and lies about 10 mi. south of the Smith River mouth. Traditionally the local economy has relied on the timber industry and commercial fishing; today, recreation and tourism are becoming increasingly important.

Much of the land in the watershed is publicly owned. Redwood National and State Parks (RNSP) encompass 206 mi^2 along the northern California coast just below the Oregon border; 61 mi^2 of RNSP are old-growth forest. Six Rivers National Forest lies east of RNSP; it encompasses 1496 mi^2 of National Forest land and 208 mi^2 of land under other ownership. The Smith River National Recreation Area (NRA) was established in 1990; it comprises 469 mi^2 of land in the Six Rivers National Forest. Large timber companies hold most of the privately owned land.

2.5.2.2. Land Use and History

Mining and prospecting for minerals have been an important part of the history of the Smith River area since the 1850s. Mining operations within the Smith River drainage historically have been small-scale placer gold exploration and recovery operations within the bed and banks of the Smith River and its main tributaries. Today, panning, sluicing, and dredging operations occur predominantly during the summer months. In recent years, large, low-grade nickel-cobalt deposits in the uplands of the Smith River watershed have attracted attention. As of May 1997, there were approximately 305 mining claims, covering about 12 mi^2 of National Forest Service lands within the Smith River NRA.

The Low Divide copper mining district is located approximately 13 mi northeast of Crescent City and 7 mi east of the town of Smith River in Del Norte County. The district is contained within the Six Rivers National Forest. Copper was discovered in the Low Divide district at the head of Copper creek in 1853 and a number of mining camps were established. The mines in this district have been inactive for more than 50 years. In the late 1900s, it was found that massive sulfide bodies rich in troilite, an iron sulfide, were common in the area. While troilite occurs worldwide, it is a very rare mineral.

2.5.2.3. Vegetation & Wildlife

The Smith River watershed contains lush coastal redwoods, dense stands of mixed conifers and hardwoods, ancient redwood groves and other old growth forests in RNSP and the Smith River NRA. These forests provide habitat for the Northern spotted owl and marbled murrelet, both of which are Federally Threatened species. The unique and diverse geology of the watershed allows for high botanical diversity. The watershed supports four distinct botanical areas:

- The North Fork Smith Botanical Area is one of the most botanically significant areas in the Six Rivers National Forest, containing plant habitat for one Federally Endangered species, nine Sensitive plants, and an estimated 40 rare plant species.
- Bear Basin Butte and Broken Rib Botanical Areas are noted for the presence of enriched mixed conifer stands including the Brewer’s spruce, a Klamath Mountain endemic.
- Myrtle Creek is both a botanical and cultural area. Ecologically, this area marks the boundary between the redwood forest and Douglas fir-mixed evergreen forest.

2.5.2.4. Topography and Geology

The topography of the area is typical of the northern California Coast Ranges. There are steep, rugged mountains with deeply incised drainage systems, high areas with little relief that represent the remnants of a late Tertiary erosion surface known as the Klamath peneplane. Landslides, some still active, have occurred on a large scale, particularly along streams that cut soft, easily eroded serpentinite.

This region of northwestern California and southwestern Oregon contains one of the largest intact ophiolites known, the Josephine Ophiolite, with an areal extent of more than 309 mi^2. The Josephine Ophiolite and the overlying Galice Formation are part of the Western Jurassic Belt of the Klamath Mountains geomorphic province.

2.5.2.5. Water Quality Issues

Highway 199 bisects the Smith River watershed with much of the roadway located within the inner gorge of the mainstem where it has the potential to impact a variety of resources including water quality and aesthetics. The highway is a primary transportation artery carrying much of the region's traffic, including hazardous materials with potential for catastrophic spills into the Smith River (Del Norte County's primary water supply). Plans to widen the road will result in larger cut-banks and fill areas, degrading scenic quality. Many roads on private and public lands are in poor condition and contribute sediment to streams, impacting fish habitat.

Gravel extraction on private lands downstream of the Smith River NRA, particularly the practice of trenching (digging out the channel vs. scraping off the top of the channel deposits), has impacted aquatic habitat, gravel bars, and salmon spawning habitat. In addition, noxious, non-native weeds such as scotch broom, English ivy, pampas grass, cottoneaster, acacia, knapweed, and gorse are becoming established on gravel bars along the river.

In the Smith River NRA, river-oriented unmanaged dispersed recreation threatens water quality. Campers at undesignated dispersed sites located directly adjacent to streams dump trash, defecate, and cut trees in these areas. These activities can lead to the loss of riparian vegetation, bank destabilization, and consequent impairment of water quality and aesthetics.

Rowdy Creek Fish Hatchery currently stocks 100,000 steelhead smolts annually at the boat ramp by the forks. This practice creates a risk of displacing the wild juvenile steelhead that may be rearing downstream of the release site. The potential impacts to wild steelhead genetics are also of concern.

As in many of the North Coast watersheds, the beneficial uses associated with coldwater fishery appear to be the most sensitive of the beneficial uses in the watershed because of the sensitivity of salmonid species to habitat changes and water quality degradation. Accordingly, protection of these beneficial uses is presumed to protect any of the other beneficial uses that might also be harmed by sedimentation and high water temperatures.

2.5.3. Cape Mendocino HU (112.00) - [Mattole River HA (112.30)]

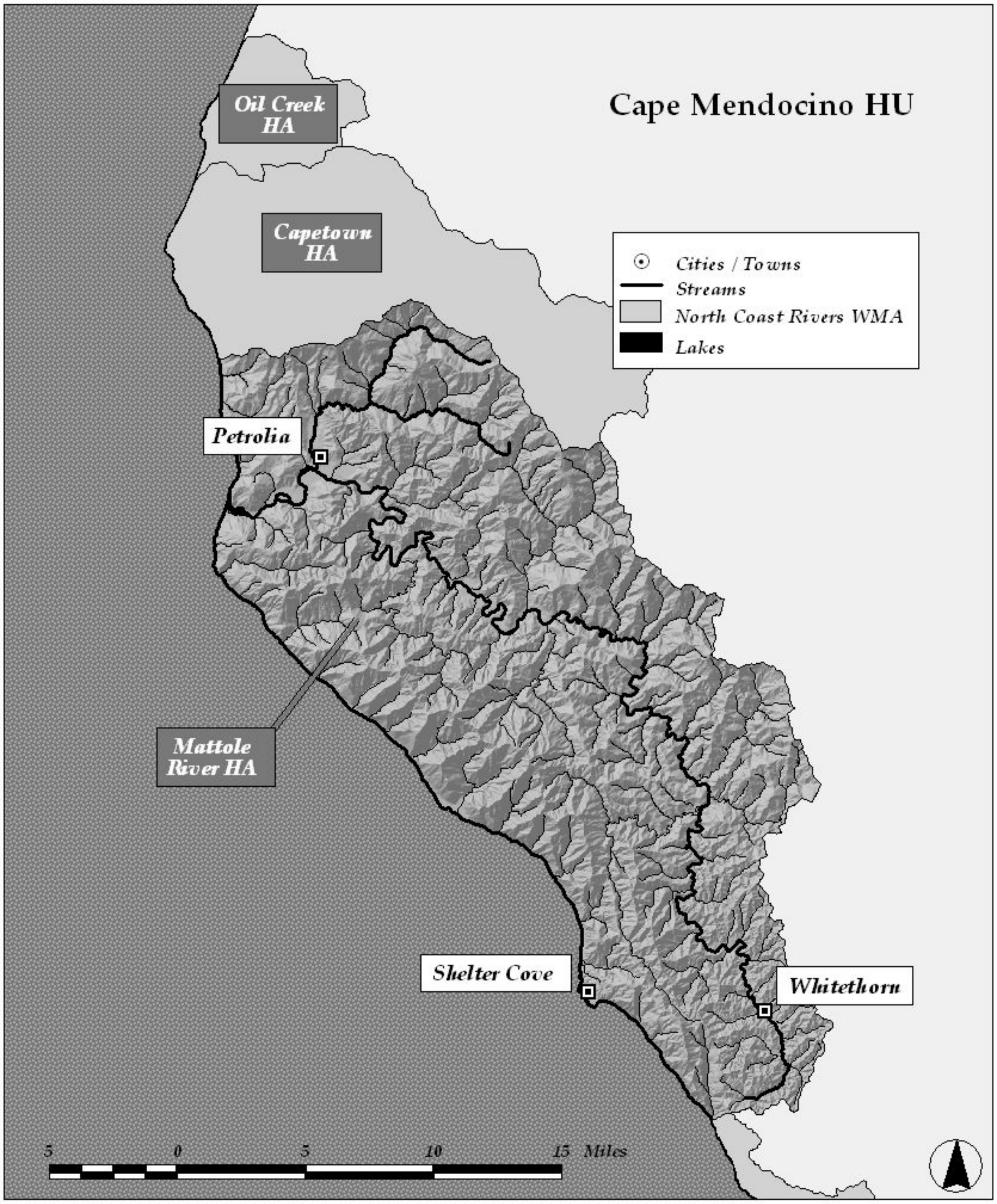

Figure 24. Map of the Cape Mendocino HU

The text presented within this section includes information that has been previously published by USEPA 2003 (Mattole River Total Maximum Daily Loads for Sediment and Temperature) and references included therein.

2.5.3.1. Overview

The Mattole River HA drains a 296 mi^2 watershed in western Humboldt County and northern Mendocino County. The river flows 62 miles north from its headwaters through steep, forested lands in Humboldt County and into the Pacific Ocean ten miles south of Cape Mendocino (Figure 24). Elevation in the Mattole River watershed ranges from sea level to 4,090 feet at the top of Kings Peak, between the Mattole River watershed and the coast, and to more than 3,600 feet on the divide to the east between the Mattole and the South Fork Eel River.

The 2000 census estimated the population of the Mattole basin at about 1,200, with the majority of the population centered around the three communities of Whitethorn in the south, Honeydew near the middle of the watershed, and Petrolia near the mouth. Land uses in the watershed include timber harvesting (primarily in the headwaters and upper watershed) and livestock agriculture (primarily in the lower watershed). Small landowners (less than 450 acres) own 43% of the land, Bureau of Land Management (BLM) owns about 12%, and commercial timber companies own most of the remaining 45% of the land.

2.5.3.2. History and Land Use

Prior to settlement by pioneers, Athapascan-speaking Mattole and Sinkyone native peoples inhabited the Mattole River valley. However, arrival of early settlers led to the demise of the native peoples within little more than a decade. Until World War II, oil, tanbark, and agricultural booms drew new settlers to the Mattole River basin, and these people kept lands cleared and engaged in agricultural production. The decades following World War II brought a timber boom to the watershed. The most intense harvesting, in terms of acres per year, took place from 1945 to 1961. Thousands of miles of logging roads were constructed.

Extremely heavy rainfall in 1955 and 1964 triggered erosion throughout the watershed, especially from recently logged areas, causing a devastating increase in sediment delivery to streams in the watershed. This deluge of sediment changed the form and function of the stream system. The river, and some tributaries, buried many acres of fertile bottom land beneath barren gravels during these floods. From 1955 to present, high waters have filled in the deep pools with gravel and swept away much of the riverbank vegetation.

Today, timber harvesting still occurs in the Mattole River watershed. It is estimated that 82% of the timber in the Mattole River watershed was harvested between 1947 and 1987. By 1988, more than 90% of old-growth forests had been harvested; by 1996, late seral habitats covered less than 8% of the area of the original forest cover. A large part of the late seral stage acreage lies within the King Range National Conservation Area, which has been managed as a Spotted Owl Habitat Conservation Area since 1991. Currently, Sanctuary Forest, a non-profit land conservation organization, owns about 1,100 acres of old growth forest, and BLM manages about 6,500 acres of old growth in Gillham Butte and Mill Creek Forests.

2.5.3.3. Vegetation

The majority of the Mattole River watershed is covered with a mix of grasslands and conifer and hardwood forests. Grasslands occur throughout the watershed, but are most widespread in the northern, upstream, half of the basin. Forests dominate the southern half of the basin and consist primarily of a mix of Douglas fir and tanoak with varying proportions of madrone, bigleaf maple, California bay laurel, canyon live oak, chinquapin, redwood, alder, and Oregon ash. Trees in the watershed are generally relatively small due to large-scale timber extraction after World War II, wildfires, conversion of forestland to rangeland, and reversion of rangeland to forestland.

2.5.3.4. Climate and Hydrology

The Mediterranean climate in the watershed is characterized by a pattern of high-intensity rainfall in the winter and warm, dry summers with coastal fog primarily in the northern and western parts of the basin. Mean annual precipitation ranges from about 45 inches at the coast, to more than 115 inches on Rainbow Ridge, the divide between the Mattole and the South Fork Eel River. Snowfall occurs occasionally in the higher elevations of the watershed but rarely accumulates and is not considered to have a significant effect on the watershed hydrology. The “one hundred year” floods of 1955 and 1964 delivered large amounts of sediment into the river system from which the Mattole River has yet to recover. Major floods also occurred in 1995 and 1997.

Winter monthly stream flows in the Mattole River, measured near Petrolia, average between 1,710 and 4,170 cubic feet per second (cfs), with instantaneous measured maximum peak flows of 90,400 cfs on December 22, 1955 and 78,500 cfs December 22, 1964. The Mattole River begins to overtop its banks at Petrolia when the discharge exceeds approximately 31,000 cfs. Summer and fall flows typically drop to as little as 28 cfs, and the minimum recorded flow was 17 cfs (1977 and 2001).

2.5.3.5. Fishery

Fish found in the Mattole River watershed include Chinook and coho salmon, steelhead and rainbow trout, green sturgeon, brook lamprey, Pacific lamprey, coast range sculpin, prickly sculpin, threespine stickleback, surf smelt, redtail surfperch, walleye surfperch, staghorn sculpin, speckled sanddab, and starry flounder.

The populations of anadromous salmonid species in the Mattole River watershed have declined dramatically since the 1960s when there were an estimated 2,000 Chinook spawners, 5,000 coho spawners and 10,000 steelhead spawners. In 1981-82, escapement data indicated the presence of 3,000 Chinook and 500 coho, but by 1989 there were only 150 Chinook (a 95% reduction) and 50 coho (90% reduction) present, and the salmon population was considered barely viable. There were about 100 Chinook in 1990-91, and populations increased to 500 in 1994-95.

Chinook in the Mattole River and its tributaries, part of the California Coastal Evolutionarily Significant Unit (ESU), were listed as threatened in 1999. Coho in the Mattole River and its tributaries are included in the Southern Oregon/Northern California Evolutionarily Significant Unit (ESU), which was listed as threatened in 1997. Steelhead in the Mattole River and its tributaries are included in the Northern California ESU, which was listed as threatened in 2000.

2.5.3.6. Topography and Geology

The Mattole basin lies in a geologically complex setting adjacent to the junction of the North American, Pacific, and Gorda tectonic plates, known as the Mendocino Triple Junction. Active tectonic movements associated with this junction cause some of the highest rates of crustal deformation, surface uplift (1-2 cm year-1), and seismic activity in North America. Intense tectonic deformation has weakened much of the bedrock underlying the Mattole watershed increasing its susceptibility to erosion and mass wasting.

All of the basement rocks in the area are part of the Franciscan Complex, which consists primarily of sedimentary rocks deposited offshore in a trench/continental-slope environment. These rocks have been “scraped off” the Gorda plate as it plunges beneath the North American plate. Most of these rocks are argillite (sedimentary rock that is rich in clay, such as shale and mudstone). Some of the rock is sandstone, which is stronger than argillite and is less weakened by tectonic deformation. The difference is shown dramatically in the landscape where erosion leaves isolated blocks of sandstone standing as large gray knobs above slopes underlain by argillite. In areas where a large proportion of the bedrock is sandstone, slopes tend to be steeper, and landslides are less numerous, shallower, and smaller.

The uppermost two miles of the Mattole River are typical of mountain valleys in this watershed; they are narrow and steep-sided with a steep gradient and very little flood plain. Continuing downstream, the valley bottom opens up to 600-1,000 feet wide and consists of floodplain and channel, surrounded by river terraces in most areas. Parts of the terrace surfaces are used for grazing and hay cropping. From RM 52.1 to 47.7 is a steep-sided canyon known locally as the Grand Canyon of the Mattole. The area has steep cliffs, deep pools, and falls as high as 8 feet. The middle section of the valley runs from RM 42.8 to RM 26.5, the confluence with Bear Creek. Through this reach, the channel, flood plain, and river terraces combined are generally less than 600 feet wide and rarely greater than 800 feet.

In the lower section of the valley, the valley bottom broadens to as wide as 1,500 feet. Many sections of river terraces and marine terraces, which are mostly bedrock overlain by river gravels capped by colluvium and alluvial fan deposits, stand 40 to 80 feet above the river. At Petrolia (RM5) the valley bottom opens up to almost a mile wide, before narrowing to a half mile near the mouth. Tributary valleys are mostly steep-sided and separated by sharp ridges. In the lower reaches of some larger tributaries, such as the North Fork Mattole River and Mattole Canyon Creek, the valleys broaden to 1,000 feet or more. The upper parts of these valleys, however, generally fit the pattern of smaller tributaries, with narrow, steep-sided valleys having extensive stretches of very steep-sided inner gorges.

2.5.3.7. Sedimentation

Erosion and delivery of the sediment to streams are major concerns in the Mattole River watershed. Causes of sediment delivery to aquatic habitat include natural processes such as tectonic movement, slope instability, and high levels of rainfall. Associated natural disasters such as earthquakes, wildfires, and floods also promote erosion. Sediment delivery is also influenced by human activities, such as road construction, operation, and maintenance, timber harvest activities, livestock grazing, and residential development. The estimated rate of sediment delivery to streams in the Mattole River watershed is 8000 t mi^{-2} yr^{-1}. Approximately 36 % of this sediment can be attributed to natural erosional processes and the remaining 64% can be attributed to human activity. Roads account for approximately 76 % of human-induced erosion in the watershed. A 1993 inventory estimated 3,350 miles of active and abandoned roads in the Mattole basin, with 115 miles maintained by the county, 25 miles maintained by BLM, and 425 miles of active roads and 2,785 miles of abandoned roads that are not managed or maintained.

2.5.3.8. Water Quality Issues

Management activities including road building and use, forestry practices, and ranching have increased sediment loads and elevated water temperatures, contributing to the decline of the cold water salmonid fishery. Water quality conditions do not adequately support the populations of coho and Chinook salmon and steelhead trout present in the Mattole River and its tributaries. Specifically, sedimentation has resulted in embedded spawning gravels, filled-in pools, aggraded streambeds, and increased water temperature. Of 46 streams representing all of the sub-basins, only three had good sediment habitat conditions. All others exhibited an unacceptable degree of embeddedness and had few deep pools.

Elevated water temperatures are produced by changes in riparian cover, increased solar heating, and changes in streamside microclimates. Water temperatures exceed the stress threshold in the estuary, mainstem, and lower downstream areas, and even lethal temperatures have been measured. The Mattole River estuary, important for fish rearing, is filling in with sediment from the upper watershed, which is reducing its volume and depth and contributing to higher temperatures.

High water temperatures in the estuary likely limit salmonid production. A study by Humboldt State University from 1985-92 found that summer estuary temperatures were lethal to juvenile Chinook. Juvenile Chinook are no longer found in the Mattole summer lagoon, which may be due to the elevated temperatures and possibly to anoxic zones.

Temperature extremes also affect the lower-gradient downstream reaches of Lower and Upper North Forks of the Mattole River, and Honeydew, Blue Slide, Lower Bear, Mattole Canyon, and Squaw Creeks. In the headwaters and upper reaches of large tributaries however, temperatures are adequate to optimal for rearing salmonids.

Additionally, reduced flows, migration barriers, and loss of large woody debris have dramatically reduced the amount and quality of habitat for fish. The cool pools that coho salmon require now exist only in the headwaters and tributaries because LWD and rock outcrops in the lower mainstem have largely been covered by sediment or washed away. In addition to anadromous salmonids, species at high risk of extinction include the southern torrent salamander and the tailed frog.

In 2003, the NCRWQCB established Sediment and Temperature TMDLs for the Mattole River to address the impairment of the cold water fishery, including the migration, spawning, reproduction, and early development of cold water fish such as coho salmon and steelhead trout. An implementation plan was added in 2004.

Primary water quality issues in the Mattole River watershed include:

- Lack of large woody debris.
- High water temperatures.
- Sediment buildup and siltation in the mouth of the river, the mainstem, and the tributaries.
- Increased turbidity.
- Salmonid habitat disturbance.
- Flooding from sediment discharges.
- Forest herbicide applications.

Concerns about groundwater quality focus on petroleum contamination. Groundwater and surface water contamination are suspected at former and existing mill sites that historically used wood treatment chemicals. Discharges of pentachlorophenol, polychlorodibenzodioxins, and polychlorodibenzofurans likely occurred as a result of the poor containment typically used in historical wood treatment applications. These discharges persist in the environment and accumulate in surface water, sediments, and the food chain.

As in many of the North Coast watersheds, the beneficial uses associated with coldwater fishery appear to be the most sensitive of the beneficial uses in the watershed because of the sensitivity of salmonid species to habitat changes and water quality degradation. Accordingly, protection of these beneficial uses is presumed to protect any of the other beneficial uses that might also be harmed by sedimentation and high water temperatures.

2.5.4. Mendocino Coast HU (113.00)

2.5.4.1. Rockport HA (113.10) - [Ten Mile River HSA (113.13)]

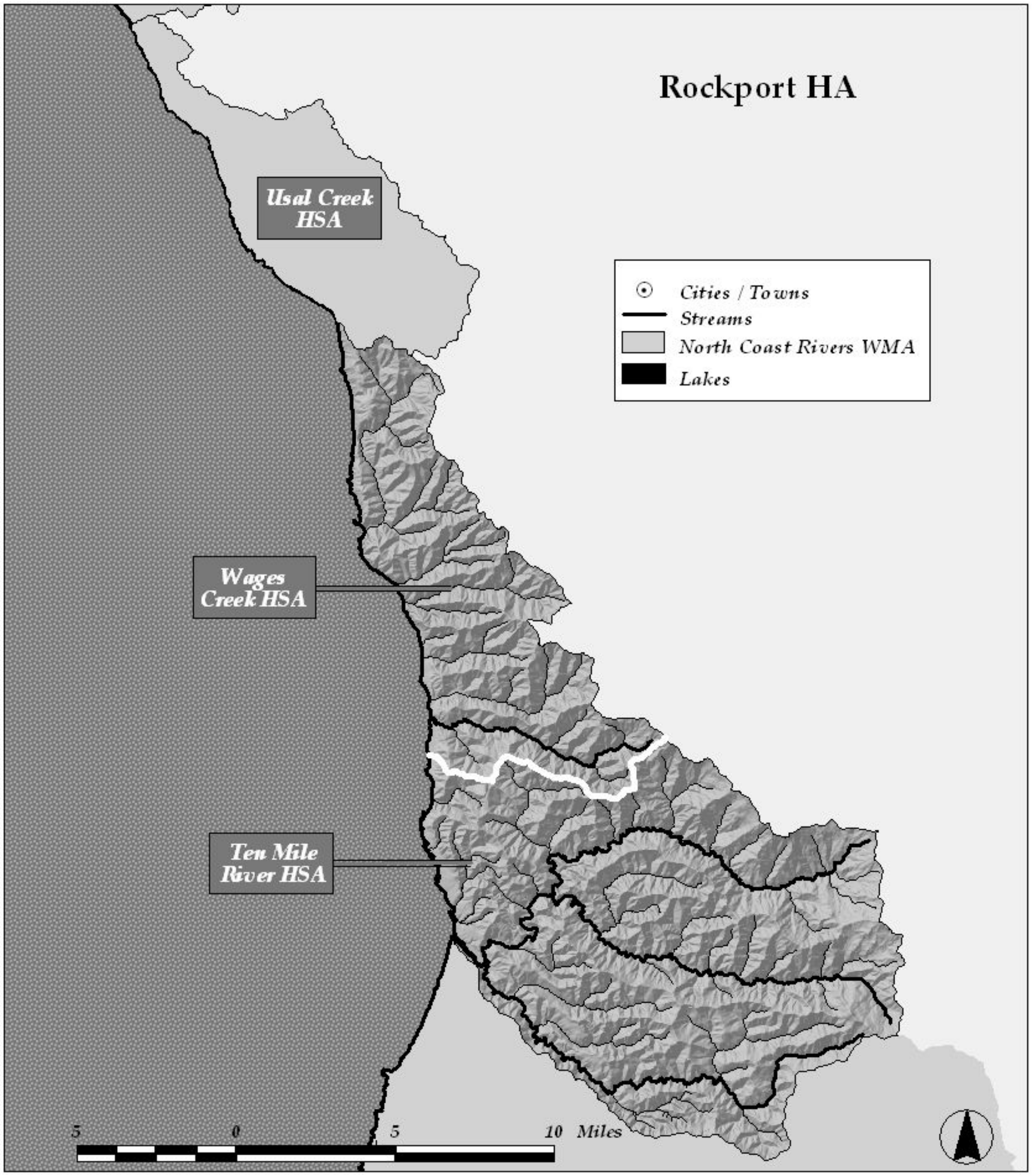

Figure 25. Map of the Rockport HA

The text presented within this section includes information that has been previously published by USEPA 2000 (Ten Mile River Total Maximum Daily Load for Sediment) and references included therein.

2.5.4.1.1.____Overview

The Ten Mile River HSA drains an area of approximately 120 mi^2 in Mendocino County. The mouth of the river is located 8 miles north of the city of Fort Bragg. The watershed shares divides with Pudding Creek and the North Fork of the Noyo River to the south and Wages Creek and the South Fork of the Eel River to the north. Ten Mile River has three main forks: the North Fork, Middle Fork (also known as the Clark Fork), and the South Fork. Much of the watershed is privately owned by industrial and non-industrial timber harvesters. Currently, Hawthorne Timber Company owns about 85 % of the watershed.

2.5.4.1.2.____History and Land Use

Much of the Ten Mile River watershed was harvested for timber beginning in the lower basin in the 1870s. Railroads were developed in the 1910-20s and used for timber yarding (the transport of logs or trees from the cutting site to a landing or temporary storage site). Main tracks extended far up the South Fork, with spur lines up Smith Creek, Campbell Creek, and Redwood Creek. Tractor yarding, with its associated road, skid trail, and landing construction, began in the 1930s, and major portions of the watershed were harvested for timber from the 1940s to the 1960s. Beginning in the 1940s, railroads were replaced by trucks, and the railroad grades were converted to road beds. The forest was left to regenerate until the 1980s when timber harvesting increased again, particularly in the South Fork sub-basin. Tractor yarding is used on gentle hillslopes for 40-80 % of the harvest, and cable yarding is used on steeper slopes. Intense timber harvest, combined with heavy rainfall and flood flows, has resulted in a large number of landslides within the watershed.

Gravel mining also occurs in the Ten Mile River watershed but does not appear to contribute significantly to in-stream sedimentation. Currently two permits for gravel mining are in effect in the Ten Mile River watershed. One permit is issued to Watkins Sand & Gravel for the removal of up to 2,500 cubic yards of gravel per year from several sites in the South Fork of the Ten Mile River channel and up to 10,000 cubic yards from a hillside quarry. The other is to Baxman Gravel Company for the removal of up to 50,000 cubic yards of rock per year from a hillside quarry. Previously, unpermitted gravel mining operations had occurred in the Ten Mile River watershed.

2.5.4.1.3.____Vegetation

The Ten Mile River watershed has a dominant overstory of redwood and Douglas fir. Hardwood species such as tanoak and Pacific madrone are other common components of conifer stands on xeric sites. Interior live oak is a minor component at most xeric sites on inland ridges. Near the headwaters, open grassland dominates with an overstory of California black oak and Oregon white oak punctuated with Douglas-fir/redwood/tanoak stands.

2.5.4.1.4.____Climate

The watershed has a Mediterranean climate typified by abundant rainfall and cool temperatures during the winter and dry, hot summers punctuated with cool breezes and fog along the coast. Precipitation occurs primarily as rain with 40-45 inches in the western portion and 70-85 inches at higher elevations in the northern and eastern portions of the watershed. Approximately 90% of the annual precipitation occurs between October and April.

2.5.4.1.5.____Fishery and Wildlife

The primary beneficial use of concern in the Ten Mile River watershed is the cold freshwater fishery that supports native, federally listed threatened salmonid species, namely coho and Chinook salmon and steelhead trout. The coho population has declined sharply in the last 40 years. In the 1960s, there were about 6,000 coho; more recently, 1989-1996, population estimates range from 14-351 fish. Coho have been found in the Little North, Clark, and South Forks, and Bear Haven, Smith, Campbell, and Churchman Creeks. The spawning survey data indicate that the Little North Fork and Bear Haven Creek have the best coho habitat in the basin. Smith and Campbell Creeks also provide good coho habitat. Significantly, most of the streams in which salmon were observed spawning and/or rearing with some consistency in the 1990s tended to have lower sediment loading rates than the basin-wide average.

Chinook were locally extirpated prior to the 1950s but they were re-introduced to the Ten Mile River in large numbers beginning in 1979. Nine thousand fingerlings were released at the last and largest release in 1987. Coho and steelhead were also planted, in lower numbers, beginning in the 1950s. Chinook carcasses found in the watershed from various age groups may indicate a rare successful re-introduction, but less than ten fish were found in the watershed in 1995-96. The population of steelhead may actually be larger now than in the 1960s when it was estimated at 12,000 individuals. Other resident native and introduced fish and aquatic species include three-spined stickleback, coast range sculpin, prickly sculpin, several species of lamprey, pacific giant salamander, several species of newt, yellow-legged frog, and tailed frog.

2.5.4.1.6.____Topography and Geology

Terrain in the Ten Mile River watershed varies from the flat estuary and broad river floodplain to rugged mountainous topography with high relief. There are grasslands in the northeast, but most of the rest of the basin is characterized by narrow drainages bordered by steep to moderately steep slopes leading to the headwaters of the tributaries. Elevations range from sea level to 3,205 feet (977 meters). The lower portions of the South Fork, Middle Fork and mainstem have broad alluvial valleys bordered by high relief terrain. The headwaters of the North Fork are characterized by relatively gentle terrain, while the headwaters of the Middle and South Forks are characterized more by summits and ridgelines. Inner gorge topography (oversteepened slopes adjacent to stream courses) locally characterizes portions of the tributaries. Fluvial cut terraces are also present locally, except along the Middle Fork. Most of the drainages are narrow, with 60-80% of the basin area in steep to moderately steep slopes (15-35%). Less than 3% of the area has slopes greater than 40%.

The bedrock geology of the watershed is dominated by rocks of the Franciscan Complex, primarily the relatively coherent and stable Coastal Belt Terrane. Relatively incoherent Central Belt Terrane rock outcrops in the northeastern area in the headwaters of the North Fork are responsible for the subdued topography in that area. These rocks are overlain by a variety of surficial deposits, varying locally from beach sand, marine terrace deposits, dune sands, estuary deposits, landslide debris, alluvium, and soil and colluvium.

2.5.4.1.7.____Sedimentation

The average annual sediment load in the Ten Mile River watershed was 1,124 t mi^{-2} yr^{-1} for the period 1933-1999, 75% of which was management related, but only 629 t mi^{-2} yr^{-1} for the period 1989-1999, and only half of this load was management related. While overall sediment delivery rates declined from 1933 to 1999, sediment generation from road surface erosion has increased. There are currently 940 miles of roads in the Ten Mile Watershed, which translates to a basin-wide road density of 7.86 mi mi^{-2}. Roads produce an overall average sediment yield of 225 t mi^{-2} yr^{-1}, and road-related landslides produce 38 t mi^{-2} yr^{-1}. From 1989-99, these were the largest source of sediment, and they constitute 42% of the current loading rate. Fluvial erosion at 200 t mi^{-2} yr^{-1} is the next largest current component and represents about 32% of the current loading rate. The current total landslide contribution is 114 t mi^{-2} yr^{-1}, which is 18% of the total budget. Nearly 70% of the landsliding amount is management-related.

2.5.4.1.8.____Water Quality Issues

Throughout the watershed, high concentrations of channel-bottom fine sediment, excessive gravel embeddedness, inadequate pool frequency and depth, and lack of LWD appear to be limiting the success of salmonids, especially coho salmon. It appears that each of the three main forks in the Ten Mile River watershed, on average, only minimally supports salmonid spawning, incubation, and emergence success.

There may be a link between coho abundance and the occurrence of pools formed by LWD. Coho have been found only in creeks where there was abundant LWD, and in four creeks where coho were found, more than 30% of the pools were formed by LWD. This suggests that a low percentage of LWD-formed pools could adversely affect juvenile coho populations. The South Fork sub-basin has the highest percentage of pools formed by large woody debris (42%), followed by the Middle Fork (19%) and North Fork (18%).

Timber harvest activities have been identified as the probable cause of the impairment. Current and historical timber harvest and associated road networks and high skid trail densities have contributed to accelerated erosion and delivery of sediment to streams throughout the watershed. Current sediment delivery from all sources is estimated at 629 tons mile-2 year-1. About half of this is natural background loading, but the rest is directly and indirectly caused by land management activities. Previous un-permitted and current permitted gravel mining operations do not appear to have contributed significantly to the sediment issues. The contribution of hillside vineyards to erosion is unknown.

In 2000, the USEPA established a TMDL for the Ten Mile River, and the NCRWQCB adopted an implementation plan in 2004 to address the impairment of the cold water fishery by sedimentation. The Ten Mile River is currently 303(d) listed for temperature impairments.

Primary water quality issues in the Ten Mile River watershed are:

- Salmonid habitat disturbance
- Lack of large woody debris
- High water temperatures
- Sedimentation of streams

As in many of the North Coast watersheds, the beneficial uses associated with coldwater fishery appear to be the most sensitive of the beneficial uses in the watershed because of the sensitivity of salmonid species to habitat changes and water quality degradation. Accordingly, protection of these beneficial uses is presumed to protect any of the other beneficial uses that might also be harmed by sedimentation and high water temperatures.

2.5.4.2.______Noyo River HA (113.20)

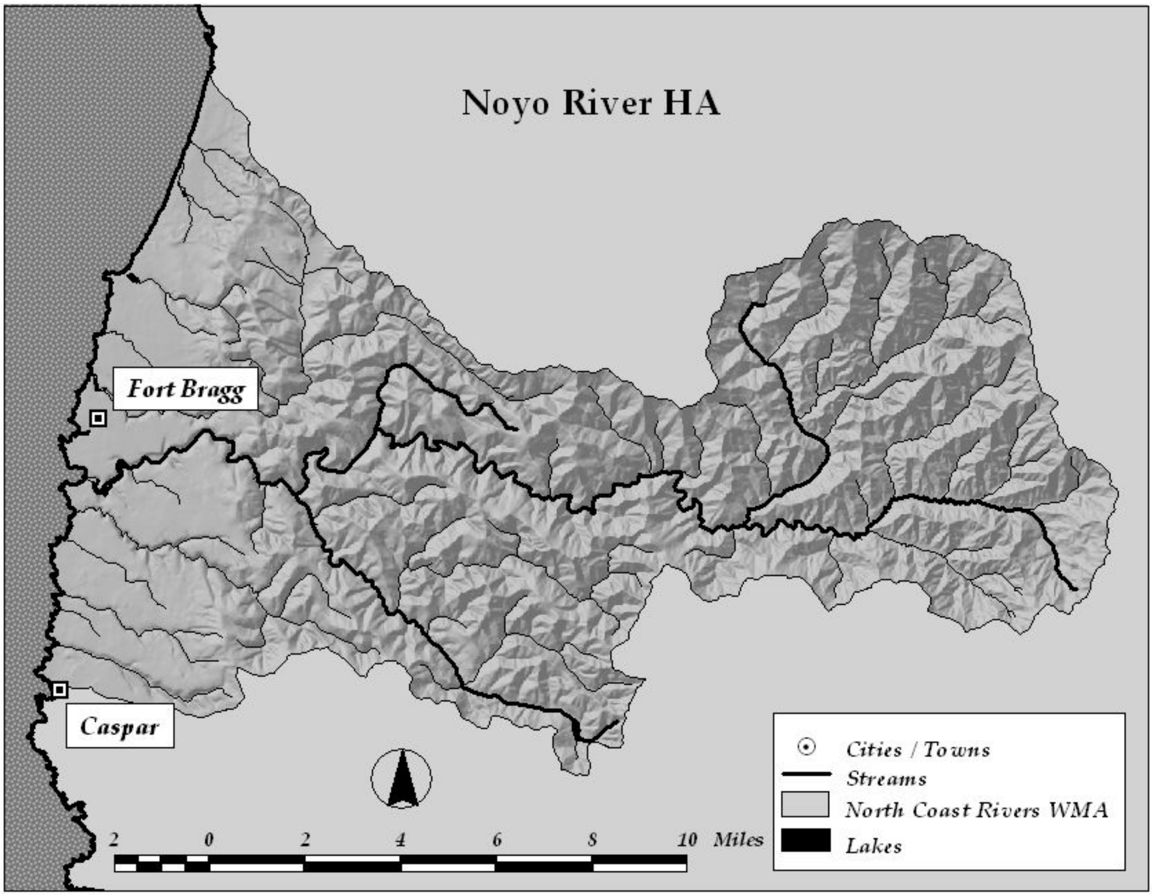

Figure 26. Map of the Noyo River HA

2.5.4.2.1._____Overview

The Noyo River HA is located in northern Mendocino County. This hydrologic area includes the Noyo River watershed and the coastal watersheds of Pudding and Jug Handle Creeks. The Noyo River watershed, which is west of the city of Willits, is approximately 113 mi^2 and reaches the Pacific Ocean approximately two miles south of Fort Bragg.

Approximately 50% of the land is under the ownership of 2 commercial timber companies and another 20% is owned by the California Division of Forestry and Fire Protection (CDF); its holdings comprise the Jackson Demonstration State Forest. The remaining 30% is held privately by smaller landowners.

2.5.4.2.2._____History and Land Use

The primary land use within the watershed is timber production and harvesting. Old growth logging started in the mid-1800s and continued into the early part of the 20th century. The Noyo River itself was used to transport logs from the logging areas to the mills downstream. Splash dams may have been used to assist in river transportation. Logging in the South Fork began near the turn of the century. The Caspar Lumber Company acquired ownership of extensive tracts of old growth and eventually extended the railroad into the South Fork Noyo via a tunnel from Hare Creek. From there, several remote logging areas were connected to the railroad with a series of inclines, the first built in 1915.

By 1930, more than half of the Noyo River watershed had been logged. In the 1960s, second growth logging began, primarily in the lower main drainage area, and continues today. Removal of residual old growth stands also began in the 1960s and continued into the mid 1980s. Many areas of the watershed have been logged multiple times. Tractor yarding is the predominant yarding method used in the Noyo River watershed, accounting for 66% of the yarding conducted since 1986. Cable yarding accounts for 32% of the yarding conducted in the watershed, overall. Helicopter yarding accounted for two percent of the area logged from 1986-1998. The relationship between yarding technique and sediment delivery is well established: tractor yarding causes the most ground disturbance and sediment delivery while cable and helicopter yarding cause the least.

Additional uses in the Noyo River watershed include the Sierra Railroad, which operates the Skunk Train passenger rail service. Forty miles of track begin at the Fort Bragg railroad depot just south of Pudding Creek, follow lower Pudding Creek, and then travel a tunnel through a mountain dividing the Pudding Creek drainage from the Noyo River drainage. Most of the length of the track follows the Noyo River mainstem corridor, until a second tunnel that delivers the train to Willits. Thirty-one bridges and trestles cross the river. Other minor land uses in the basin include ranching, recreation, and residential. Little development has occurred in the watershed in the last two decades; however, vineyards are expanding in the region. Much of this expansion is occurring on hillsides where there is increased potential of erosion and delivery of sediment to nearby streams. The mouth of the Noyo River is dominated by a marina and associated fish processing facilities in support of the local fishing industry. This is the only major fishing fleet between Bodega Bay and Eureka.

The Noyo River is subject to numerous diversions. The city of Fort Bragg uses surface water from the Noyo River as a primary source of drinking water. Another diversion has been established to send water to Pudding Creek to service the dismantling and cleanup of the Georgia Pacific Corporation mill. Many summer camps also use the river for water supply.

2.5.4.2.3. Fishery

The Noyo River supports an anadromous fishery including coho and Chinook salmon and steelhead trout. Stream gradients, climate, geology and vegetation are all conducive to the development of aquatic habitat suitable for these salmonids. Historically, salmonids were found throughout the watershed, and were relatively abundant in the period 1933-1957. In the 1960s, Redwood Creek in the headwaters sub-basin may have had as many as 3,700 coho and 1,500 steelhead, and North Fork Noyo River may have had as many as 11,200 coho and 1,500 steelhead. Hayworth Creek, also in the North Fork sub-basin, may have had 2,340 coho and 11,600 steelhead, and Kass Creek in the South Fork sub-basin may have had up to 6,800 coho in this same time period. In the Little North Fork Noyo River in the mainstem sub-basin, salmonid biomass changed little from the 1960s to the 1980s, but the species composition changed from 17% steelhead in 1966-69 to 80% steelhead in 1992.

2.5.4.2.4.____Topography and Geology

The Noyo River drainage is underlain mostly by the Franciscan Coastal Belt, although some Franciscan Melange occurs at the upper end of the Noyo River mainstem. A thrust fault separates the Coastal Belt Franciscan from the Franciscan Melange. The Franciscan Coastal Belt rocks are of Tertiary-Cretaceous age and consist of well-consolidated, hard sandstone interbedded with small amounts of siltstone, mudstone, and conglomerate. These rocks are pervasively sheared, commonly highly weathered, and tend to disaggregate easily, resulting in numerous debris slides along creeks and roads within debris slide amphitheaters/slopes. The Franciscan Melange is a pervasively sheared sandstone and mudstone with minor amounts of conglomerate resulting from regional tectonic movement. Failures occur on slopes more gentle than those in more competent units elsewhere, generally by shallow debris slides along roads and creeks, and by deeper-seated failures elsewhere. The area contains large translational/rotational slides, earth flows, and numerous debris slides throughout. The South Fork Noyo River and many of the tributaries to the Noyo River have steep inner gorges and extensive debris slides.

2.5.4.2.5.____Sedimentation

High sediment production and delivery in the Noyo River have produced changes in channel morphology. The average sediment loading rate for the 47 year period from 1933-1979 was ~539 t mi^{-2} yr^{-1}, 67% of which was natural background loading. During the 20 year period from 1979-99, the rate was 667 t mi^{-2} yr^{-1}, of which 56% was background. At the USGS gaging station just below the confluence of the South Fork Noyo River with the mainstem, alternating periods of channel bed aggradation and degradation have resulted in a net decrease in channel depth of one and a half to two feet over the 1957-1999 period. Timber harvest and logging roads are partly responsible for increased erosion and sediment deposition in the Noyo River watershed. Rural residential roads also contribute to mass wasting and sediment discharge. The average road density for the watershed overall is 6.71 miles $mile^{-2}$, and the majority of roads are seasonal, un-surfaced, and have great potential for surface erosion.

2.5.4.2.6.____Water Quality Issues

High rates of timber harvest, a strong reliance on ground-based yarding methods (particularly in the headwaters and North Fork areas), and high road densities have led to an increase in the rates of sediment delivery due to landsliding, fluvial erosion, and surface erosion related to land management activities. The success of salmonids throughout the watershed, especially coho salmon, is limited by elevated fines in potential spawning gravels, embedded cobble, infrequent and shallow pools, lack of LWD, and the lack of backwater pools and other forms of shelter from high winter flows. Overall, average pool depths and volumes have decreased due to the accumulation of fine sediment. Limited availability of LWD exacerbates this problem because there is no mechanism to create the scour that removes silt, deepens pools, and exposes cobble. Hillside vineyard development is a concern for production of sediment as land is expected to be converted to new vineyards in the future.

Drinking water supply is also of significant concern. Fort Bragg's Noyo River water supply is directly influenced by the quality of the surface water and suffers from frequent siltation of the intakes. Turbidity values increased dramatically between 1993 and 1997. Turbidity levels remain elevated even after precipitation ends, and these high levels of turbidity adversely affect drinking water quality.

In 1999, the NCRWQCB established a TMDL for Sediment for the Noyo River to address the impairment of the cold water fishery, including the migration, spawning, reproduction, and early development of cold water fish such as coho salmon and steelhead trout, by sedimentation. Pudding Creek and portions of the Noyo River are currently 303(d) listed for temperature impairments.

Primary water quality issues in the Noyo River watershed are:

- Salmonid habitat disturbance
- Sedimentation of streams and harbors
- Turbidity

Additionally, there are numerous additional water quality concerns including those related to toxic substances:

- Contamination from diesel, penta- and tetrachlorophenol, and dioxins in stream sediments in the Parlin Fork and the Noyo River as a result of past activities at a wood treatment plant
- Metals and creosote from the Skunk Train
- Tannins leaching from an old Georgia Pacific bark dump on the north side of the river into a wetland area at Newman Gulch
- Herbicide use on forestlands
- Frequent oil spills in the harbor area, and fish waste dumping; urchin wastes are discharged one mile offshore, and assessment of this practice is incomplete.
- Contamination from toxins associated with marina use and boat repair
- Waste discharges from the Conservation Camps at Chamberlin Creek and Parlin Fork.

Concerns about groundwater quality focus on petroleum contamination. In addition, groundwater and surface water contamination are suspected at former and existing mill sites that historically used wood treatment chemicals. Discharges of pentachlorophenol, polychlorodibenzodioxins, and polychlorodibenzofurans likely occurred with poor containment typically used in historical wood treatment applications. These discharges persist in the environment and accumulate in surface water sediments and the food chain.

As in many of the North Coast watersheds, the beneficial uses associated with coldwater fishery appear to be the most sensitive of the beneficial uses in the watershed because of the sensitivity of salmonid species to habitat changes and water quality degradation. Accordingly, protection of these beneficial uses is presumed to protect any of the other beneficial uses that might also be harmed by sedimentation and high water temperatures.

2.5.4.3. Big River HA (113.30)

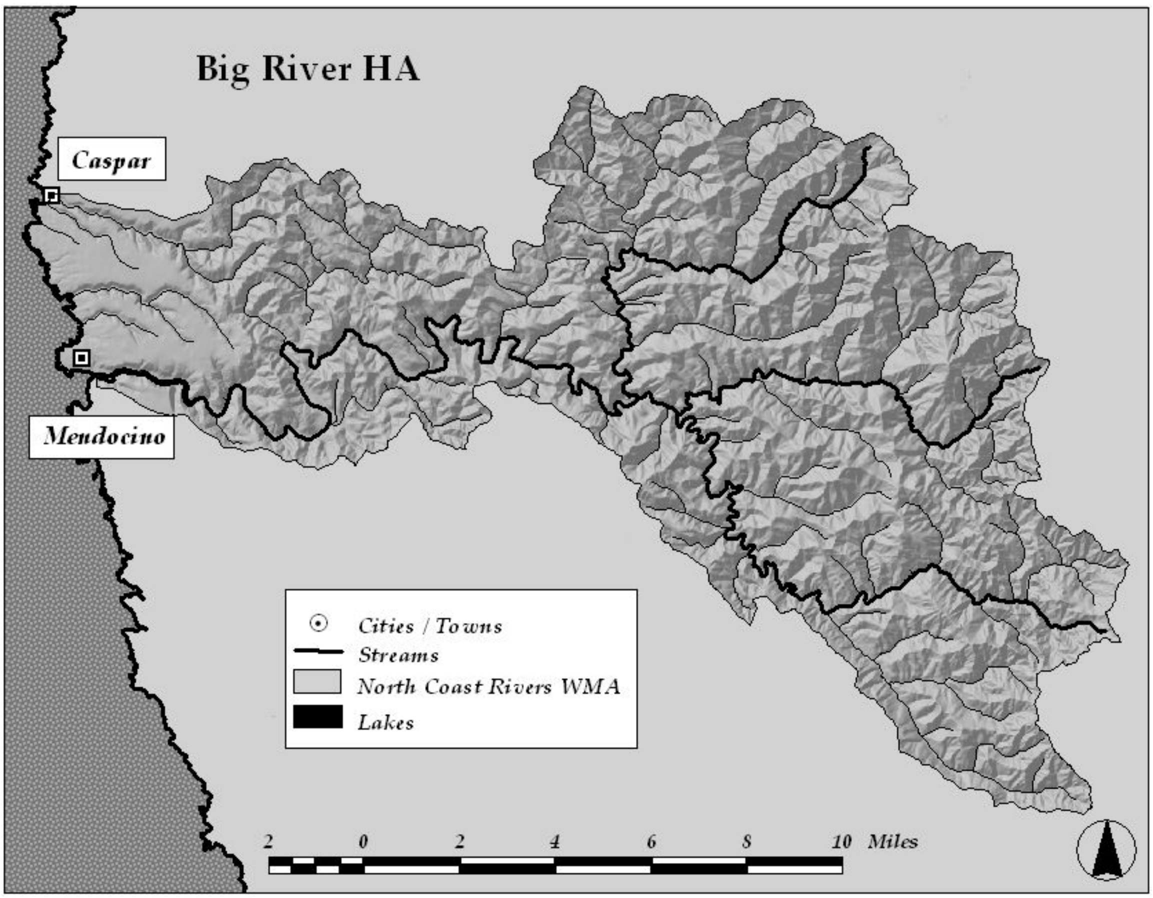

Figure 27. Map of the Big River HA

The text presented within this section includes information that has been previously published by USEPA 2001 (Big River Total Maximum Daily Load for Sediment) and references included therein.

2.5.4.3.1. Overview

The Big River HA in western Mendocino County includes the Big River watershed and the coastal watersheds of Caspar Creek and Russian Gulch. The Big River drains ~181 mi^2, flowing into the Pacific Ocean at the Mendocino Coast State Seashore immediately south of the town of Mendocino and approximately ten miles south of Fort Bragg. Caspar Creek meets the ocean several miles north of Mendocino. The Noyo River watershed is to the north, the Eel River watershed is to the east, and the Little, Albion, and Navarro River watersheds are to the south.

The Big River basin is sparsely populated, with most of the land is used for silviculture and some smaller areas are used for ranching. There are only a handful of populated areas within the Big River basin, including the areas around Orrs Springs, Whiskey Springs, Cameron, and Mendocino, which is the largest population center with approximately 824 people. Timber production and harvest are the primary land uses in the watershed: the five largest property owners are private timber companies and a state-owned forest; together they own 83% of the watershed. Thirty-one property owners (ownership from 160 to 3,760 acres) own another 14% of the land; uses of this land include industrial and non-industrial timber, ranching, and public and quasi-public use. There is some grazing along Comptche-Ukiah Road and in the southeast portion of the watershed.

The Big River estuary is a drowned river valley, eroded by a terrestrial river, and later flooded by a rise in sea level. Wetlands in the lower reaches of tributaries show that the estuary extended further upstream in the past. The Big River Estuary is one of the largest relatively undisturbed estuaries remaining along the California coast. The mouth of the river stays open all year with tidal influence extending approximately 8.3 miles up the Big River estuary in the summer and three miles during the winter. The estuary contains eelgrass, pondweed, water plantain, sedge, low club rush, and brass buttons. In 2002, the majority of the Big River Estuary, as well as upland areas, were added to Mendocino Headland State Park. The Big River Unit consists of 7,334 acres, which, when added to the surrounding State Park system, creates a 74,000-acre wildlife corridor which links diverse coastal and inland habitats into the largest piece of connected public land entirely within Mendocino County. Reaching from the river's mouth to 800-foot high inland ridges, the Big River wetlands property includes a wide range of habitats including 12 miles of salmonid spawning gravel and over 1,500 acres of California’s remaining wetlands. The land was purchased with private funds through the Mendocino Land Trust.

The Big River watershed also includes ecologically valuable freshwater marshes and brackish and freshwater bogs. There are eight freshwater marshes within the first seven miles of the estuary valley, and they include sedge, cattail, yellow pond lily, water hemlock, yellow cress, pondweed, azolla, duckweed, and bladderwort. Plants common in the brackish and freshwater bogs include sedge, yellow skunk cabbage, common spike rush, bulrush, water hemlock, willow herb, brooklime, and cattail.

2.5.4.3.2. History and Land Use

Timber harvest has been the dominant activity in the Big River watershed beginning in 1852 when a mill was constructed in what was then known as Mendocino City. This facility was repeatedly damaged by high river flows, and in 1854 a new mill was built on the flat east of the present Highway 1. This mill operated from 1855 to 1937, when it was shut down. It was the largest producer of lumber in Mendocino County until 1879. The estuary was used extensively as a mill pond for the transport and storage of logs. Pilings were placed almost continuously between the piers and the mill pond to assist in the transport of the logs to the mill.

Logging operations began in the lower part of the watershed, proceeded up as far as the Little North Fork and Two Log Creek by the 1870s, and then gradually into the headwaters over the next 40 to 80 years. A short railroad was constructed in the lower reaches of the Little North Fork watershed. This section of the railroad operated from 1883 to 1936, although from 1883 to about 1900 it was operated only as a tramway, and not for hauling logs. In 1936, this section was shut down and replaced by truck transport.

In the late 1930s, the Caspar Lumber Company railroad was extended over a low pass from the South Fork Noyo into the North Fork Big River. A branch of the railroad into Two Log Creek was built in 1937, and in 1939, Camp 20 near the Dunlap Ranch at Chamberlain Creek opened. The area around Chamberlain Creek was harvested from 1940 to 1946, at which time the railroad was finally shut down. After harvesting much of the old growth, Caspar Logging Company sold 47,500 acres to create Jackson Demonstration State Forest.

One of the most damaging logging practices in Mendocino County involved the construction and operation of artificial dams ("splash" dams) to transport logs downstream to the mill. This was a widely used practice in Mendocino County, particularly where difficult access precluded more reliable transportation methods (i.e., railroads), and has been documented in the Big River and Caspar Creek watersheds. During the winter, when the reservoirs behind the dams were full, the gates were tripped, timed so that a flash flood would move downstream, picking up tiers of logs that had been carefully stacked in channels downstream. These "log drives" could occur one or more times per winter. Before these log drives could be undertaken, however, the entire stream channel between the dam and the estuary had to be cleared of any obstructions that would interfere with the downstream movement of the logs, which involved cutting, burning, and blasting of boulders, large rocks, leaning trees, sunken logs or any other obstructions. Log jams occasionally occurred and sometimes lasted for years, particularly in the Hellsgate reach of the Lower South Fork.

At least 27 splash dams have been identified in the Big River watershed. The first of these dams were built between 1860 and 1870, the last in 1924. The dams varied in size and construction methods, but ranged to as tall as 40 feet. Operation of these dams ceased in 1937. The geomorphic effect of these log drives and associated channel clearing on downstream channels must have been immense. The greatly increased peak flows, combined with the battering-ram effect of transport of thousands of logs, would likely have caused channel erosion and incision. Removal of all in-channel debris undoubtedly released a tremendous amount of sediment that had previously been stored behind these obstructions.

After 1940, tractor yarding and the construction of roads, skid trails and landings were the primary types of logging practices. Since the late 1980s, the use of cable yarding on steeper slopes has increased substantially, and tractor logging is generally restricted to gentler slopes.

2.5.4.3.3.____Vegetation

Vegetation in the Big River basin is predominantly coniferous with redwoods near the coast and in the stream bottoms and Douglas fir in the interior and along the ridges. Interspersed throughout the conifer stands are Broadleaf trees typical of the area including tanoak, live oak, alder, bay, and madrone. On the drier slopes in the headwaters is considerable oak-grassland and brush. California black oak, Oregon oak, ceanothus, currant, raspberry, and manzanita make up woody species that dominant in these areas. Herbaceous species consist of oat grasses, bromes, fescues, and filagree.

2.5.4.3.4.____Climate

The Big River watershed has a Mediterranean climate, characterized by moderate rainfall in the winter and cool, dry summers with coastal fog. Mean annual rainfall for the entire watershed is about 56 inches; at the higher elevations, rainfall can exceed 65 inches annually. About 90% of the precipitation occurs between October and April with the highest average precipitation in January. Snowfall occurs only at the highest elevations, rarely accumulates, and has relatively little effect on the watershed’s hydrology.

2.5.4.3.5.____Fishery

Historically, Chinook and coho salmon and steelhead trout utilized the Big River watershed, and they are still present. There is limited information from which to estimate the historic population size of salmon and steelhead in the Big River watershed but it is believed that their populations have decreased substantially. In 1965, CDFG estimated 6,000 coho and 12,000 steelhead spawners in the watershed but no Chinook. At that time, CDFG also noted that the watershed was not supporting larger runs of fish and cited erosion and siltation as limiting factors. Brown and others (1994) estimated that there were 6,000 coho spawners in the Big River watershed in 1973 and that thirty years later the coho spawning population in the watershed was about 280 fish.

There are no current quantitative estimates of steelhead population size. Their decline has not been as great as that of coho, and they are still found throughout most of the basin, but in populations that are greatly reduced from historical levels. Little is known about the current population size or extent of Chinook, but it is likely that the population is extremely low. Chinook and steelhead both are federally listed threatened species in the Big River watershed, and coho are listed as endangered.

2.5.4.3.6. Topography and Geology

The watershed's topography is diverse along its length, varying from flat estuarine environments and uplifted marine terraces near the coast to rugged mountains with high relief in the eastern portion; the maximum elevation is 2725 feet. The watershed is characterized by narrow ridgelines separated by deeply incised inner gorges of the major streams. The western end of the drainage is distinguished by a drowned and filled estuary occupying a relatively narrow inner gorge, characterized by steep slopes that extend up to the flat coastal terraces. Farther upstream, mudflats transition to narrow floodplains. Most of the Big River watershed is underlain by the Coastal Belt Franciscan Complex. This portion of the Franciscan Complex is relatively stable compared to the mélange terrane of the Central Belt, which is found only in the upper parts of the watershed. A small area of Tertiary sandstone is found in the Greenough Ridge-Montgomery Woods State Reserve area.

2.5.4.3.7. Sedimentation

Sediment delivery to the river and tributaries has varied over the years with the amount of timber harvested. Over the 80-year period from 1921-2000, average annual sediment delivery was 944 t mi^{-2} yr^{-1}; about one third of this was considered natural background and two thirds was related to land management activities. When timber harvest was very intensive and harvest practices generally caused more erosion than they do today, rates were higher. Sediment production in the watershed was greatest from 1937-1952 (1,686 t mi-2 yr-1); 81% of this was due to land management activity. Most of the timber stock was depleted by the 1950s, and sediment production was lower from 1966-1988 (~600 t mi^{-2} yr^{-1}) because the second-growth timber was not mature enough to harvest. Timber harvesting increased again in the 1980s, and since then more than 55 % of the watershed has been harvested, but the current rate of total sediment generation (~600 t mi^{-2} yr^{-1}) has not increased over sediment loads associated with historical timber harvesting levels. About half of the current sediment delivery is considered to be land management-related and the other half is background.

From 1921-2000, road-related sediment generation has increased in both absolute quantity and as a proportion of the total sediment load. The contribution of road-related sediment, from surface erosion and landslides combined, was estimated to be as low as 6 t mi^{-2} yr^{-1} from 1921-1936 (1% of total sediment, all from surface erosion), but this figure may be an underestimate. More than one third of the roads in the watershed were constructed in the 1990s. In 2001 there were 1,242 miles of roads in the Big River watershed, which translates to a basin-wide road density of 6.86 miles mile-2. Currently, an estimated 181 t mi^{-2} yr^{-1} of sediment (24% of the total) are generated from roads, including associated landslides.

There are specific concerns about sedimentation on the estuarine processes in Big River. Estuaries are subject to natural sedimentation with the coarser particles settling out upriver and the finer particles settling out in the estuary and floodplains along the lower reaches of the estuary. Deposition of excessive sediment in the estuary has resulted in substantial decreases in its width, filling of tidal sloughs, and rapid colonization of mudflats by salt marsh vegetation. The narrowing channel has caused an increase in water velocity and increased deposition of fine sediment on the floodplains in the tidal areas. Natural levees built up at the edges of wetland flats where they adjoin the main channel are primary indicators of this rapid sediment accretion. These levees extend at least two miles further down the estuary than they did 80 years ago. There is concern about the effect of excessive sedimentation in the estuary on vegetation, because the productivity of the estuary relies heavily on the productivity of salt marshes, and sediment-driven levee formation has cut off tidewater intrusion in and around the estuarine sloughs. This situation has the potential to not only change the biotic composition of the estuary, but also to decrease its total productivity.

2.5.4.3.8. Water Quality Issues

The primary beneficial uses of concern in the Big River watershed are those uses associated with the cold freshwater fishery that supports coho salmon, Chinook salmon, and steelhead trout, which are listed as threatened under the federal Endangered Species Act.

The Big River watershed is a deeply entrenched stream system, in many places cut down to bedrock, lacking functional floodplains, and substantially depleted in large in-stream woody debris. Excessive inputs of sediment to the Big River and its tributaries have reduced the quality and quantity of in-stream habitat that is capable of fully supporting many of the beneficial uses of the Big River, in particular salmonid habitat. The quality of summer rearing and overwintering habitats is limited by high sedimentation, a lack of LWD, a low number of pools, the shallow depth of pools, channel entrenchment, and a lack of connection to off-channel habitat. Spawning gravels generally are present, but their quality is low due to embeddedness of the gravels and fine sediment in the substrate. The current entrenched condition in the Caspar Creek watershed indicates that valley fills have been converted from long-term sediment sinks (floodplains) to substantial sediment sources (terraces), which has significantly altered the sediment budget for the basin.

High water temperatures in Big River hinder salmonid rearing. Potential causes of high water temperatures include stream bank modification/destabilization, the removal of riparian vegetation resulting in low canopy cover, habitat modification, and nonpoint source pollution.

The specific factors affecting the tributaries vary. In the Upper Big River, data are limited but indicate degraded habitat and depressed salmonid populations. The North Fork Big River and Two Log Creek are particularly sensitive to disturbances because of the relatively high abundance of non-confined, low-gradient channels that are valuable for habitat. High sedimentation and erosion potential diminishes and further threatens the habitat value. Recent events, including blasting at a rock quarry in Two Log Creek in July 2000, resulted in 225 yds3 of earthen material being deposited in the creek, some of which remains even following excavation.

Throughout the South Fork Big River, pools are shallow and spawning gravels are embedded. Canopy cover is diminished and water temperatures are high. In Chamberlain Creek, stream channels are entrenched and lack LWD. Pools are shallow, and embeddedness is high. Sediment inputs are high and canopy cover is depleted. The Little North Fork contains valuable wetlands, leading to relatively high habitat complexity. The Little North Fork has relatively high amounts of LWD and canopy cover but is adversely affected by high sediment input, substrate embeddedness and low pool volume. The Lower Big River also includes valuable estuarine habitat, the value of which is diminished by sediment deposition and channel confinement. Natural and man-made levee formation is fragmenting habitat by cutting off the lower river from the floodplain. Decreased access to adjacent off-channel habitat reduces sheltering, rearing, and feeding areas for salmonids.

In 2001, the USEPA established a TMDL for Big River, and the NCRWQCB adopted an implementation plan in 2004 to address the impairment of the cold water fishery by sedimentation. Portions of the Big River system, including the areas of the mainstem Big River and the North Fork Big River, are currently 303(d) listed for temperature impairment. Big River and its estuary are also Critical Coastal Area (CCA) listed waterbodies for impacts by sediment and temperature. These impacts are attributable to several sources, including silviculture, roads, habitat modification, removal of riparian vegetation, and other nonpoint sources (NPS) of pollutants.

The primary water quality issues in the Big River watershed are:

- Sedimentation of streams
- Salmonid habitat degradation
- High water temperatures

Other issues of concern in the watershed are potential herbicide runoff due to timberland management, livestock entry into watercourses, an inactive rock quarry adjacent to the estuary, a permitted septic disposal facility adjacent to Lagoon Creek, a landfill near Casper, a small mill still in operation on Chamberlain Creek near the men’s conservation camp, and the town of Mendocino that is sewered with an ocean outfall. There are some leaking underground fuel storage tank sites in Mendocino and in the watershed itself. There has been at least one incident of a fuel spill on Highway 20 into James Creek (a Big River tributary) that continues to contaminate James Creek.

Concerns about groundwater quality focus on petroleum contamination. Groundwater and surface water contamination are suspected at former and existing mill sites that historically used wood treatment chemicals. Discharges of pentachlorophenol, polychlorodibenzodioxins, and polychlorodibenzofurans likely occurred with poor containment typically used in historical wood treatment applications. These discharges persist in the environment and accumulate in surface water, sediments, and the food chain.

As in many of the North Coast watersheds, the beneficial uses associated with coldwater fishery appear to be the most sensitive of the beneficial uses in the watershed because of the sensitivity of salmonid species to habitat changes and water quality degradation. Accordingly, protection of these beneficial uses is presumed to protect any of the other beneficial uses that might also be harmed by sedimentation and high water temperatures.

2.5.4.4. Albion River HA (113.40)

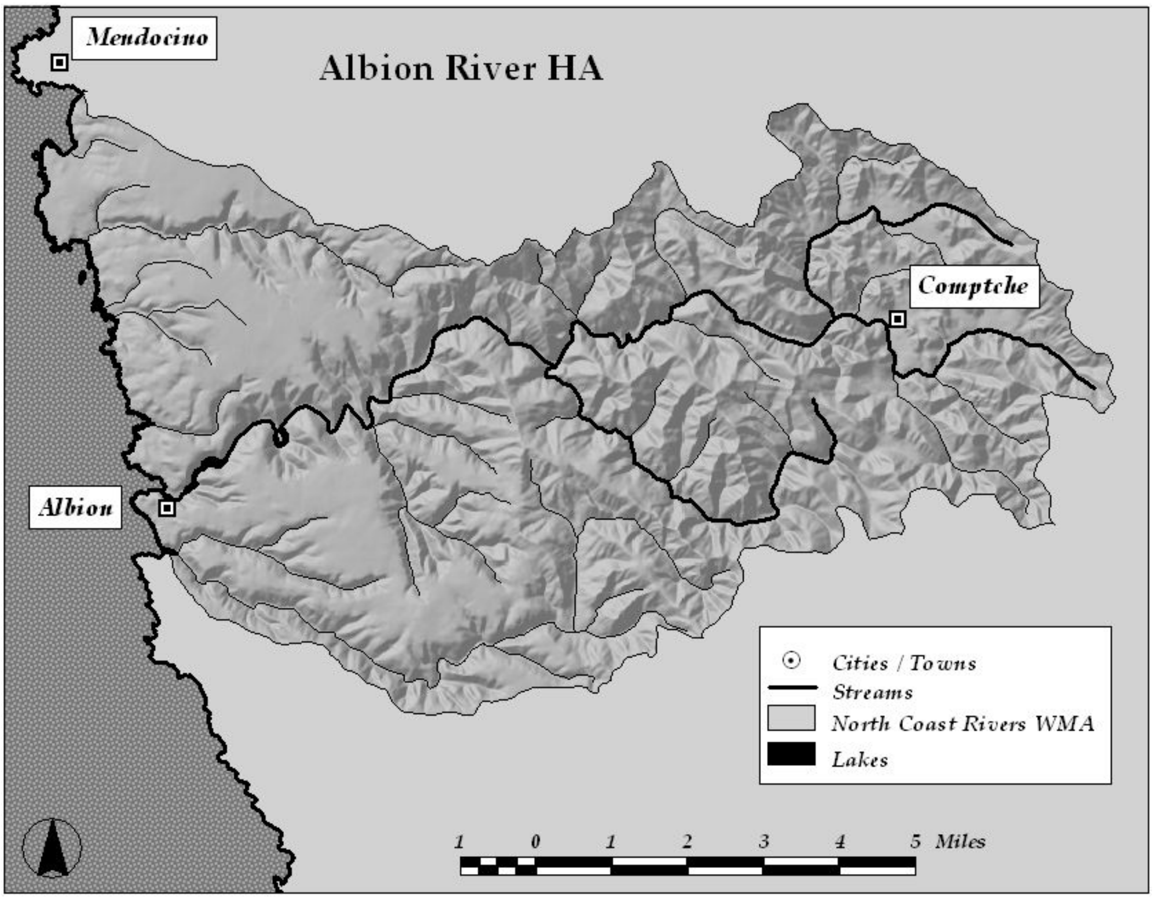

Figure 28. Map of the Albion River HA

> *The text presented within this section includes information that has been previously published by USEPA 2001 (Albion River Total Maximum Daily Load for Sediment) and references included therein.*

2.5.4.4.1. Overview

The Albion River HA in western Mendocino County includes the Albion River watershed and the coastal watersheds of the Little and Big Salmon Creeks and Little River. The Albion River watershed is a 43 mi^2 basin that reaches the Pacific Ocean near the town of

Albion, approximately 16 miles south of the city of Fort Bragg. It shares divides with the Big River watershed to the north and northeast and the Navarro River watershed to the south and southeast. Elevations range from sea level to 1,566 feet.

One industrial timber company owns approximately 54% of the land in the Albion River watershed. Smaller industrial timberland ownerships, a few ranches, and numerous small parcels, typically private residences, make up the balance. No other property owner owns more than 5% of the watershed. The eight largest property owners own about 70% of the watershed. Over a third of the parcels are less than 5 acres, but these parcels make up only 2% of the watershed. Population centers are the towns of Albion and Comptche.

The Albion River estuary is a drowned river valley resulting from a rise in sea level. The mouth of the river is defined by a narrow opening along the south side of the bay protected by rock headlands. This embayment reduces long ocean swell and sea height, and it minimizes wave-induced longshore sediment transport allowing stream to remain open to the ocean year round. Tidal influence in the Albion River extends as much as five miles upstream.

The estuary contains more than two miles of eel grass beds and a diverse macroalgal community, and empties into the Mendocino Coast State Seashore. The estuary is used as a commercial and sport fishing harbor and contains a small boat basin. Sedimentation of the estuary from natural and human sources such as silviculture and roads is a water quality concern. The average depth of the estuary was estimated at 20-25 feet in the 1940s, five feet with a maximum depth of 20 feet in 1961, 8 feet in 1966, and less than 6 feet in 1979

2.5.4.4.2. History and Land Use

The history of the Albion River watershed is dominated by timber harvest. Logging began in the lower basin about 1852, around the time that the first mill was constructed near the lagoon upstream from the mouth of the Albion River. By 1921, 56% of the watershed had been harvested. Early harvesting employed hand methods, and logs were hauled by teams of oxen or floated to the mill at the mouth of the river. Five splash dams for the transport of logs to the downstream mill have been documented in the Albion River watershed; though their operation is undocumented, it was likely similar to that of the Big River dams. These methods were later replaced by railroad logging until the mill closed in 1928. The railroad closed in 1930, and most of the railroad grades were converted to roads, and tractor logging became the principal method of harvesting. Since 1940, tractor yarding and the construction of roads, skid trails and landings have been the primary types of logging practices. A number of smaller mills operated in the Comptche area between the mid 1930s and the 1960s, but harvest levels were apparently far lower than from 1890-1928, because the forest was fairly well depleted and was left to regenerate.

2.5.4.4.3. Climate

The Mediterranean climate in the watershed is characterized by a pattern of low intensity rainfall in the winter and cool, dry summers with coastal fog. Mean annual precipitation is about 38 inches near the western margin of the watershed and about 50 to 55 inches in the eastern portion. About 90% of the precipitation occurs between October and April, with the highest average precipitation in January. Intense periods of rainfall can result in large flood events. Snowfall in this watershed is very rare and hydrologically insignificant. Redwood and Douglas fir forest dominate the Albion River watershed. A 1949 survey identified the following assemblages: redwood and fir forest, laurel and poison oak, chaparral, salt marsh, sedge, coast hemlock, cypress, red alder, velvet grass, blackberry, bull thistle, and tangled underbrush.

2.5.4.4.4. Water Resources

Flows in the Albion watershed are sometimes quite low. Almost 30% of the time, flows throughout the Albion watershed average less than 1 cfs, while about 5% of the time there is no flow. Diversions for irrigation and domestic use are currently permitted for at least 0.5 cfs in the vicinity of Comptche and only a few diversions are permitted in the North Fork sub-watershed. While most of these diversions are permitted for winter months only, and may not affect low-flow periods, they may interfere with sediment transport and thus be responsible for the lack of gravels and for excessive embeddedness. Many of the channel reaches are incised to bedrock along much of their length, and suitable spawning gravels are frequently quite limited. The prime limiting factor for salmonid production in the watershed may well be absence of gravel combined with quite low summer flows rather than the presence of fine sediment in existing gravels.

2.5.4.4.5. Fishery

Historically, coho salmon and steelhead trout utilized habitat throughout the Albion River watershed, and are still present today in much of the basin. Chinook salmon have also been found in the Albion River watershed. Data on the salmonid populations in the Albion River watershed are sparse; there are no known quantitative analyses of historic salmonid abundance and distribution specific to the Albion River watershed. There is general agreement that populations of Chinook, coho, and steelhead in the Albion River and its tributaries have decreased substantially and continue to decline. Coho have declined more significantly than steelhead, and population levels appear to be severely depressed.

The populations of Chinook and coho salmon and steelhead trout in the Albion River and its tributaries have been listed as threatened. Coho in the Albion River and its tributaries are included in the Central California Coast ESU (endangered), Chinook are included in the California Coastal ESU (threatened), and steelhead are included in the Northern California ESU (threatened).

CDFG began in the 1960s conducting qualitative surveys of fish presence and absence and habitat conditions. Even in that early period, surveyors noted very poor habitat conditions. On the mainstem Albion River and the South Fork Albion River above the Little North Fork, CDFG attributed low numbers of coho to poor conditions related to effects from logging and post-logging fires. By contrast, the lower South Fork Albion, below the Little North Fork confluence, was deemed to have excellent spawning grounds and fair nursery grounds.

More recently, the Upper Albion River has been reported to have relatively good spawning habitat with moderately embedded to unembedded gravels, and good overwintering habitat with LWD and frequent pools. The rearing habitat however is only fair due to shallow pools and low shelter complexity; water diversions may be influencing sediment transport and deposition by limiting the water supply.

The Middle Albion River spawning habitat is fair with moderate to low levels of embeddedness and fair to good gravel quality, however the area is negatively affected overall by a high amount of fine sediment. Rearing habitat is negatively affected by the low percentage of deep pools and sparse LWD.

The South Fork receives the highest amount of sediment input in the Albion River watershed, with most of it coming from roads. Embedded spawning gravels and abundant deposition of fine sediment have reduced the habitat quality in this area to the poorest in the watershed. Although LWD and deep pools are present, rearing habitat is only fair due to the low numbers of pools, the high levels of embeddedness and a lack of shelter complexity.

The habitat quality of the Lower Albion is fair, limited by low shelter complexity. Compared to the rest of the watershed, only in the Lower Albion do pools of at least three feet in depth make up a sizeable portion of the reach. The riparian canopy closure is fair to good. However, the Lower Albion River has low dissolved oxygen conditions, which may be related to excess sediment, shallower water due to sediment deposition, increased vegetation, lower water flows, or some combination of these and other factors. Shallower depths from sediment deposition may also be causing additional problems for other beneficial uses.

2.5.4.4.6. Topography and Geology

The watershed is dominated by two distinct landforms: the relatively flat marine terraces extending several miles inland, and intervening deeply incised inner gorges of the major river channels and streams that dissect these surfaces. The Albion River flows into a drowned river valley that occupies a relatively narrow inner gorge characterized by steep slopes that extend up to the flat coastal terraces. The central part of the watershed is generally characterized by narrow incised drainages. Steep slopes and narrow summits and ridgelines border these drainages. The headwaters area is characterized by moderate relief and relatively wide valleys, although these valley floors are rarely functional floodplains due to the incised nature of the present channel system.

The Albion River watershed is primarily underlain by Coastal Belt Franciscan Complex. A large part of the geology of the upper Albion River watershed is Coastal Belt Franciscan Complex – greenstone formation. River terrace deposits are found in the upper Albion River watershed around Comptche and around the North Fork Albion above Soda Spring Creek. Marine Terrace deposits are in the lower Albion River watershed. Small deposits of Quaternary sedimentary rocks and areas of alluvial fan/colluvium are found in limited locations.

2.5.4.4.7.____Sedimentation

Sediment delivery to the river and tributaries has varied over the years with the amount of timber harvested.

- Over the 80-year period from 1921-2000, average annual sediment delivery was 602 t mi^{-2} yr^{-1}; about 45% of this was background and 55% was related to land management activities.
- From 1921-2000, road-related sediment generation increased in both absolute quantity and as a proportion of the total sediment load; the contribution was as low as 37 t mi^{-2} yr^{-1} in the 1921-1936 period (6% of total sediment), but increased to 260 t mi^{-2} yr^{-1} by 2000 (38% of the total).
- From 1937-1952, when timber harvest was very intensive and harvest practices generally caused more erosion than they do today, rates were higher (799 t mi^{-2} yr^{-1}); ~65% of this was due to land management activity.
- By the 1950s, most of the timber stock was depleted and overall sediment production was lower from 1966-1978 (459 t mi^{-2} yr^{-1}; 25% of this was due to land management activity) and even lower from 1979-1988 (381 t mi^{-2} yr^{-1}) because the second-growth timber stocks were not mature enough to harvest.
- From 1989-2000, harvesting activity increased, and 47% of the watershed was harvested in the 1990s. During this time, the quantity of roads increased dramatically, with almost half of the roads in the watershed being built since 1980, and related sediment generation increased to 691 t mi^{-2} yr^{-1}. Though road building and timber harvest practices have improved so that less sediment is produced on a mi^{-2} yr^{-1} basis, and landsliding rates have declined, 63-66% of the sediment load during this period was related to the increased number of roads that accompanied the increased harvest levels.
- In 2001 there were 362 miles of roads in the Albion watershed, a road density of 8.43 miles $mile^{-2}$.

2.5.4.4.8.____Water Quality Issues

The primary beneficial uses of concern in the Big River watershed are those associated with the cold freshwater fishery that supports coho salmon, Chinook salmon, and steelhead trout. All three of these species are listed as threatened under the federal Endangered Species Act. Salmonid habitat is limited by excess sediment, lack of complex, deep pools, fair to poor spawning gravels, and limited shelter. Excess Sediment is causing moderate to high embeddedness of substrate and spawning gravels and adversely impacting the number and volume of pools in the basin. Shelter complexity is poor throughout the basin as the watershed is largely depleted of LWD.

The Albion River watershed is a deeply entrenched stream system, in many places cut down to bedrock, lacking functional floodplains, and substantially depleted of large in-stream woody debris. Lack of instream log jams allows sediment delivered to the main channels to move through the system far more quickly, and ultimately reach the estuary in greater quantities, than historically occurred pre-disturbance.

Low dissolved oxygen concentrations in the Albion River estuary indicate that DO may be a limiting factor for salmonids in the upper portions of the estuary late in the season, a condition that may be exacerbated in low flow years.

In 2001, the USEPA established a TMDL for the Albion River, and the NCRWQCB adopted an implementation plan in 2004 to address the impairment of the cold water fishery by sedimentation. The Albion River is currently 303(d) listed for temperature impairments.

The primary water quality issues in the Albion River watershed are:

- Sedimentation of streams
- Salmonid habitat degradation
- Low dissolved oxygen in the estuary

Other issues of concern are:

- Two trailer parks with septic system problems that need to be investigated
- Underground storage tanks leaking to ground water near the bluffs overlooking the ocean
- Mendocino Mineral Water bottling plant that at one time had a waste discharge requirement and now needs investigation
- New development of homes and septic systems in the Comptche area
- Fish processing and individual waste disposal systems in the harbor
- Construction related problems
- Small episodic oil spills in the estuary associated with the fishing industry

Concerns about groundwater quality focus on petroleum contamination. Groundwater and surface water contamination are suspected at former and existing mill sites that historically used wood treatment chemicals. Discharges of pentachlorophenol, polychlorodibenzodioxins, and polychlorodibenzofurans likely occurred with poor containment typically used in historical wood treatment applications. These discharges persist in the environment and accumulate in surface water sediments and the food chain.

As in many of the North Coast watersheds, the beneficial uses associated with cold water fishery appear to be the most sensitive of the beneficial uses in the watershed because of the sensitivity of salmonid species to habitat changes and water quality degradation. Accordingly, protection of these beneficial uses is presumed to protect any of the other beneficial uses that might also be harmed by sedimentation.

2.5.4.5. Navarro River HA (113.50)

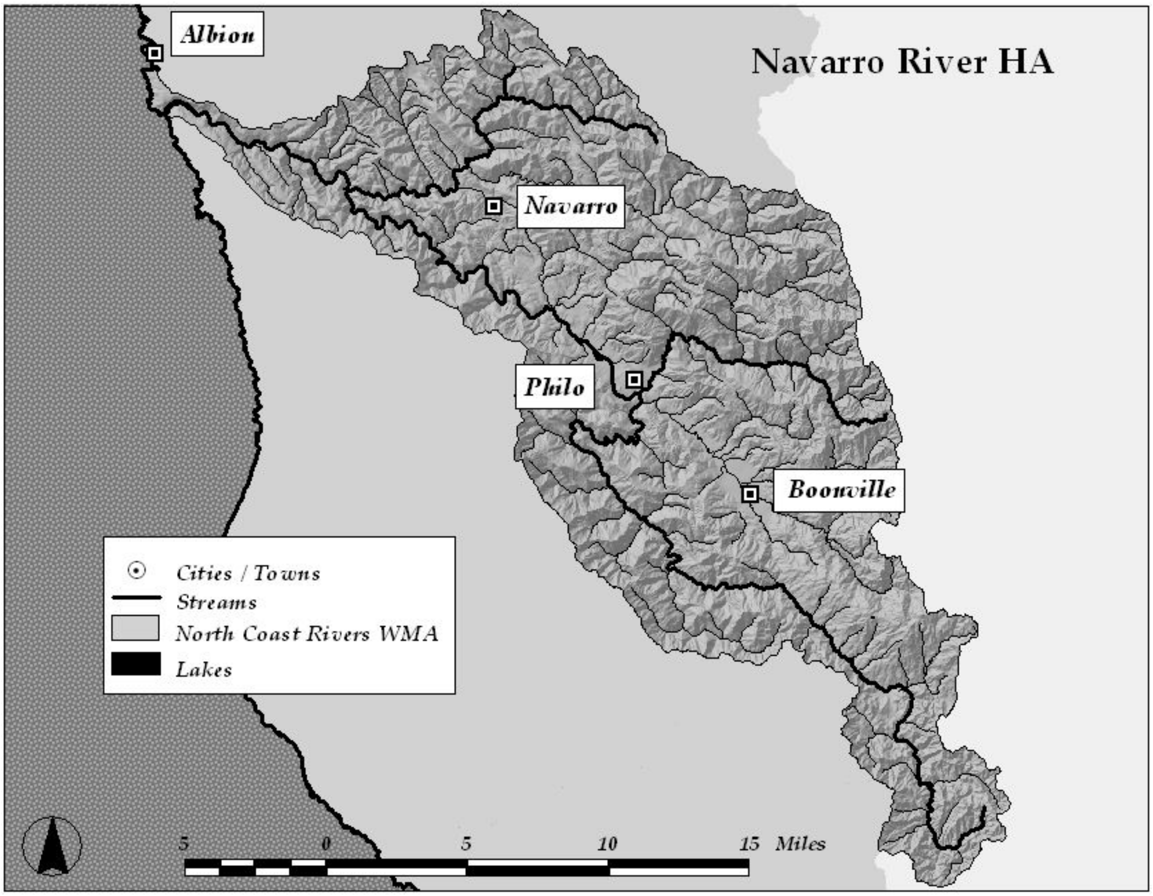

Figure 29. Map of the Navarro River HA

> *The text presented within this section includes information that has been previously published by Entrix et al. 1998 (Navarro River Restoration Plan), USEPA 2000 (Navarro River Total Maximum Daily Loads for Temperature and Sediment) and references included therein.*

2.5.4.5.1. Overview

The Navarro River HA is a 315 mi^2 coastal watershed in southern Mendocino County, approximately 120 miles north northwest of San Francisco, 30 miles west of Ukiah and three miles south of the town of Albion. Rainfall averages about 40 inches per year in the center of the watershed at Philo, with most of it occurring between December and March. Elevations in the basin range from sea level to about 3,000 feet. About 3,500 people live in the Navarro River watershed, mostly in and around the towns of Boonville, Philo, and Navarro. State Highway 128 traverses much of the watershed, paralleling Rancheria

Creek and the mainstem Navarro River for approximately 25 miles. The Navarro River flows through the Coast Ranges, and Anderson Valley, and out to the Pacific Ocean at Mendocino Coast State Seashore. The watershed is the largest coastal basin in Mendocino County and can be subdivided into five major drainage basins: mainstem Navarro River, North Fork Navarro River, Indian Creek, Anderson Creek, and Rancheria Creek.

2.5.4.5.2.____History and Land Use

Land use in the watershed includes forestland (70%), rangeland (25%), and agriculture (5%) with a small percentage devoted to rural residential development; these land uses have existed in the watershed since the mid-1800s. Sheep and cattle graze the open grassland areas, especially in the headwaters. Anderson Valley, the most settled part of the basin, supports significant orchard and viticulture industries. The lower basin supports mixed redwood-Douglas fir forest, which has been heavily logged.

Timber harvesting began in earnest in the watershed during the mid-1800s following the gold rush. A second logging boom occurred from the later 1930s to the early 1950s, when large tracts of redwood-dominated forest in the mainstem Navarro River sub-watershed were re-harvested, and Douglas fir-dominated forest in the North Fork Navarro sub-watershed was cut for the first time.

2.5.4.5.3.____Fishery

Coho salmon and steelhead trout occur in the Navarro River watershed. The Navarro River was once famous for its coho salmon runs. As recently as 1985, the Navarro was considered to have the best and the most anadromous fish habitat of any coastal stream in the country. Today the range and abundance of coho salmon have been greatly reduced. In the 1990s, coho occurred in less than 30% of streams surveyed and were restricted to the western part of the drainage, either in small tributaries to the mainstem Navarro River or in North Fork Navarro basin. Steelhead were distributed throughout the watershed and fare somewhat better than coho salmon due to a higher tolerance for high water temperature, but their populations also have been severely reduced from historical levels. In the 1960s, there were 16,000 steelhead in the watershed. Now, populations of both coho and steelhead are federally listed as threatened.

2.5.4.5.4.____Topography and Geology

Three geologic formations make up most of the Navarro River watershed: the Melange Unit of the Franciscan Assemblage, the Coastal Belt of the Franciscan Assemblage, and alluvial fill. Rocks associated with the Melange Unit, which is found in much of the Anderson Creek basin, the middle and upper Rancheria Creek basins, and a portion of the Indian Creek basin, produce highly erodible soils. Soils associated with the Coastal Belt, found in much of the rest of the watershed, are more stable and resistant to erosion. Alluvial fill, found in Anderson Valley and in low-lying reaches of the major tributaries, is also highly erodible.

2.5.4.5.5. Sedimentation

Timber harvesting, ranching, and agriculture have contributed to pervasive sedimentation in the Navarro River watershed. Most tributaries and extensive reaches of the main trunk streams underwent channel aggradation and widening beginning in the 1950s and 1960s due to coarse sediment accumulation during the period of un-regulated tractor logging. In addition, several major storm events during this period produced profound effects on stream channel morphology and fish habitat. Sediment production rates decreased in the 1950s, from1970 to the 1980s, and in the 1990s. This improvement was likely due to improved timber harvest practices and regulations along with improved road construction and maintenance practices for active logging roads.

The current trend in most streams is toward recovery, as most channels are narrowing and scouring their beds, returning to about pre-aggradation levels. Exceptions are Anderson Creek in Anderson Valley and upper and middle Rancheria Creek. Fine sediment deposition is still significant in these areas, which have wide valleys and low gradients. Streambed aggradation and widening persist, which in turn result in increased bank erosion and input of additional sediment. These streams still exhibit poorly developed riparian vegetation, shallow pools, and abundant frequently mobilized sediment. In some aggraded reaches, there is no summer surface flow; all flow is subsurface.

Present-day rates of sediment production remain high in comparison with the pre-settlement era; the average annual sediment production for 1984-1996 was 1,945 t mi^{-2} yr^{-1}. Forty percent was from human sources. The highest rates of sediment production in the Navarro River watershed are in the Anderson Creek basin. The significantly higher rates and total amount of sediment from the Anderson Creek basin are attributable primarily to the highly erodible soils of the Franciscan Melange bedrock. Most of the sediment that enters first and second order stream channels is transported relatively quickly to lower gradient, higher order streams. This is attributable to the smaller channel's confinement within narrow valleys, their high gradient, and their lack of large woody debris.

Eighty percent of anthropogenic sediment generation is related to roads. The dominance of roads as a source of sediment reflects the land uses in the watershed, specifically timber production and ranching, which use vast networks of roads. The amount of sediment eroded from roads and delivered to stream channels is related to road density, road type and level of use, geology, and topographic location. Those sub-basins with the highest rates and overall volume of road-related sediment generation are the North Fork Navarro and mainstem Navarro basins.

Bank erosion and shallow landslides in larger channels, especially those that flow through alluvial valleys and those flowing through the melange terrane, account for about 37% of the total sediment production to streams. Bank erosion and shallow landslides to smaller channels (15%) and gullies (16%) constitute the next tier of sources of sediment production to stream channels. Infrequent but large deep-seated landslides account for about 6% of total sediment production to streams. Deep-seated landslides are only significant in the Rancheria Creek basin and the mainstem Navarro River basin. Vineyards, which occupy only about 2-5% of the watershed, have the potential to be locally significant sediment sources.

Historical and current logging practices have limited the amount of LWD present in stream channels. Prior to the 1950s and 1960s, large, old-growth redwood trunks were common in many channels where they created several important fish habitat elements:

- Diverse channel morphology
- Habitat complexity
- Cover
- Deep and frequent pool
- Sediment storage sites that buffered streams from the impacts of high sediment production
- Sites for deposition and retention of spawning gravels

Previous field surveys indicated that pools made up as much as 70-80% of the habitat in some streams in the Navarro River watershed. Much of the LWD was removed in the 1950s and 1960s as part of salvage logging operations or because fisheries managers believed that the debris created barriers to upstream fish migration. The loss of LWD is directly related to a reduction in habitat complexity, lack of high-quality cover, and a reduction in the frequency of pools.

It is likely that summertime water temperatures in the streams of the Navarro River watershed have increased during the past fifty years. Stream canopy cover has been reduced by the widening of channels and the loss of riparian vegetation through logging and other land use practices. The resulting wide, shallow, exposed stream channels often have very low summer flows and high temperatures. Current stream temperatures tend to be lowest in small tributary streams where channels are narrow and riparian vegetation can shade the channel. Temperatures are highest in locations on the mainstems of Anderson, Indian, and Rancheria Creeks, and on the Navarro River where the channels are wider than natural and riparian vegetation is sparse. Summer base flows are typically low in the Navarro River watershed and contribute to elevated stream temperatures. Diversion of water by agricultural pumping, particularly on the lower reaches of Anderson, Rancheria, and Indian Creeks, significantly reduces flow and contributes to high water temperatures. Diversions in lower Anderson Creek have reduced surface flow to 0 cfs, leaving isolated pools that rapidly heat up with solar radiation.

2.5.4.5.6. Water Quality Issues

In the Navarro watershed, land-use practices including forestry, grazing, agriculture, and urban development have substantially altered watershed processes over time, resulting in the degradation of water quality and loss of fish habitat. The specific factors that limit salmonid habitat and production are sedimentation and lack of LWD, which result in altered channel morphology, high water temperatures, and a lack of pools. Many streams in the watershed have abundant sand or fine sediments, causing embeddedness, reducing embryo survival, and limiting aquatic insect production. Many streams also have substrate that is too large for the fish to move, preventing redd building. High quality spawning substrate was observed only in the North Branch of the North Fork Navarro. A few other streams provided some good spawning habitat, but the majority of spawning habitat is poor or fair.

Throughout much of the watershed, maximum water temperatures and large diurnal fluctuations create unsuitable conditions for salmonids. Suitable temperatures for coho were found in the western portion of the watershed, such as the North Fork basin, which is close to the coast and has moderate temperatures. Suitable temperatures were also found in a few other tributaries with well-shaded channels and sufficient summer flows, such as Mill Creek, lower Indian Creek, and tributaries to lower Rancheria Creek. At locations along the large, inland streams with open canopies, such as Indian Creek, Rancheria Creek, and Anderson Creek, where maximum air temperatures are higher than in the coastal areas, water temperatures are too high for coho salmon and may even be lethal. Most of the Navarro River basin has adequate summer temperature regimes to support steelhead with the exception of Anderson Creek in Anderson Valley.

In 2000, the NCRWQCB established Temperature and Sediment TMDLs for the Navarro River to address the impairment of the cold water fishery, including the migration, spawning, reproduction, and early development of cold water fish such as coho salmon and steelhead trout. The NCRWQCB adopted an implementation plan in 2004 to address the sediment impairment and has yet to develop an implementation plan for temperature.

The primary water quality issues in the Navarro River watershed are:

- Sedimentation of streams
- High water temperatures
- Salmonid habitat degradation

Concerns about groundwater quality focus on petroleum contamination. Groundwater and surface water contamination are suspected at former and existing mill sites that historically used wood treatment chemicals. Discharges of pentachlorophenol, polychlorodibenzodioxins, and polychlorodibenzofurans likely occurred as a result of poor containment typically used in historical wood treatment applications. These discharges persist in the environment and accumulate in surface water, sediments, and the food chain.

As in many of the North Coast watersheds, the beneficial uses associated with cold water fishery appear to be the most sensitive of the beneficial uses in the watershed because of the sensitivity of salmonid species to habitat changes and water quality degradation. Accordingly, protection of these beneficial uses is presumed to protect any of the other beneficial uses that might also be harmed by sedimentation.

2.5.4.6.______Garcia River HA (113.70)

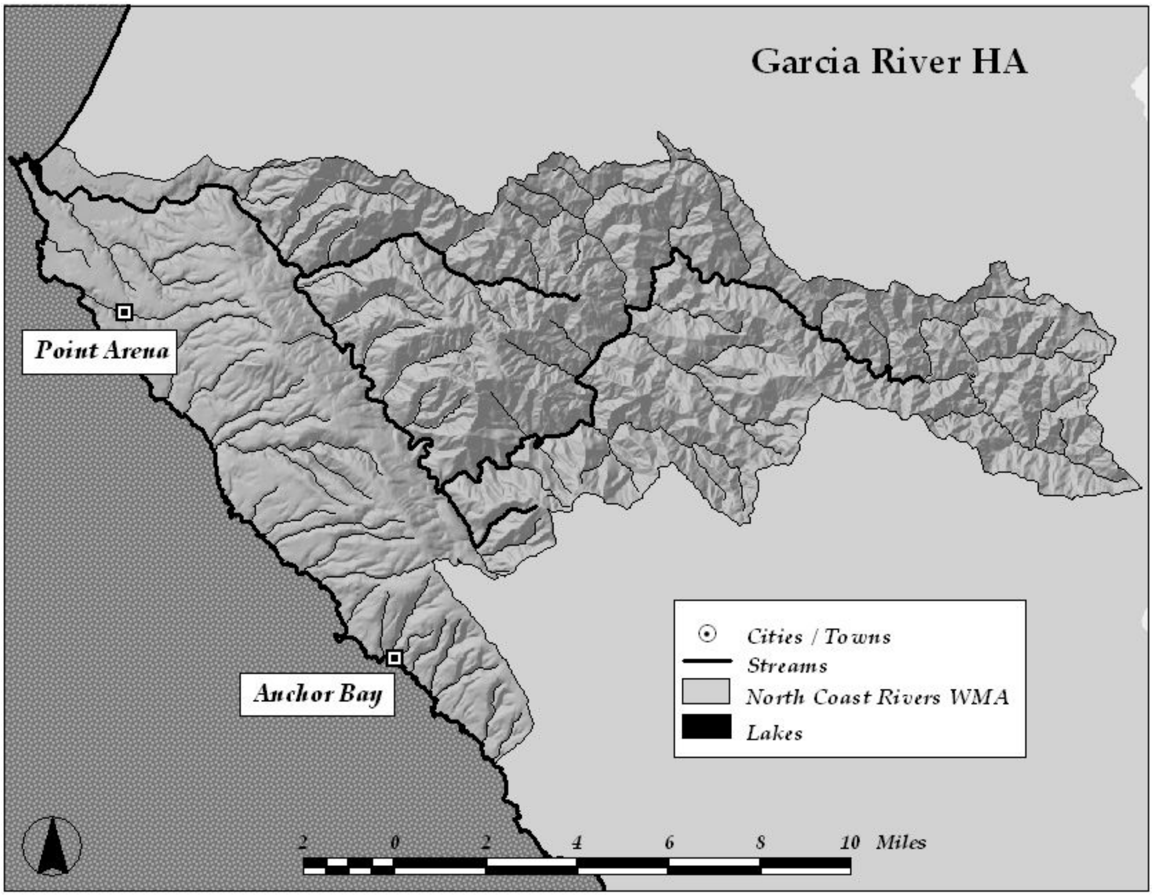

Figure 30. Map of the Garcia River HA

> *The text presented within this section includes information that has been previously published by North Coast Regional Water Quality Control Board 2000 (Reference Document for the Garcia River Watershed Water Quality Attainment Action Plan for Sediment) and references included therein.*

2.5.4.6.1._____Overview

The Garcia River HA is a 114 mi^2 watershed located in southwestern Mendocino County. The river flows northwest along the San Andreas Fault Zone for part of its course and then west to the Pacific Ocean where it discharges just north of the city of Point Arena. The Garcia River watershed ranges from 2,470 feet at the headwaters to sea level where the Garcia River forms an estuary from the confluence of Hathaway Creek to the ocean. The watershed is almost completely privately owned. Industrial timber companies own 52% of the basin. Seven large family holdings account for another 29.5% of the basin in parcels ranging from 700-8,000 acres. The remaining 18.5% is shared by about 76 other private owners, two Rancherias, one Air Force Radar Station, and a State Forest Reserve.

2.5.4.6.2.____History and Land Use

Timber harvesting is the dominant land use activity in the Garcia River watershed. The watershed has undergone waves of timber cutting.

- The first period of intense timber harvest was in the late 1800s. A number of mills and flumes were erected in the Garcia River basin providing building lumber, shingles, railroad ties, and other commodities. This lasted until 1915 when the last of the timber harvesting activities ceased.
- The second wave of timber cutting, the most intense in the watershed's history, occurred from 1954-1961 in response to the post-World War II demand for new housing and as a result of the new logging machinery that allowed for cheaper cutting and transportation.
- Industrial and non-industrial timber harvesting continues today. Fifty-two percent of the watershed was harvested from 1987-1997, and 42% of that harvesting occurred in 1988 and 1989.

Before, during, and between the years of timber cutting, the area has supported a diversity of farming and ranching activities. The estuary area was developed for farming, ranching, and dairy, and several thousand acres of cut-over timberland were put into use as rangeland by 1912. Slashing camps were started, with axemen cutting all young virgin and second growth trees. In 1915, the holdings of the White Lumber Company, including much of the timbered land in the Point Arena area, were sold as small ranches and farms. Similarly, in the 1960s the County of Mendocino issued permits for approximately 7,372 acres in the upper watershed allowing conversion from forest to grazing lands. The number of acres of permitted land, which was eventually converted, is currently unknown. Vineyards are currently expanding rapidly in the watershed. Much of this expansion is occurring on hillsides where there is potential for increased erosion and delivery of sediment to nearby streams. In addition, gravel is mined in the watershed.

2.5.4.6.3.____Vegetation

The vegetation types found in the Garcia River watershed have been categorized based on the soils and the vegetation that each soil supports. The vegetation types include:

- Cropland
- Former redwood habitat converted to cropland or pasture
- Coastal prairie/scrub
- Mixed evergreen
- Redwood forest
- Northern seashore
- Coastal cypress/pine
- Chaparral
- Oak woodland/grassland

The upper watershed comprises a mixture of oak woodland/grassland, chaparral, mixed evergreen, and redwood forest soils. The mid-upper watershed is dominated by redwood forest soils, but includes some oak woodland/grassland, and chaparral soils. The mid-watershed is similarly dominated by redwood forest soils, but includes converted redwood, coastal cypress/pine, riverwash, and other soils. The lower watershed is dominated by cropland soils, but includes coastal prairie/scrub, coastal cypress/pine, northern seashore, redwood, converted redwood, and riverwash soils. The soil types represented in the watershed overall predominantly support redwood forest (> 50%), followed by mixed evergreen and oak woodland/grassland complexes.

2.5.4.6.4._____Climate and Hydrology

Average annual rainfall in the watershed ranges from 45 inches near the coast to 75 inches farther inland. Rainfall generally occurs between October and April with the highest rainfall occurring in January.

2.5.4.6.5._____Fishery

Steelhead trout and coho salmon have historically spawned and reared in the Garcia River watershed and continue to do so today, though populations have experienced severe declines since 1960 when there were an estimated 2000 coho and 4000 steelhead. By the 1970s, creel census data indicated that only 0-20 coho and 100-200 steelhead were being caught annually. CDFG data from the 1980s and 1990s indicate that the highest steelhead densities were in the North Fork Garcia, Signal, Rolling Brook, Pardaloe, and Blue Waterhole Creeks, and the lower Garcia River. The highest coho densities were in the South Fork Garcia and Fleming Creek, and the highest redd densities from 1989-2000 were found in Pardaloe Creek, Mill Creek, and the South Fork Garcia River. Fewer than 200 wild coho enter and spawn in the Garcia River today. They appear to favor the small tributaries of the lower watershed, the South Fork Garcia, Signal Creek, and Inman Creek. Steelhead populations are reduced from historical levels but are more widely distributed throughout the basin than coho.

2.5.4.6.6._____Topography and Geology

The entire mainstem of the Garcia River from the headwaters to the estuary has a channel slope gradient ranging from 0-3%. Several larger tributaries also have relatively low gradients; these stream segments have the greatest potential to provide salmonid habitat, particularly for coho, which prefer slower moving stream segments. Many of the smaller tributaries are steeper in gradient ranging up to greater than 20%. There is suitable steelhead habitat in many of these moderate to steep regions.

The San Andreas fault is a significant geological feature in the Garcia River watershed and controls the drainage pattern of the watershed; the South Fork and part of the mainstem Garcia River run along it. The area to the northeast of the San Andreas Fault primarily consists of Coastal Belt Franciscan with periodic outcrops of Franciscan Melange and potential Ohlson Ranch Formation. The Coastal Belt Franciscan consists of well-consolidated, hard sandstone interbedded with small amounts of siltstone, mudstone, and conglomerate. It is pervasively sheared, commonly highly weathered, and tends to easily disaggregate, resulting in numerous debris slides along creeks and roads within debris slide amphitheaters/slopes.

The Franciscan Melange is a pervasively sheared sandstone and mudstone with minor amounts of conglomerate resulting from regional tectonic movement. Failures occur on slopes more gentle than those in more competent units elsewhere, generally by shallow debris slides along roads and creeks, and by deeper-seated failures elsewhere. The Ohlson Ranch Formation consists of semi-consolidated marine nearshore deposits of silt, sand and gravel lying unconformably over Franciscan rocks.

The area to the southwest of the San Andreas Fault primarily consists of Marine Terrace Deposits with occasional outcrops of German Rancho Formation, Galloway-Schooner Gulch Formation, and Monterey Group. The Marine Terrace Deposits consist of poorly to moderately consolidated deposits of marine silts, sands, and quartz-rich pea gravels forming extensive flat benches paralleling the coastline. The German Rancho Formation consists of consolidated, moderately hard, coarse-grained sandstone interbedded with minor mudstone and less common conglomerate. It is overlain in many places by undifferentiated marine terrace sands and is highly sheared and colluvial in appearance near the San Andreas fault system. The Galloway-Schooner Gulch formation consists of moderately consolidated sandstone. The Monterey Group is mostly well-consolidated brown to white porcelaneous shale and siltstone overlain by consolidated sandstone, siltstone, and sandy mudstone. It contains dolomitic concretions and asphaltic sands. The geology of the upper and mid-upper watershed is not currently very well understood.

2.5.4.6.7. Sedimentation

The Garcia River watershed is naturally a highly erodible watershed due to its unstable geology, including a Franciscan-dominated bedrock and the effects of the San Andreas Fault system. The inherent geologic instabilities of the watershed combined with past and present land use practices have led to elevated sedimentation. Mass wasting produces the greatest volume of sediment in the basin followed by fluvial erosion and surface erosion. Mass wasting and fluvial erosion are generally initiated by storm events and deliver both coarse and fine sediment to the stream system. Surface erosion occurs annually and delivers fine sediment to the watershed. Roads are both a primary source of human-caused sediment delivery and the most controllable source in comparison to mass wasting, and fluvial and other surface erosion. It is estimated that in the 40 year period from 1957-1996, ~60% of both mass movement features and shallow rapid landslides were associated with roads, landings, and skid trails, and 20% were associated with harvest units. The remaining 18% was inferred to be of natural origin. Fluvial and surface erosion from roads, skid trails, and other bare soils account for 40-60% of the overall sediment budget.

In the early 1960s, CDFG determined that of 104 miles of stream surveyed in the Garcia River watershed, 37 miles were severely damaged (36%), 15 miles were moderately damaged (14%), 37 miles were lightly damaged (36%), and 15 miles were undamaged (14%) by land use activities. Overall sediment production rates decreased throughout most of the Garcia River basin from 1978 to 1997. However, in the 1990s approximately 43% of the Garcia River watershed was subjected to renewed timber harvesting and road reconstruction. There was not, however, a concomitant increase in sediment production possibly due to drought conditions over that same time period. Road densities in the watershed are well above the desired density to protect in-stream habitat, and continued erosion from roads is a source of concern.

The supply of sediment and the ability of the stream to move it determine in-stream substrate characteristics, which can limit the amount of available salmonid habitat. Accelerated erosion and sedimentation in the Garcia River watershed have contributed to the reduction and loss of habitat necessary to support the migration, spawning, reproduction, and early development of anadromous fish. Most of the stream reaches in the Garcia River watershed have predominantly gravel and rubble substrates. The particle size distribution has fluctuated, dramatically in some sub-basins, over time. Only in Inman Creek and in the North Fork Garcia River sub-basin is the amount of fine sediment (< 0.85 mm) low enough for optimum for salmonid embryo development. None of the streams surveyed had low enough percentages of sediment < 6.5 mm optimum for successful incubation. In the North Fork Garcia sub-basin, more than half of surveyed areas had potential spawning gravels that were more than 50% embedded. Thirty-six percent of Pardaloe and 33% of Mill Creek sub-basins had potential spawning gravels that were more than 50% embedded. Embeddedness cements gravels in place and reduces the following:

- The amount of spawning substrate
- The oxygen available to fish embryos
- Intra-gravel water velocities and the delivery of nutrients to and waste material from the interior of the redd
- Ability of fry to emerge as free-swimming fish

Sedimentation also reduces the volume of available rearing habitat by filling in pools and burying pool-forming structural elements such as large woody debris. Shallow pools are not deep enough to achieve the temperature stratification that deeper pools can, thus cool water refuge is not provided. Sedimentation reduces the availability of fish cover through decreased depths and the burial of large woody debris and other structural elements. Filling once noted in the estuary and lower mainstem appears to be reversing, indicating that the process of recovery has begun. Pool depth is adequate for salmonid rearing in the lower reaches of the watershed, though deep holes are still absent in the estuary and lower mainstem; pool depth is not adequate in any of the other surveyed sub-basins.

Sedimentation impacts stream channel stability by causing aggradation, stream channel widening, greater flood potential, and greater stream bank erosion. Undercut banks and overhanging vegetation are lacking in many stream reaches. The amount of stream channels without riparian canopy (“open” streams) peaked in most areas of the watershed in 1966. Since then, canopy cover has increased but it is still less than half of historical levels in Larmour and Pardaloe Creeks and the North Fork Garcia. Poor canopy cover contributes to high water temperatures, which interfere with the production of salmonids, particularly coho salmon. Canopy density is also related to stream bank stability and large woody debris recruitment, particularly from coniferous species; the occurrence of LWD is generally low.

2.5.4.6.8. Water Quality Issues

The most sensitive beneficial uses of the Garcia River include cold freshwater habitat; migration of aquatic organisms; spawning, reproduction, and early development; and estuarine habitat. Natural processes combined with multiple land uses are responsible to varying degrees for impairment of these beneficial uses. Anthropogenic activities – including timber production and harvest, road construction and maintenance, grazing, gravel mining, and agriculture – have accelerated mass wasting, erosion, and sedimentation. These processes have reduced the quality and amount of in-stream habitat in the Garcia River that is capable of fully supporting the beneficial use of a coldwater fishery. The migration, spawning, reproduction, and early development of cold-water fish such as coho and steelhead have been reduced. Increased sediment deposition in the Garcia River estuary has decreased the depth and size of the estuary.

Existing barriers to anadromous fish migration include:

- Improperly installed culverts that provide either a poor starting location, require too high a jump for anadromous fish to successfully navigate, or reduce the depth of the water
- Sediment deltas at the mouths of several tributaries
- Aggraded reaches of stream that dewater during summer months; and summer low flows that occasionally trap juvenile salmonids throughout the mainstem Garcia River

In 1998, the NCRWQCB established a TMDL for the Garcia River to address the impairment of the cold water fishery, including the migration, spawning, reproduction, and early development of cold water fish such as coho salmon and steelhead trout, by sedimentation. The NCRWQCB adopted an implementation plan in 2001 to address the sediment impairment. The Garcia River is currently 303(d) listed for temperature impairments.

The primary water quality issues in the Garcia River watershed are:

- Sedimentation of streams
- Salmonid habitat degradation
- High water temperatures

Additional water quality issues include the detection of solvents, petroleum, and metals in the ground water and surface water at the US Air Force's Point Arena Station. A number of small sites are contaminated with petroleum products.

As in many of the North Coast watersheds, the coldwater fishery appears to be the most sensitive of the beneficial uses in the watershed because of the sensitivity of salmonid species to habitat changes and water quality degradation. Accordingly, protection of these beneficial uses is presumed to protect any of the other beneficial uses that might also be harmed by impaired water quality.

2.5.4.7. Gualala River HA (113.80)

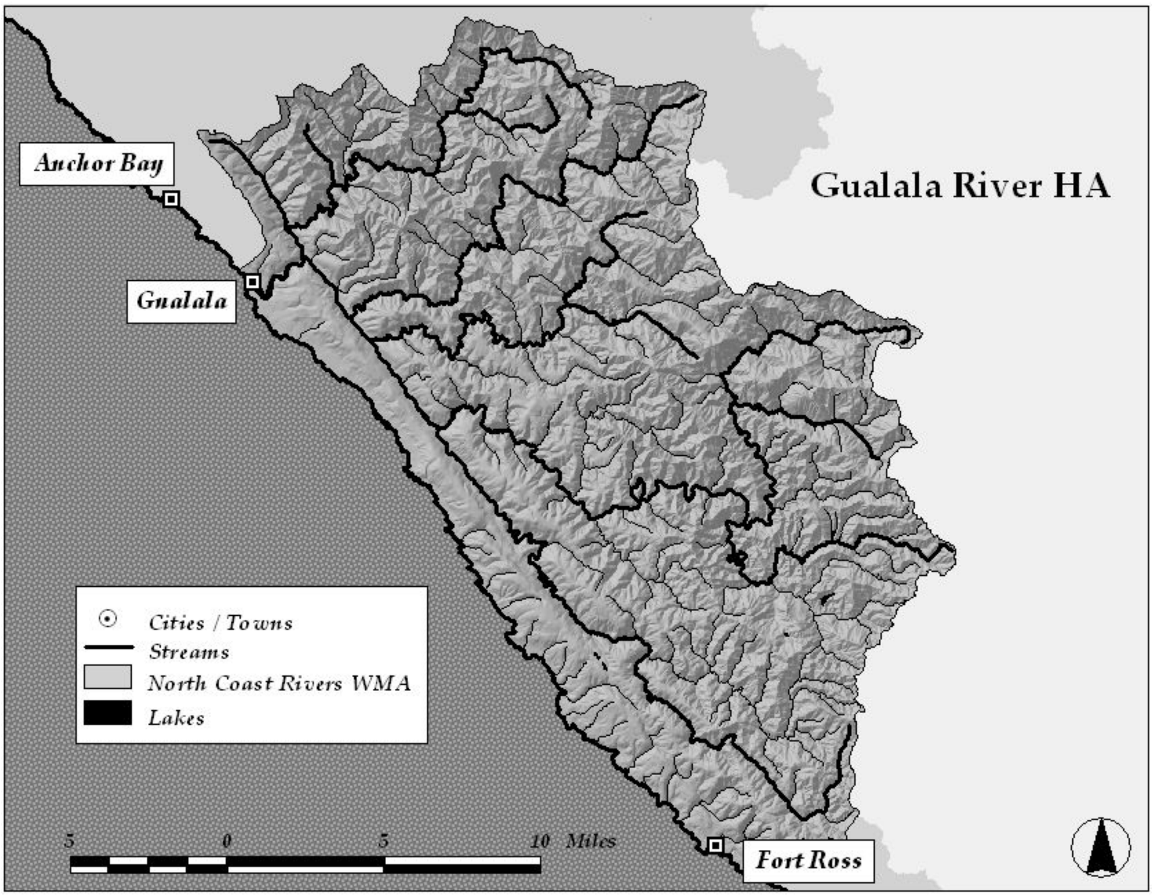

Figure 31. Map of the Gualala River HA

> *The text presented within this section includes information that has been previously published by USEPA 2001 (Gualala River Total Maximum Daily Load for Sediment), North Coast Regional Water Quality Control Board 2001 (Technical Support Document for the Gualala River Watershed Water Quality Attainment Action Plan for Sediment) and references included therein.*

2.5.4.7.1. Overview

The Gualala River HA in Sonoma and Mendocino counties is about 300 mi^2 and drains into the ocean at the town of Gualala (see Figure 31), approximately 114 miles north-

northwest of San Francisco and 17 miles south of Point Arena. The primary population centers in the Gualala River watershed are the towns of Gualala, The Sea Ranch, Stewarts Point, Annapolis, and Plantation.

The watershed consists of five principle tributaries: North Fork, Rockpile Creek, Buckeye Creek, Wheatfield Fork, and South Fork. The mainstem of the Gualala River is actually quite short, flowing from the confluence of the South and North Forks to the Pacific Ocean. This reach is greatly influenced by seasonal closures of the river mouth, which typically occur in early summer and last until the first heavy rains of October or November. The mouth may also close briefly during the winter months.

2.5.4.7.2.____History and Land Use

Historically, timber harvest was a primary land use. Harvesting of old growth trees began in the lower watershed in 1862. Seven mills were built by 1869 and mill construction continued for the next 35 years. In 1872-1873, a railroad was built to move timber to Bourne's Landing, which was about 2.5 miles north of Gualala. From 1908 until the end of WW II, logging slowed, but by 1952, a second wave of cutting had begun. Large areas without trees, scarred by roads and skid trails, are evident in aerial photos from 1965. In 1968, major timber harvesting in the watershed slowed and active harvesting activities were confined to the selective harvest of relatively small areas of second growth Redwood and Douglas fir.

Livestock grazing and agriculture were other primary land uses in the Gualala River watershed. However, sheep and cattle ranching are less prominent industries today than they were in the past and currently do not significantly contribute to sedimentation. Orchards were also a significant agricultural activity in the past. Today, vineyards are becoming more common throughout the watershed and areas previously harvested for timber are being converted to vineyards. These vineyards are often developed on steep hillsides where there is increased erosion potential and delivery of sediment to nearby streams.

Gravel mining has also occurred in the Gualala River watershed, probably beginning in the 1950s when gravel was extracted for use on logging roads. Gravel mining increased by almost ten-fold during the 1960s when commercial mining began and material was needed for residential road construction in The Sea Ranch. From 1974 to the present, a 40,000 ton per year gravel extraction limit has been in place for commercial extraction; since 1993, gravel extraction has been below this limit. Gravel extraction is done mainly by gravel bar skimming on two gravel bars totaling about 26 acres on the Wheatfield and Upper South Forks.

2.5.4.7.3.____Vegetation

Steep slopes of the upper portions of the South Fork and Wheatfield Fork sub-watersheds are forested by redwood, Douglas fir, madrone, and tanoak. The headwaters of the North Fork, Rockpile Creek, Buckeye Creek, and Wheatfield Fork sub-watersheds have open grasslands. The oak-woodland predominates as a more continuous distribution on higher terrain, inland from the coastal marine influence. Along streams, vegetation consists primarily of red alder, California laurel, and redwood. Dense stands of redwood and some fir and hardwoods occur to within one-quarter mile of the coast. A very narrow coastal prairie strip is present near the mouth and along the coast.

2.5.4.7.4.____Climate

The Gualala River watershed has a temperate climate, particularly along the coast. At Fort Ross, along the coast, the average annual temperature from 1948 to 2000 was 12.1°C (53.7°F) and varied from a minimum of 7.1°C (44.7°F) and to a maximum of 17.0°C (62.6°F). Temperature fluctuations inland are more extreme, ranging from a low of below freezing to a high of 26-32°C (80-90°F). Rainfall averages 33 inches per year at the coast and averages 65-70 inches year-1 inland. More than 90% of the annual precipitation occurs between October and April, with the greatest amounts in January.

2.5.4.7.5.____Fishery

Historically, Chinook salmon were not present in the Gualala River watershed. Coho salmon and steelhead trout, however, were found throughout the watershed. It is estimated that in the 1960s 4,000 coho and 16,000 steelhead lived in the watershed. Today, populations have declined significantly from historical levels, and steelhead are federally listed as threatened. Currently, steelhead are present in tributaries throughout the watershed with the exception of minor tributaries to the Wheatfield Fork, which were reported to have little to no water during the summer months. Coho are rarer and may be limited to the Little North Fork. Coho and steelhead were planted in the Gualala River by CDFG as late at 1997, and, while survival rates of these planted fish are unknown, steelhead and coho found in the watershed today may not be native stock.

In the early 1990s, the fish communities of the South Fork Gualala River and the Wheatfield Fork were dominated by Gualala roach (Lenvenia parvipinnis) and three-spine stickleback (Gasterosteus aculeatus), which are native species. Other native species are prickly sculpin (Cottus asper), Coast Range sculpin (Cottus aleuticus), and Pacific Lamprey (Lampetra tridentata). The Gualala roach has been designated as a “Species of Special Concern” because it is a distinct subspecies, apparently endemic to the Gualala River system, and its life history and population status are poorly understood.

2.5.4.7.6.____Topography and Geology

The Gualala River watershed is mostly mountainous, rugged terrain with relatively erodible soils. The tributaries flow through steep valleys with narrow bottom lands, and elevations range from sea level to over 2,650 feet. The bedrock is pervasively sheared and largely folded Franciscan rocks. The San Andreas Fault runs the length of the watershed from southeast to northwest. The South Fork and Little North Fork Gualala River run along the 1-1.5 mile wide valley eroded along the fault. Gualala Ridge, a long, forested, northwestward trending ridge, separates the South Fork from the short streams that flow directly westward to the ocean. There are several other faults in the watershed, though none are known to be active. One fault runs from the mouth of Buckeye Creek under the length of Miller Ridge. Several other smaller faults are found in the highly fractured areas of Skyline Ridge, Table Mountain, and Mohrhardt Ridge. The Mount Jackson Fault cuts through the eastern Gualala River watershed on a northwestward trend paralleling the coast approximately ten miles inland.

2.5.4.7.7.____Sedimentation

Timber companies own approximately 34% of the watershed and employ a variety of harvesting practices including clear-cutting and burning coupled with herbicide applications. Timber harvesting activities on the unstable slopes that are present throughout the area affect slope stability. Roads associated with timber harvest and other land uses are a major source of sediment. About one third of the annual sediment load to the Gualala River is natural background loading (380 t mi^{-2} yr^{-1}) and the other two thirds are due to land use activities (840 t mi^{-2} yr^{-1} total, 710 t mi^{-2} yr^{-1} from roads). The Buckeye and North Fork sub-watersheds each have a road density of approximately 6 mi mi^{-2} and a road related sediment delivery of about 900 t mi^{-2} yr^{-1}. In contrast, the other three sub-watersheds have less than 5 mi mi^{-2} of road, resulting in less than 700 t mi^{-2} yr^{-1}. Forest fires may have exacerbated the effects of timber harvest activities on sediment loading to the streams. In areas in the headwaters of the South Fork Gualala and Wheatfield Fork tributary watersheds that have burned repeatedly during the last fifty years, increased sediment loading have impacted the in-stream habitat of these tributaries.

2.5.4.7.8.____Water Quality Issues

Designated beneficial uses for cold water fish are not being protected as shown by a lack of aquatic habitat needed to support salmonid spawning, incubation, and emergence. Upslope erosion contributes sediment to streams, and the depth and size of the estuary have decreased because of sedimentation. High rates of natural and human-caused erosion are attributable to the region’s unstable geology, high precipitation rates, and land use practices. Natural sediment yield accounts for approximately 1/3 of the total sediment delivery in the watershed while human-caused sediment delivery accounts for 2/3 of the sediment delivery. The protection of cold water fish such as coho and steelhead from human-caused erosion of sediment is a significant concern. Many tributaries have been found to have percent fines greater than 15%, which is above the ideal range for salmonid habitat. The excess sediment negatively impacts spawning and rearing habitats, reduces channel complexity, and increases stream temperatures.

Stream temperatures throughout much of the watershed have increased as the result of a combination of riparian canopy removal and increased sediment loading, leading to stream aggradation and changes in channel morphology. Temperatures exceeding preferred juvenile steelhead and coho rearing temperature ranges occurred in much of the watershed, and temperatures exceeding mean weekly average temperature (MWAT) metrics for coho salmon growth (64°F) and juvenile steelhead growth (66°F) and upper lethal temperature (75°F) for rearing coho salmon and steelhead occurred mostly along the mainstems of the Gualala River and its major tributaries. Observed temperature exceedances were limited in the North Fork Gualala River sub-watershed; temperatures may be lower in this sub-watershed than in others.

Lack of LWD limits the number of deep pools in the Gualala River, further limiting the availability of cool refugia from high water temperatures. Stream reaches throughout the Gualala River watershed lack essential habitat provided by LWD due to historical logging activities and the operation of splash dams. Previous CDFG projects that removed LWD thought to be migration barriers throughout the watershed have also contributed to the paucity of salmonid habitat provided by LWD. Additionally, excess sediment buries any LWD that is present.

In 2001, the NCRWQCB established a Sediment TMDL for the Gualala River to address the impairment of the cold water fishery, including the migration, spawning, reproduction, and early development of cold water fish such as coho salmon and steelhead trout, by sedimentation. The NCRWQCB adopted an implementation plan in 2004 to address the sediment impairment. The Gualala River is currently 303(d) listed for temperature impairments.

The primary water quality problems in the Gualala River watershed are:

- Sedimentation of streams
- Increased water temperatures

The primary water quality goals for the Gualala River watershed focus on protection of the beneficial uses associated with aquatic life and drinking water supplies. Reducing sedimentation is the highest priority. Other issues are related to groundwater and vineyard expansion. Large deep wells installed by vineyards are of concern to surrounding landowners with shallow wells. Decreases in water yield are anticipated. With a recorded decrease in precipitation, water rights and the impact on stream flows in summer are concerns.

Concerns about groundwater quality focus on petroleum contamination. Groundwater and surface water contamination are suspected at former and existing mill sites that historically used wood treatment chemicals. Discharges of pentachlorophenol, polychlorodibenzodioxins, and polychlorodibenzofurans likely occurred with poor containment typically used in historical wood treatment applications. These discharges persist in the environment and accumulate in surface water sediments and the food chain.

As with many of the North Coast watersheds, the coldwater fishery appears to be the most sensitive of the beneficial uses in the watershed because of the sensitivity of salmonid species to habitat changes and water quality degradation. Accordingly, protection of these beneficial uses is presumed to protect any of the other beneficial uses that might also be harmed by impaired water quality.

2.6.__________Russian /Bodega WMA

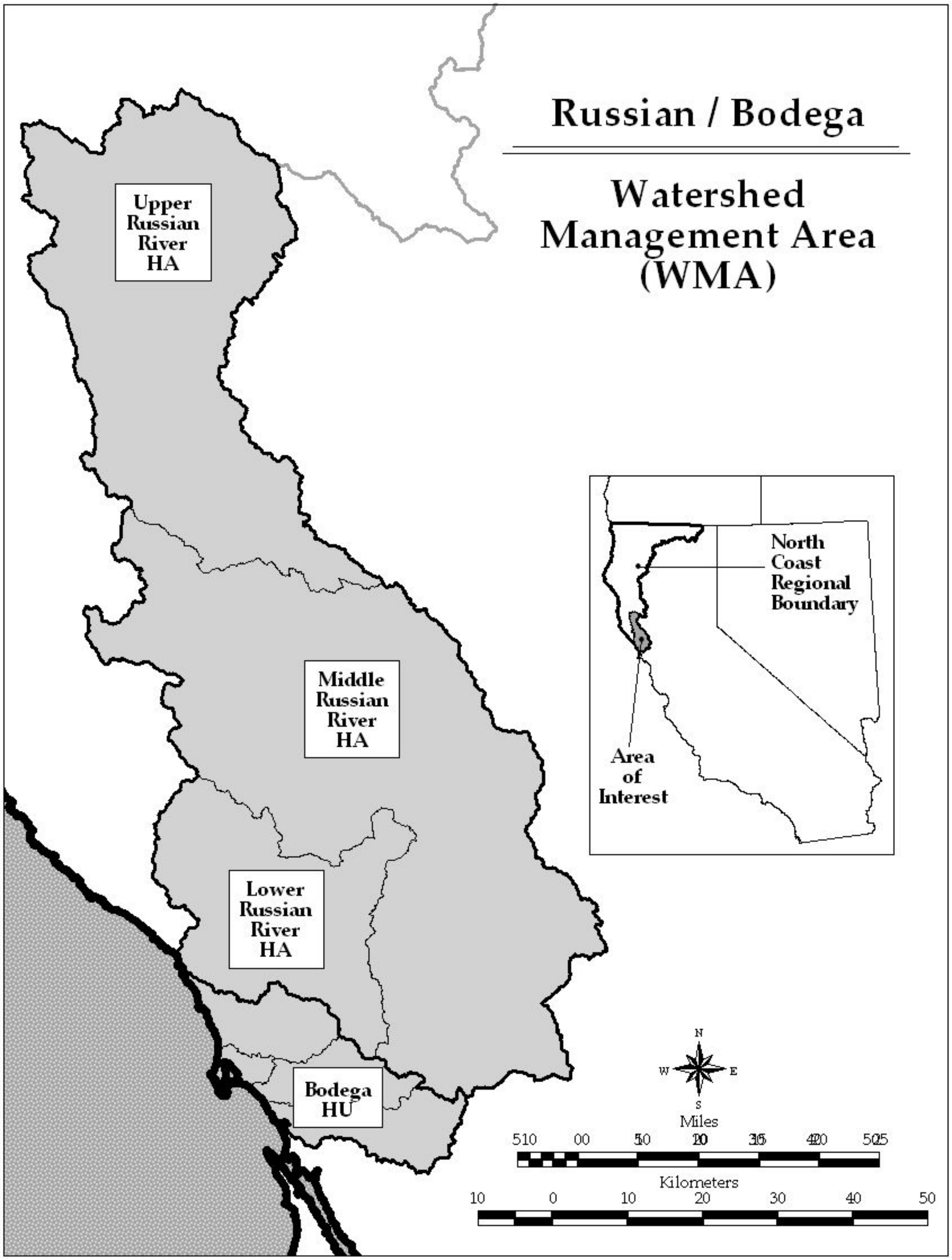

Figure 32. Hydrologic Areas of the Russian/Bodega WMA

2.6.1. Overview

The Russian/Bodega WMA includes the Russian River HU (114.00) and the Bodega HU (115.00), which includes the Salmon Creek HA (115.10), Bodega Bay HA (115.20), Estero Americano HA (115.30), and the Estero San Antonio HA (115.40).

2.6.2. Russian River HU (114.00)

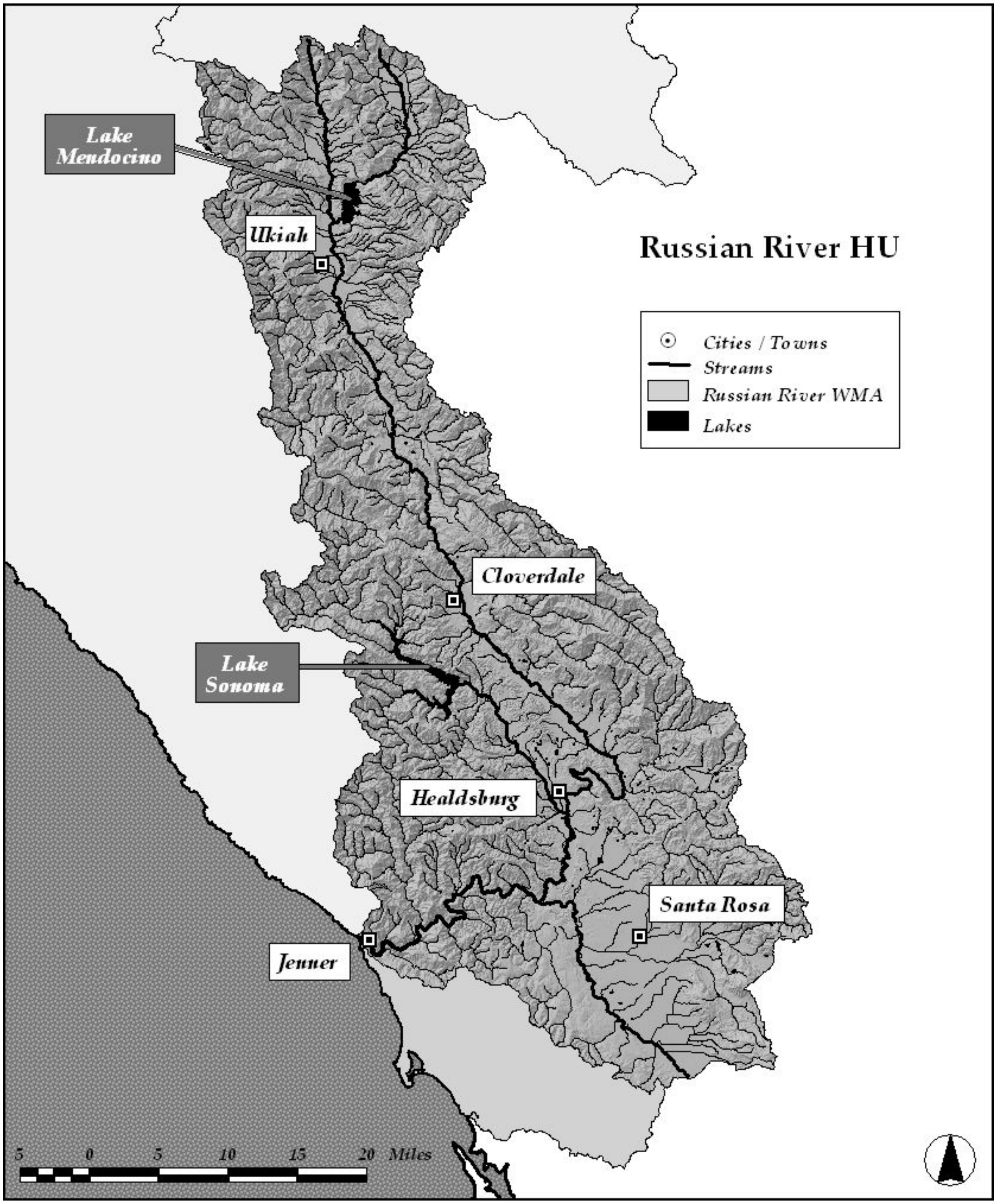

Figure 33. Map of the Russian River HU

The text presented within this section includes information that has been previously published by Entrix Inc. 2002 (Russian River Biological Assessment - Alternatives: Evaluation of Management Actions), Federal Energy Regulatory Commission 2002 (Biological opinion for the proposed license amendment for the Potter Valley Project [Federal Energy Regulatory Commission Project Number 77-110]), California Department of Fish and Game 2002 (Russian River Basin Fisheries Restoration Plan) and references included therein.

2.6.2.1.______Overview

The Russian River HU encompasses 1,485 mi^2 in Mendocino and Sonoma counties and is bordered on the west by the Coast Range and on the east by the Mayacama Mountains; the Sonoma Mountains occur in the southern part of the watershed (see Figure 33). The mainstem is about 110 miles long, flowing southward from its headwaters through small valleys and past the cities of Ukiah, Hopland, and Healdsburg before turning west at Mirabel Park. Joining the river near that point are Mark West Creek and Laguna de Santa Rosa, which drain much of the southern portion of the basin. From Mirabel, the river flows west cutting through the coast range; low mountains along both banks confine the river for the remaining 22 miles where the river empties into the Pacific Ocean at Jenner. The Russian River hydrologic unit supplies drinking water, including ground water supply to over 500,000 people and a varying amount of water for agricultural purposes.

2.6.2.2.______History and Land use

Prior to the late 1700s, the Russian River area was inhabited by Native Americans who had very little impact on the land relative to today's activities. Spaniards and Russians arrived in the late 1700-early 1800s and initiated development of the Russian River Valley, which ultimately led to the demise of native peoples. The California Gold Rush in 1849 triggered the development of new settlements along the Russian River, and land was cleared to meet the demand for wood and agricultural products, and for cattle and horse ranching. As ranching increased, much of the lowland area in the watershed was converted from forest to grasslands, with most streams flowing through a narrow corridor of riparian habitat. The lower watershed was intensively logged. Roads and a railroad were constructed to export timber products from the area. The pace of urban development in the Russian River watershed accelerated in the late 1800s to support the agricultural industry, particularly wine grape vineyards. The timber industry declined significantly once most of the harvestable trees were removed, but the lower Russian River area became a popular tourist destination. By 1910, Highway 101 was built, becoming a four-lane highway in the 1950s and a major U.S. freeway by 1980.

Logging has occurred in the Russian River watershed since the mid 1800s. Redwoods were intensively harvested until they were mostly depleted and the remaining stands were protected, then Douglas fir was logged. Over the last 50 years timber harvesting in the

Russian River watershed has declined dramatically. Currently, less than 5 percent of the timber harvested in California's northwest region comes from the Russian River watershed. Most current logging operations are located in the lower mainstem west of Guerneville and the upper mainstem near Ukiah. The main effect of timber harvesting on fish species in the Russian River is produced by soil erosion, which is caused by landslides that result from the destabilization of slopes due to the removal of trees. Timber-related landslides can affect listed salmonids by silting out spawning habitat, raising stream and river temperatures, and destabilizing streambanks.

Agriculture, including wine-producing vineyards, has been, and increasingly is, a significant activity in the Russian River watershed. By the 1850s, Mendocino and Sonoma counties had become major national wine producers, and land was being converted to vineyards at a rapid pace. By 1900, regional orchard and row crops included prunes, apples, pears, cherries, walnuts, hops, olives, berries, potatoes, asparagus, melons, and many varieties of vegetables. Riparian vegetation was removed and sloughs and side channels were filled in order to maximize agricultural areas; this resulted in the loss of many wetlands.

Most land currently in agricultural production has been grazed or cultivated for many years. Substantial areas of undeveloped lands that were not in agricultural production have been converted to vineyards in recent years; currently more than 60,000 acres are devoted to vineyards. Many vineyards are located on hillsides, where erosion is a greater problem than on flat ground. This has led to additional sedimentation of the Russian River via runoff from hillside vineyards into streams and tributaries. Additionally, agriculture impacts river flows; water is needed from May through October for irrigation and livestock, and in the spring to protect vineyards from frost.

Since the mid-1800s, small-scale gravel mines have operated along the Russian River valley – some in the river and some in terraces alongside the river. The period from 1940-1979 saw intensive in-stream gravel extraction in Dry Creek, which caused severe erosion, degradation, and channel widening. In-channel gravel extraction increased on the Russian River in the late 1940s when demand for sand and gravel increased and the United States Army Corps of Engineers (USACE) began constructing flood control projects. This practice removes material directly from stream channels by skimming gravel from bars or directly excavating from active-channel deposits that emerge during low flows. Depressions can be left in the mined areas that trap or strand fish. In the 1970s, terrace or pit mining increased. This method removes gravel from historic or active flood plain deposits. The pits are separated from the active channel by buffer zones. Currently, gravel is also extracted by quarry mining. Quarry mining uses sites away from the stream and its floodplain, but can require as much as 20,000 gallons of water per day. Of the three extraction methods used in the Russian River, quarry mining has the least direct effect on salmonid habitat.

Potential effects of gravel mining on Russian River salmonids include

- River incision

- Bank erosion
- Tributary down-cutting
- Reduced habitat complexity
- Reduced riparian vegetation along stream corridors
- Increased sediment deposition within streambeds
- Altered flows, especially in high-velocity channels, leading to the removal of spawning gravels

All of these processes can negatively affect salmonids by reducing the amount of quality habitat available for spawning and rearing. The Aggregate Resources Management Plan (ARM) for Sonoma County addresses gravel extraction processes and the need to reduce environmental impacts.

Land use in the upper Russian River watershed today consists of rural residential, agriculture, and small towns; the population in these areas is predicted to increase over the next several decades. In the middle of the watershed, urbanization has increased recently and will probably continue to do so. The lower basin of the Russian River watershed is rapidly urbanizing. Overall, about 90 mi^2 (6% of the watershed) has been developed for residential, commercial, and industrial use, and there are many diversions for domestic water supply and agricultural, municipal, and industrial use. Industrial activities are related to construction, high-technology, petroleum distribution, light manufacturing, and wrecking and salvage yards. Agriculture is still the predominant land use in the watershed. Land is being converted to vineyards from crop, livestock, dairy, and forest lands. Other land uses include timber harvest and gravel mining.

2.6.2.3.______Vegetation

Upland areas are characterized by coniferous forests in the cool, wet western mountains. Mixed hardwoods and chaparral characterize the eastern foothills and upper inland basin. Some hillside oak woodlands have been converted to vineyards. Grasslands occur throughout the upland and lower plain areas. Foothills and lowland plains have riparian areas, though the amount of riparian vegetation has been reduced dramatically over the last 150 years by agricultural practices, livestock grazing, urban development, flood control, gravel mining, and road construction. Currently only thin, discontinuous riparian strips exist.

2.6.2.4.______Climate

The Russian River watershed has a Mediterranean climate with warm, dry summers and cool, wet winters. During the summer, fog moderates temperature fluctuations along the coast and conditions are moist and cool. The drier interior area, however, which is more isolated from the coastal influence, experiences hot, dry summers. The basin-wide mean annual precipitation is 41 inches, with a range of 22 to 80 inches. Approximately 95% of the annual runoff occurs from November to April, and consequently the majority of flow in the Russian River is during the winter season. The greatest precipitation occurs at high elevations and in coastal mountains near Cazadero, while the lowest precipitation falls in the southern Santa Rosa Plain.

2.6.2.5. Water Resource Management

The Russian River is a highly managed system controlled for the most part by the Sonoma County Water Agency (SCWA) and the United States Army Corps of Engineers (USACE). Hydromodifications, extensive development, and water rights have changed the timing, frequency, magnitude, and duration of flows from historical, predevelopment conditions, particularly in the mainstem and Dry Creek. The natural hydrology of the Russian River is typical of most coastal streams in northern California. There are high, natural streamflows in winter, low flows in summer, and high variability in annual runoff. However, a portion of the winter runoff is now stored behind dams for release during dry months. This practice reduces storm flows, decreases winter/spring average monthly flows, and increases summer/fall average flows. Water imported to the basin also substantially increases the amount of water available during the summer. Augmented summer flows have increased the amount of water that flows to the estuary, which historically received much less or no flow during the summer and likely remained closed to the ocean for weeks or months at a time. Currently, inflows to the estuary threaten periodic flooding of low-lying properties so the barrier sandbar is artificially breached to restore tidal flushing. Artificial sandbar breaching and high summertime fresh water inputs have probably altered habitat conditions for listed fish species.

There are numerous diversions for water storage, irrigation, and flood control. In 1997, there were 1,326 recorded water rights in the watershed and 81 pending applications for additional water diversions in Mendocino and Sonoma Counties. Water is diverted for municipal, domestic, agricultural, industrial, and recreational uses. Most agricultural diversions are for irrigation. For that reason, the demand for water is great during summer at a time when instream flow is critically important for coho and steelhead.

The SCWA diverts a total of 442,500 ac-ft annually from the river system for storage in Lakes Mendocino and Sonoma and at the Wohler-Mirabel pumping plant. Physical structures along the Russian River include an inflatable dam at RM 22, the permanent Willow County Water Diversion Dam at RM 88, numerous large and small temporary seasonal dams that may impact anadromous fish, and temporary and semi-permanent road crossings.

2.6.2.6. Fishery

The Russian River and its estuary support more than 75 species of resident and anadromous fish, many of which are native. Abundant resident species inhabiting the mainstem Russian River include smallmouth bass, Sacramento sucker, hardhead, endemic Russian River tuleperch, Sacramento pikeminnow (squawfish), and California roach. Steelhead and sculpin are abundant in the upper reaches of the larger tributaries and rainbow trout are abundant in headwater streams that have relatively high gradients and cold, well-oxygenated water.

In the estuary, abundant species include threespine stickleback, topsmelt, surfsmelt, English sole, Pacific herring, Pacific sanddab, prickly sculpin, starry flounder, bay pipefish, and staghorn sculpin as well as Sacramento sucker, Navarro roach and Sacramento pikeminnow in the fresher portions of the estuary. California roach, pikeminnow, hardhead, Sacramento suckers, and large and smallmouth bass compete with and prey on salmonid and steelhead smolts that migrate through the estuary and have been found rearing there.

Russian River fish identified by CDFG as species of special concern include coho salmon (Oncorhynchus kisutch), pink salmon (Oncorhynchus gorbuscha), river lamprey (Lampetra ayresi), green sturgeon (Acipenser medirostris), California roach (Hesperoleucus symmetricus), hardhead (Mylapharadon conocephalus), Sacramento perch (Archoplites interruptus), and the Russian River tuleperch (Hysterocarpus traski pomo). The Russian River was the southern boundary of pink salmon distribution. Their numbers were probably never large and recently have been considered to be functionally extinct. One species of invertebrate, the California freshwater shrimp (Syncaris pacifica), which is present in some tributaries of the Russian River, has been federally listed as endangered.

Anadromous fish of particular importance in the Russian River watershed are:

- Coho salmon (Oncorhyncus kisutch, also known as silver salmon): Federally listed as endangered
- Steelhead trout (O. mykiss): federally listed as threatened
- Chinook salmon (O. tshawytscha, also known as king salmon): Federally listed as threatened. A small population exists in the Russian River but it is unknown how much of this population is natural versus introduced. Population estimates range from less than 1,000 to more than 5,000.
- American shad (Alosa sapidissima): Introduced and have become an important sport fishery, but populations have declined over the last 30 years.

Coho and steelhead are native to the Russian River but there have been introductions from other river systems in the past via stocking practices. In 1975, there was an estimated coho population of 7,000; in the 1990s, there were less than 1,000 coho. In the 1880s, estimates of the steelhead population ranged from 20,000 to 60,000; currently, the estimated population ranges from 10,000 to 20,000, including hatchery fish.

In spite of all the challenges salmonids face in the Russian River watershed, they are present where cover and food supply are adequate, and water temperatures are suitable for fry and juvenile rearing. Gravel and streamflow conditions in the Russian River mainstem and tributaries are suitable for salmonid spawning. The mainstem above Cloverdale and upper reaches of the tributaries provide the most suitable rearing habitat for steelhead, and steelhead have been observed utilizing summer habitat as far downstream as Healdsburg. Steelhead have been able to establish populations above barriers to migration and are known as rainbow trout when they are resident. The upper portions of the Mark West and Santa Rosa Creek watersheds contain good coho and steelhead rearing and spawning habitat. Excellent coho salmon spawning and rearing habitat can be found in tributaries of the upper portion of the Russian River watershed, tributaries on the western side of the Russian River valley, and in the Maacama Creek watershed.

In-stream conditions during each of these life history stages are critically important. High water temperatures can result in decreased growth and reproductive fitness, increased susceptibility to disease, and ultimately, mortality. During late spring and early summer, water temperatures in the uppermost portion of the Russian River and its tributaries are optimal for salmonids, but later in the summer, temperatures increase to stressful levels along portions of the mainstem. Summer temperatures in many of the Russian River tributaries exceed the optimum temperature ranges for salmon and steelhead.

Flow is also a critical factor, and it affects other water quality measures such as temperature, DO, and turbidity for example. Adequate flow is required for successful migration, spawning¸ incubation, rearing, and out-migration. High flows prevent increases in temperature and reductions in dissolved oxygen. High flows also move LWD and gravel downstream and remove silt from gravel, creating suitable spawning habitat. The amount of rearing habitat in the tributaries for coho and steelhead, which is determined by flow, is generally considered the limiting factor of population size. Alternatively, flow can be too high, preventing fish from migrating upstream or scouring nests. Today, flows in the Russian River watershed are altered significantly from historical conditions due to numerous diversions and dams that control the timing and magnitude of flows. Generally, flows are reduced but increases in peak runoff and dam discharges can occur.

Dams pose additional threats to anadromous fish by preventing migration and blocking access to habitat. One hundred thirty mi^2 above Lake Sonoma (11% of the watershed) and 105 mi^2 above Lake Mendocino (7% of the watershed) are inaccessible. Dams also alter river flow and temperature and block sediment transport, which can cause a stream to incise and/or erode its banks downstream. Lastly, the dams create habitat for other species that threaten salmonids. Lakes Mendocino and Sonoma both contain non-native, warmwater fisheries, and some of the fish are potential predators of salmon and trout. Non-native predators can establish themselves downstream when released from the lakes either accidentally or with a planned release.

The quality of the mainstem has also been reduced by gravel mining, stream bed erosion (downcutting), loss of riparian habitat, reduced flow, degraded water quality (increased temperatures, decreased DO), and the proliferation of warm water species that prey on salmonids. Additional factors that have contributed to the decline of salmonids include: seasonal and permanent impoundments; water diversion, particularly in summer months; unscreened water diversions; adjacent land use practices; introduction of exotic species; hatchery operations; commercial and sport fishing pressures; and oceanic water quality.

2.6.2.7. Topography and Geology

Geologically, the area is characterized by northwest-trending mountain ranges and intervening alluvial valleys. Hills and mountains make up 85 percent of the basin, and gently sloping and level valley areas in the lower basin make up the remaining 15 percent. The area is underlain by the Franciscan Group, a mixture of muddy sandstones and cherts inter-layered with basalt lava flows, and crumpled sea floor sediments that form the bulk of the Coast Range. Soil types and steep topography reduce the watershed's retention capacity and lead to high rates of runoff and erosion and frequent flooding during major storms. Elevation ranges from sea level to 4,344 feet at the top of Mt. Saint Helena in the Mayacamas Mountains. Along its course, the Russian River passes through broad alluvial valleys and narrow bedrock constrictions. Many streams are oriented northwest to southeast. The lithology is, unstable and landslides are common throughout the mountainous regions.

2.6.3. Bodega HU (115.00)

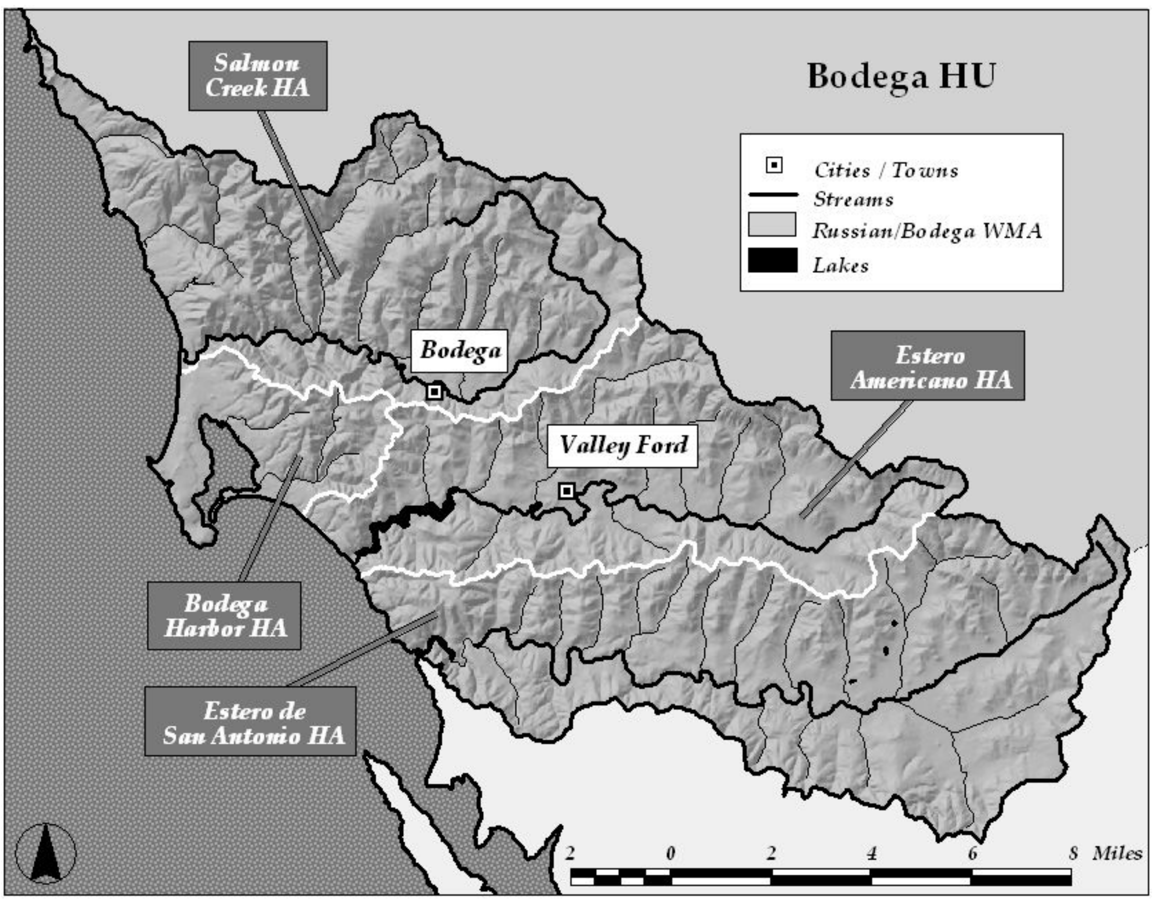

Figure 34. Map of the Bodega HU

The text presented within this section includes information that has been previously published by California State Coastal Conservancy and Circuit Rider Productions Inc. 1987 (Sonoma County Coastal Wetlands

Enhancement Plan), California Department of Fish and Game, 2004 (Stream Inventory Reports for Salmon Creek and Tributaries, Central Coast Region, CA) and references included therein.

2.6.3.1.______Overview

The Bodega HU encompasses 136 mi^2 in Mendocino and Sonoma counties. The Bodega HU includes the watersheds of the Salmon Creek HA, Estero Americano HA, Estero de San Antonio HA, and the Bodega Harbor HA.

Cool temperatures and relatively high rainfall due to coastal influences typify the Bodega hydrologic unit. The terrain in this unit is relatively steep, with the streams carving through the Coast Range and entering the Pacific Ocean south of the Russian River. Salmon Creek, Americano Creek, and Stemple Creek and their associated estuaries are the main waterbodies. These streams are located in erosive topography and are sensitive to land disturbance. Summertime flows are often non-existent in Americano Creek and Stemple Creek, while Salmon Creek flow is low but sustained. Land use is typified by rangeland grazing and animal facility operations, including dairies, and some timber production in the Salmon Creek watershed. Although the community of Bodega Bay has experienced some development in the last decade, the growth has been minimal. The population of the Bodega Bay area was 1127 residents according to the 1990 census.

2.6.3.2.______Americano Creek/Estero Americano HA (115.30)

The Americano Creek/Estero Americano forms the border between Sonoma County and Marin County to the south. All of the Estero Americano and the lower 6.5 miles of Americano Creek are within the coastal zone. Just over half of the Estero Americano is considered impaired, and the remaining portion has intermediate water quality. Almost all of the land in the watershed is under private ownership and the predominant land use in the watershed for the last 20 years has been dairy production and associated cattle grazing. Nutrient pollution from pasture lands and manure lagoons and high ammonia levels from nonpoint source discharges have contributed to sedimentation and low dissolved oxygen, which in turn have led to impairment of fish and wildlife habitat. Estero Americano waters discharge into the Gulf of the Farallones National Marine Sanctuary (NMS). Nutrient and sediment TMDLs are slated for development in Americano Creek and Estero Americano.

2.6.3.3.______Stemple Creek/Estero de San Antonio HA (115.40)

The Stemple Creek watershed is located just east of Petaluma in Sonoma County and drains into Bodega Bay via the Estero de San Antonio in Marin County. The entire Estero and approximately 2 river miles of Stemple Creek are located within the Marin County coastal zone, whereas the Sonoma County portion of Stemple Creek lies outside the coastal zone. Almost the entire watershed is under agricultural production, mainly sheep and cattle grazing and dairy farming. Historically, potato farming was a major industry, and poor farming practices led to degradation of the watershed. Nutrient pollution from pasture lands and manure lagoons has led to sedimentation, low dissolved oxygen and high ammonia levels from nonpoint source discharges. Estero de San Antonio waters discharge into the Gulf of the Farallones National Marine Sanctuary (NMS). Nutrient and sediment TMDLs are slated for development in Estero de San Antonio; nutrient and sediment TMDLs for Stemple Creek have been completed.

The Bodega Marine Life Refuge ASBS/SWQPA in Sonoma County is 1.6 miles long and encompasses 150 acres of marine habitat. It is located on a somewhat undeveloped part of the Bodega headland and includes coastal features such as highly defined natural gullies located in sheer cliffs. Much of this SWQPA falls into a marine life refuge managed by the University of California Bodega Marine Laboratory, which is restoring some areas. The marine laboratory discharges waste seawater as well as storm water runoff into the SWQPA. There is limited public access between Horseshoe Cove near the lab and the southern boundary; much of this southern area is composed of many ecological study areas associated with academic research projects.

2.6.3.4. Salmon Creek HA (115.40)

Salmon Creek is a perennial stream in southern Sonoma County that meets the Pacific Ocean north of Bodega Bay. It drains ~35 mi^2 made up of coniferous and deciduous forest, grassland, and coastal scrub. Salmon Creek has six named tributaries (Coleman Valley, Fay, Finley, Nolan, Tannery, and Thurston Creeks) and 17 unnamed minor tributaries. Elevation ranges from sea level to 797 feet at the headwaters.

The southeast portion of the watershed is grassland with low to moderate topography underlain by Merced Formation sandstone. The rest of the watershed has moderate to high relief and overlies sandstone, shale, and conglomerates from the Franciscan Complex and Great Valley Sequence. These areas have steep ephemeral tributaries with debris slides, torrents, and flows, which are attributable to previous logging activities. The upper watershed contains many alluvial valleys as well as gullies, arroyos, and eroded streambanks, which result from grazing and cultivation. Erosion in the upper watershed is causing sedimentation and aggradation in the lower portions of the tributaries, and wide, shallow, flat channels are forming.

Land use in the Salmon Creek sub-watershed is primarily agricultural grazing, timber, viticulture, and rural residential. Ninety-five percent of the watershed is privately owned, and the rest is owned and operated by the State Department of Parks and Recreation. Streams are lined with riparian habitat, though in some areas it has been disturbed and degraded, particularly where there are livestock, agriculture, and urban development.

Salmon Creek empties into a narrow, 1 mile long tidal estuary. The estuary is bounded by steep rock walls and is usually less than 300 ft wide. In the summer, a sand bar usually forms across the mouth of the estuary, cutting it off from oceanic exchange and causing impoundment. Vegetation includes salt marsh species and rushes that probably thrive during summer impoundments. Sedimentation near the mouth has eliminated several estuarine tidal creeks and narrowed the channel. In the last 150 years, the size of the estuary has decreased by more then 25% due to sediment accretion; open water and mudflat areas have converted to marsh and upland. The remaining marshes, mudflat, and open water areas provide valuable habitat for migratory and resident birds such as the western snowy plover, brown pelican, and peregrine falcon, which are currently or formerly listed as endangered species. The estuary also provides important nursery and rearing habitat for juvenile salmonids

Federally listed endangered coho salmon and threatened steelhead trout, and resident rainbow trout live in the Salmon Creek watershed. To survive, these fish need adequate riparian vegetation to shade the stream, gravel for spawning, adequate flow, year-round pools for juveniles, and cool summer water temperatures. The quality of the habitat decreases with distance from the mouth. Below the town of Bodega, shade-providing riparian areas and quality gravel are available. Above Bodega, the riparian buffer zone has been lost and siltation is heavy. There is riparian habitat upstream of the town of Freestone but a waterfall blocks salmonid access to much of the area. Salmonid habitat in Finley Creek improves with distance from the confluence with Salmon Creek. Erosion and sedimentation in the Salmon Creek watershed threaten the fishery. Other fish in the watershed include pacific lamprey (Lampetra tridentatus), sculpin or cottoids (Cottus spp.), California or venus roach (Hesperoleucus symmetricus), and threespine stickleback (Gasterosteus aculeatus williamsoni), all of which are native.

The federally and state listed endangered California freshwater shrimp *(Syncaris pacifica)* occurs in the Salmon Creek watershed in low gradient streams with undercut banks and pools with overhanging vegetation. Historically, the shrimp was probably common in low elevation, perennial fresh water streams in Marin, Sonoma, and Napa counties. Today, it is only found in sixteen stream segments within these counties, including Salmon Creek. Other species found in the Salmon Creek watershed include Pacific giant salamander, red-legged frogs, rough-skinned newts, turtles, garter snakes, and crayfish.

Surveys conducted in Salmon Creek in July and August 2003 recorded water temperatures from 54-76°F, above the sustained threshold level for stress. It is not known how long water temperatures were elevated or if this condition persists year to year. Many reaches of the creek had embedded cobble and some areas had reduced canopy cover, which could have contributed to locally elevated water temperatures.

2.6.4. Water Quality Issues in the Russian/Bodega WMA

Development and changes in land use in the Russian River watershed have led to the loss of riparian vegetation, reduced habitat complexity, accelerated erosion, urban runoff, augmented flows, elevated water temperatures, loss of spawning gravels, channel incision and widening, and other functional and morphological changes to the river system. Human activities have contributed to the cumulative decline of overall watershed quality and the basin-wide decline of salmonid populations. The SWRCB has issued 27 National Pollutant Discharge Elimination System (NPDES) permits for discharges to surface water including domestic and industrial sewage, non-hazardous wastes from dewatering activities, contaminated groundwater, non-hazardous manufacturing process wastes, and stormwater. Most of the permit sites are concentrated in the urbanized areas. The greatest contribution to surface flow in the Russian River watershed by NPDES permittees is from the nine sewage treatment plants that discharge to the Russian River and its tributaries between October 1 and May 14.

Water quality in the Russian/Bodega WMA has improved substantially over the last 20 years due to pollution control of point sources such as municipal and industrial plants and nonpoint sources, such as urban and agricultural runoff. However, several water quality issues remain, particularly in the vicinity of dairy operations, agriculture, industrial sites, and timber harvesting, and downstream of urbanized areas. These issues degrade water quality and threaten domestic water supplies and fisheries alike. While surface water toxins have not been problematic historically, continued monitoring is warranted as land use changes and population increases.

Contamination and degradation of ground water have been caused by discharges from underground and above ground tanks, wrecking yards, maintenance yards, septic systems, landfills, herbicide and pesticides applications, dairies, illegal disposal sites, and other agricultural and industrial facilities. Sonoma County relies heavily on ground water as a domestic supply. The extent to which some ground water contamination areas affect surface waters is not well known, but it has been documented that contaminated ground water from several toxic sites has affected nearby streams.

In 1995, the NCRWQCB established TMDLs for the Laguna de Santa Rosa to address sediment and excess nitrogen impairments, and in 1997, established TMDLs for Stemple Creek and the Estero de San Antonio to address sediment and nutrient impairments. Currently, there are numerous 303(d) listing in the Russian/Bodega WMA for impairments of sediment and siltation, temperature, DO, nutrients, mercury, pathogens, pH, specific conductivity, and exotic species.

Primary water quality issues in the Russian /Bodega WMA include:

- Sedimentation
- Stream modification
- Loss of riparian area vegetation
- Low stream flows
- High water temperatures
- Low dissolved oxygen
- Increased bacteria and nutrient concentrations
- Mercury in lakes
- Toxic contamination of ground water
- Presence of xenobiotic estrogen responses in fish

Primary pollutants of concern are PCE, petroleum hydrocarbons, pesticides, nutrients, bacteria and sediment. For nonpoint source pollution, emphasis has been increased on animal facility waste control, erosion control, riparian improvements, and fishery habitat enhancement. Nonpoint source discharges from failing septic systems and other sources along the Russian River have not been fully identified. Development has also likely altered groundwater quality and quantity, but the effects are not documented. The presence of xenobiotic estrogens and their effects on fish are also a concern.

3. Data Analysis

3.1 Introduction

The following sections contain summaries of the data collected by the North Coast Regional Water Quality Control Board (NCR) SWAMP program during the fiscal years of 2000-06. The data are presented by Watershed Management Area (WMA), and subsequently by Hydrologic Unit (HU), Hydrologic Area (HA), or Super Planning Watershed (SPW) as applicable.

The NCR SWAMP analyzed surface water grab samples for as many as 206 analytes, depending upon waterbody and season, (see Appendix AA for a list of analytes). This list includes a) analytes with stated concentration objectives, b) analytes with concentration recommendations, and c) analytes which have no stated objective or recommendation. The data are evaluated against multiple criteria to allow managers and decision-makers to evaluate where additional monitoring may be warranted and what analytes to sample when additional funding becomes available. A dash (-) in the criteria tables indicates the absence of an objective for that criterion.

The criteria used to evaluate the waterbodies of the North Coast Region include:

- North Coast Regional Water Quality Control Board's Basin Plan
- California Maximum Contaminant Limits (MCLs) Drinking Water Standards
- USEPA Maximum Contaminant Limits Drinking Water Standards
- California Toxics Rule (CTR)
- USEPA National Ambient Water Quality Criteria for Freshwater Aquatic Life Protection
- USEPA's recommended Nutrient Criteria for Rivers & Streams in the Western Forested Mountains, also known as USEPA Ecoregion II
- USEPA's Quality Criteria for Water 1986 (Gold Book)

Table 4. Basin Plan and Drinking Water standards for field-measurable parameters and dissolved solids.

	Basin Plan	Drinking Water Standards - Maximum Contaminant Levels (MCLs)			
	NCRWQCB	**Ca DHS**		**U.S. EPA**	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Field Parameters					
Specific Conductivity	*Varies by Waterbody*	-	-	-	-
Dissolved Oxygen (DO)	*Varies by Waterbody*	-	-	-	-
pH	*Varies by Waterbody*	-	-	-	-
Conventional Water Quality Constituents (mg/L)					
Chloride	-	-	250	-	250
Sulfate	-	-	250	500	250
Total Dissolved Solids (TDS)	*Varies by Waterbody*	-	500	-	500
Hardness	*Varies by Waterbody*	-	-	-	-
Nitrite-N	-	1	-	1	1
Nitrate-N	45	45	-	10	10
Trace Metals (Total) (ug/L)					
Aluminum	1000	1000	200	-	50
Arsenic	50	50	-	10	-
Cadmium	10	5	-	5	-
Chromium	50	50	-	100	-
Copper	-	1300	1000	1300	1000
Lead	50	15	-	15	-
Mercury	2	-	-	-	-
Nickel	-	100	-	50	-
Selenium	10	50	-	50	-
Silver	50	-	100	-	100
Zinc	-	-	5000	-	5000

Table 5. Freshwater Aquatic Life Protection Criteria and USEPA Nutrient Recommendations

	Freshwater Aquatic Life Protection				
	CTR		US EPA		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Conventional Water Quality Constituents (mg/L)					
Ammonia-N	-	-	*Varies with T and pH*	-	*Varies with T and pH*
Chloride	-	-	*230*	-	*860*
Trace Metals (Total) (ug/L)					
Aluminum	-	-	87	-	750
Arsenic	150	340	150	-	340
Cadmium	*Hardness Dependent* [3]	*Hardness Dependent* [3]	*Hardness Dependent* [3]	*Hardness Dependent* [1]	-
Copper	*Hardness Dependent* [3]	*Hardness Dependent* [3]	-	-	-
Lead	*Hardness Dependent* [3]	*Hardness Dependent* [3]	*Hardness Dependent* [3]	-	*Hardness Dependent* [1]
Mercury	0.05	0.051	0.77	-	1.4
Nickel	*Hardness Dependent* [3]	*Hardness Dependent* [3]	*Hardness Dependent* [3]	-	*Hardness Dependent* [3]
Selenium	5	20	5	258	
Silver	-	*Hardness Dependent* [3]	-	-	*Hardness Dependent* [3]
Zinc	*Hardness Dependent* [3]	*Hardness Dependent* [3]	*Hardness Dependent* [3]	*Hardness Dependent* [3]	-

Conventional Water Quality Constituents

USEPA Recommended Criteria			
USEPA Gold Book Recommendations	**USEPA Recommended Nutrient Criteria for Rivers & Streams**		
Orthophosphate Phosphorus (O-PO4) (mg/L)	Total-P (mg/L)	Total-N (mg/L)	Chlorophyll-A (Chl-A) (ug/L)
0.050	0.010	0.12	1.08

[1] *Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.*
[2] *Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.*
[1] *See Appendix C for graphs of these metals based on concentrations, hardness, and EPA criterion.*

These objectives and recommendations for different criteria include instantaneous measurements and a variety of averaging periods to determine compliance with or exceedance of an objective. The number of visits per site ranged from two to six per year. The visits at a given site may have occurred within the same month, spaced throughout the year, or over a period of a few years. The averaging of data within this report is thus limited to a small dataset and may not accurately represent the true average ambient conditions of the waterbody.

The terms exceedance and potential exceedance are used in this report. In this context, exceedance describes any analyte with results that are above a maximum or below a minimum objective. Potential exceedance describes any analyte for which results are above a continuous concentration criterion or above the USEPA's recommended Nutrient Criteria for Rivers & Streams in the Western Forested Mountains Ecoregion, or for which the average of the results are above a maximum average objective.

Results from analysis are reported in three categories of reported concentrations:

- Non-Detectable (ND) concentrations are concentrations of analytes below the Method Detection Limit (MDL), unable to be detected with the analysis method.
- Detected-Not Quantified (DNQ) concentrations are concentrations of the analytes above the MDL and below the Reporting Limit (RL) for the analysis method.
- Quantifiable concentrations (QC) are concentrations of the analytes above the RL.

3.2______Klamath River WMA/HU

The Klamath River Watershed Management Area/Hydrologic Unit (WMA/HU) in California has seven Hydrologic Areas (HA):

- Lost River HA
- Butte Valley HA
- Salmon River HA
- Middle Klamath River HA
- Lower Klamath River HA
- Scott River HA
- Shasta River HA

Within the Klamath River WMA, are 17 sampling locations comprising seven long-term trend monitoring sites and 10 rotating basin sampling stations. The North Coast Regional Board did not collect samples in the Lost River, Butte Valley, or Salmon River HAs. Table 6 lists the station names, locations, number of site visits and sampling period.

Table 6. Klamath River WMA/HU. Station types, locations and sampling periods.

Station ID	Station Type	Site Visits	Station Location	Sampling Time Period
Upper Klamath River HA				
KLASTL	Rotating	5	Klamath River at California-Oregon state Line	10/2002 - 6/2003
Middle Klamath River HA				
KLAMCO	Trend	17	Klamath River below Iron Gate Reservoir	3/2001 - 6/2005
KLARMP	Trend	17	Klamath River at Gottville River Access	3/2001 - 6/2005
KLAEVC	Trend	17	Klamath River below Everill Creek	3/2001 - 6/2005
KLAMSI	Trend	16	Klamath River at Seiad Valley	3/2001 - 6/2005
Shasta River HA				
SHAEDG	Rotating	5	Shasta River near Edgewood Road	10/2002 - 6/2003
SHAMON	Rotating	5	Shasta River at Montague Grenada Road	10/2002 - 6/2003
SHA263	Trend	22	Shasta River at Highway 263	3/2001 - 6/2006
Tributary to Shasta River				
YREHW3	Rotating	4	Yreka Creek at Highway 3	10/2004 - 6/2005
YREAND	Rotating	9	Yreka Creek at Anderson Grade Road	10/2002 - 6/2005
Scott River HA				
SCOTCA	Rotating	9	Scott River at Callahan	2/2002 - 6/2003
SCOTFJ	Rotating	3	Scott River at Fort Jones	2/2002 - 4/2002
SCOTJB	Rotating	7	Scott River at Jones Beach	5/2002 - 6/2003
SCOTSH	Trend	22	Scott River near Klamath River	3/2001 - 6/2006
Lower Klamath River HA				
KLAMOR	Rotating	5	Klamath River at Orleans	10/2002 - 6/2003
KLAMWP	Trend	18	Klamath River at Weitchpec	3/2001 - 6/2005
KLAMGL	Rotating	5	Klamath River at Klamath Glen	10/2002 - 6/2003

3.2.1.______Upper Klamath River HA

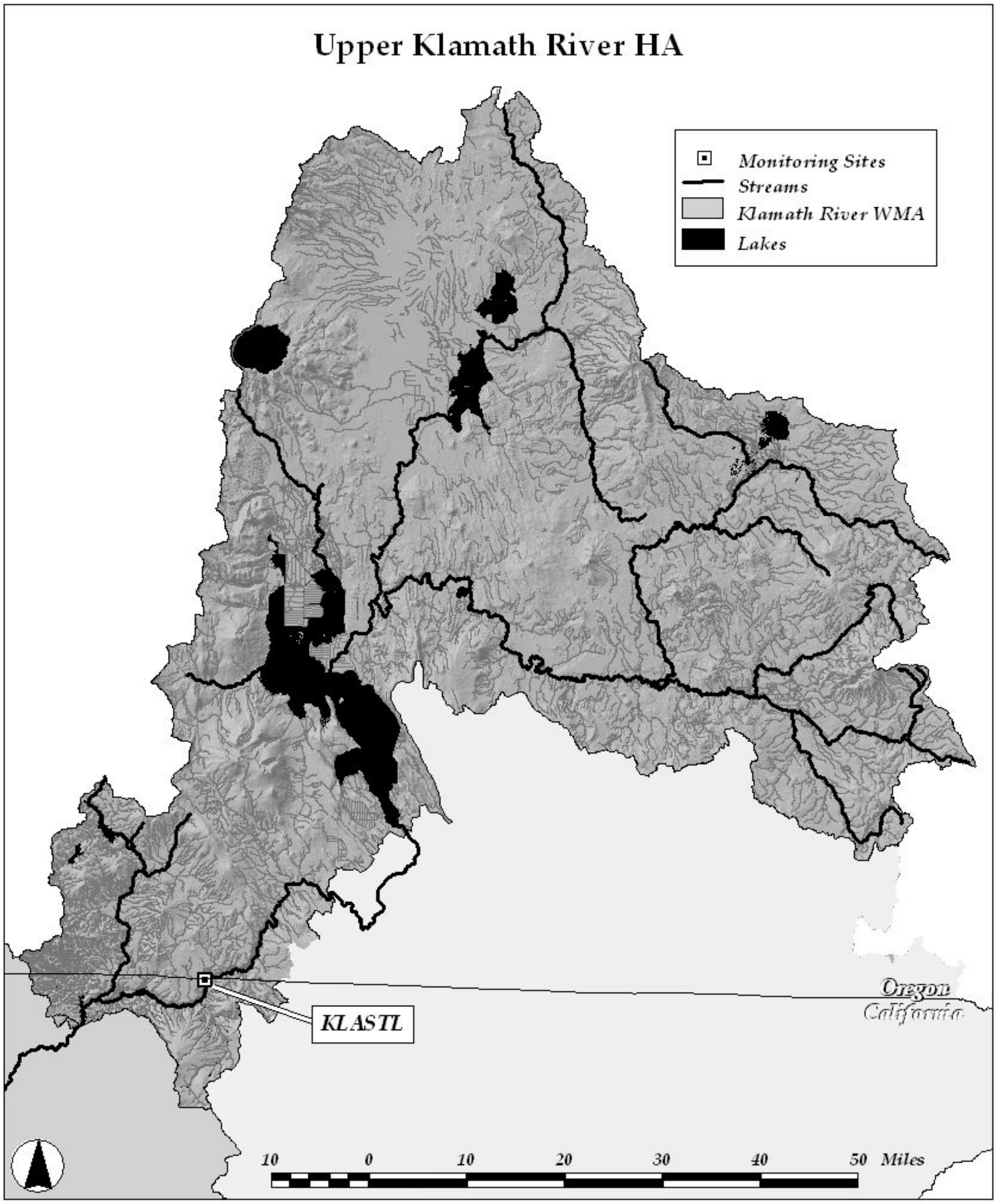

Figure 35. Sampling locations in the Upper Klamath River HA

The Upper Klamath River HA has one sampling location (see Figure 35). Station KLASTL is located at the Oregon-California boundary, approximately 19 river miles upstream of the Iron Gate Dam outlet. This is a rotating basin sampling location and had five site visits during the 2002-03 fiscal year. The site visits corresponded to Fall, Winter, Spring and Early Summer seasonal conditions.

During the five site visits, the NCR collected standard field parameters (FP), and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), and PCBs (PCB). The NCR did not analyze samples for phenolic compounds (PHEN) at this location. Table 7 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the applicable criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 list the numeric values for the criteria, objectives, and standards utilized in this report.

Table 7. Summary of sample types, sample numbers, detections, and objective exceedances in the Upper Klamath River HA

		FP	CON	MET		PEST	PCB	PHEN
KLASTL	# Sampling events	5	5	4	# Sampling events	4	4	0
	Total # Analytes	15	45	44	Total # Analytes	363	200	-
	Exceedances	1	-	-	Detections	2	-	-
	Potential Exceedances	-	19	4	Quantifiable Concentrations	-	-	-

3.2.1.1. Field Parameters

Specific Conductivity and DO conditions at the time of sampling were all in compliance with the Basin Plan. pH values met the Basin Plan objective on four of the five site visits. The Basin Plan objective for pH is a two-part objective with a minimum value of 7.0 and a maximum value of 8.5. The observed pH values ranged from 7.95 to 8.52. The minimum pH objective was met on all occasions, but the maximum Basin Plan objective was exceeded once (20% exceedance rate) on 6/18/2003 (8.52).

3.2.1.2. Conventional Water Quality Parameters

Ammonia-N, chloride, TDS, and sulfate concentrations, at the time of sampling, were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection.

Hardness values did not meet the Basin Plan objective during all site visits. The Basin Plan objective for hardness is a 50% upper limit of 60 mg/L. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 60 mg/L. The observed hardness concentrations values ranged from 49.0 to 72.8 mg/L. In 2002, Basin Plan compliance was met with no concentrations (from two samples) exceeding 60 mg/L. In 2003, possible impairment was recorded with two of three recorded concentrations exceeding 60 mg/L. It is important to note that these results are based on two and three grab samples collected during each calendar year, and are not a compilation of many samples used to calculate monthly means as the objective suggests.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes in a sample were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criterion of 0.12 mg/L on each of the five site visits (100% exceedance rate), with concentrations ranging from 0.701 to 1.637 mg/L. The largest component of the total-N concentrations was TKN, accounting for 55% to 75% of the total concentration.
- Total-P concentrations exceeded the USEPA's recommended concentration criterion of 0.10 mg/L on three of the five site visits (60% exceedance rate), with concentrations ranging from 0.098 to 0.135 mg/L.
- O-PO4 concentrations exceeded the USEPA recommended concentration criterion of 0.05 mg/L on each of the five site visits (100% exceedance rate), with concentrations ranging from 0.58 to 0.97 mg/L.
- Chl-A concentrations exceeded the USEPA recommended concentration criterion of 1.08 ug/L on each of the five site visits (60% exceedance rate), with concentrations ranging from 1.23 to 13.00 ug/L.

3.2.1.3.______Trace Metals

The NCR analyzed grab samples from this location for concentrations of dissolved metals. The results were compared with applicable objectives based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA-recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 8.

- Arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on two of four site visits (50% exceedance rate), and exceeded USEPA's secondary MCL for drinking water (50 ug/L) on all four site visits (100% exceedance rate). Aluminum concentrations ranged from 50.70 to 99.20 ug/L.

Table 8. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Upper Klamath River HA (ug/L)

	Basin Plan	Drinking Water Standards - Maximum Contaminant Levels (MCLs)			
	NCRWQCB	**Ca DHS**		**U.S. EPA**	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	0	0	0	-	4
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	2	-	0

[1] *Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.*
[2] *Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.*

3.2.1.4.______Pesticides, PCBs, and Phenols

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. There were no PCB detections, but there were two detections of pesticides in the water column. One detection of DDE (25% of samples) and one of trans-nonachlor (25% of samples) were found in DNQ concentrations (RL 0.002 ug/L, MDL 0.001 ug/L).

Chlordane and DDT are banned pesticides. trans-nonachlor is a persistent ingredient in Chlordane and DDE is a secondary breakdown products of DDT. The Basin Plan objective for Chlordane is 0.10 ug/L, therefore, this concentration is in compliance. USEPA's continuous concentration criterion for freshwater aquatic life protection for DDT is 0.001 ug/L, therefore, this concentration is in exceedance of the objective (25% exceedance rate).

3.2.2. Middle Klamath River HA

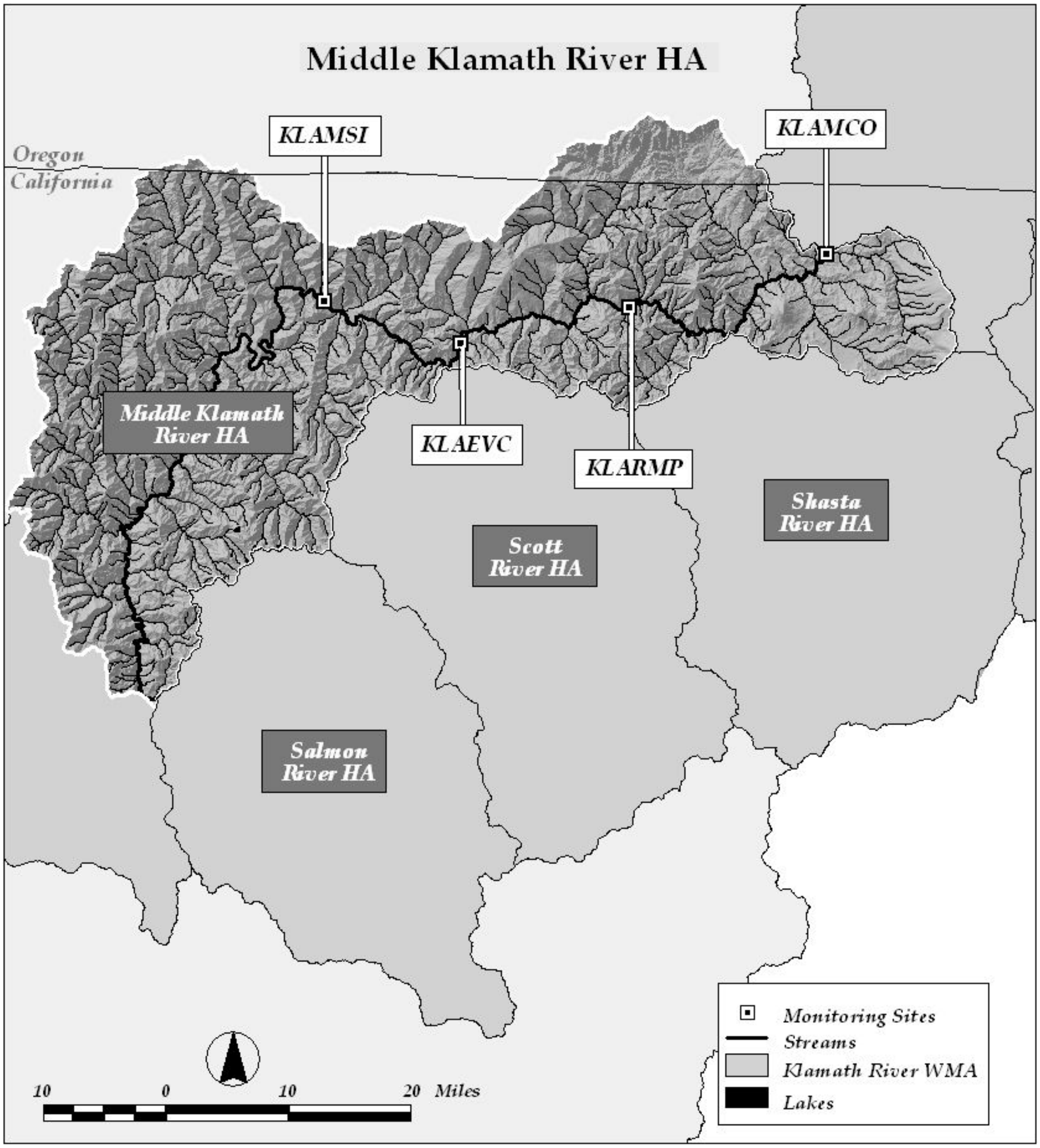

Figure 36. Sampling locations in the Middle Klamath River HA

In the Middle Klamath River HA, there were four sampling locations (see Figure 36). Table 6 lists the station names, locations, number of site visits, and sampling period. The four sampling locations are long-term trend monitoring sites. 72 site visits were made to these locations during the fiscal years of 2000-05. The site visits corresponded to Fall, Winter, Spring and Early Summer conditions.

During the 72 site visits, NCR collected standard field parameters (FP), and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), and PCBs (PCB). The NCR did not analyze samples for phenolic compounds (PHEN) at these locations. Table 9 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the applicable criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for protection of freshwater aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 list the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 9. Summary of sample types, sample numbers, and objective exceedances in the Middle Klamath River HA

		FP	CON	MET		PEST	PCB	PHEN
KLAMCO	# Sampling events	18	17	15	# Sampling events	8	8	0
	Total # Analytes	51	147	152	Total # Analytes	716	400	
	Exceedances	1	-	-	Detections	1	-	-
	Potential Exceedances	-	47	11	Quantifiable Concentrations	-	-	-
KLARMP	# Sampling events	18	17	15	# Sampling events	0	0	0
	Total # Analytes	54	147	150	Total # Analytes	-	-	-
	Exceedances	3	-	-	Detections	-	-	-
	Potential Exceedances	-	53	9	Quantifiable Concentrations	-	-	-
KLAEVC	# Sampling events	18	17	15	# Sampling events	0	0	0
	Total # Analytes	54	147	150	Total # Analytes	-	-	-
	Exceedances	5	-	-	Detections	-	-	-
	Potential Exceedances	-	52	9	Quantifiable Concentrations	-	-	-
KLAMSI	# Sampling events	17	16	14	# Sampling events	0	0	0
	Total # Analytes	51	139	142	Total # Analytes	-	-	-
	Exceedances	6	-	-	Detections	-	-	-
	Potential Exceedances	-	44	8	Quantifiable Concentrations	-	-	-

3.2.2.1.______Field Parameters

Specific Conductivity and DO conditions at the time of sampling were all in compliance with the Basin Plan. pH values met the Basin Plan objective on 56 of 71 site visits. The Basin Plan objective for pH is a two-part objective with a minimum value of 7.0 and a maximum value of 8.5. The observed pH values ranged from 7.72 to 8.71. The observed values met the minimum pH objective on all occasions, but exceeded the maximum Basin Plan objective on 15 of 71 site visits (21% exceedance rate).

3.2.2.2.______Conventional Water Quality Parameters

Ammonia-N, chloride, TDS, and sulfate concentrations at the time of sampling were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water and the USEPA recommended criteria for freshwater aquatic life protection.

Hardness values did not fully meet the Basin Plan objective during all site visits. The Basin Plan objective for hardness is a 50% upper limit of 80 mg/L. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 80 mg/L. The observed hardness concentration values for 2001-05 varied by site and ranged from 51.0 to 104.0. Basin Plan compliance was not met at station KLAMCO in 2005, while possible impairment was recorded in 2003, 2004, and 2005 at stations KLAMSI, KLARMP and KLAEVC.

The stations KLARMP, KLAEVC, and KLAMSI are all located between the Shasta and Salmon Rivers. It is important to note that these results are based on two to seven grab samples collected during the calendar years and are not a compilation of many samples used to calculate monthly means as the objective suggests. Therefore, a more detailed investigation would be required to fully understand and document whether compliance or impairment of water quality objectives is occurring at these sites, and if the Shasta, Scott, or Salmon Rivers are impacting the hardness conditions in the Klamath River mainstem.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criterion of 0.12 mg/L on 66 of 67 site visits (99% exceedance rate), with concentrations ranging from 0.070 to 1.32 mg/L.
- Total-P concentrations exceeded the USEPA's recommended concentration criterion of 0.10 mg/L on 24 of 48 site visits (50% exceedance rate), with concentrations ranging from 0.052 mg/L to 1.822 mg/L.
- O-PO4 concentrations exceeded the USEPA recommended concentration criterion of 0.05 mg/L on 44 of 63 site visits (70% exceedance rate), with concentrations ranging from 0.033 ug/L to 0.162 mg/L.
- Chl-A concentrations exceeded the USEPA recommended concentration criterion of 1.08 ug/L on 52 of 67 site visits (78% exceedance rate), with concentration ranging from 0.74 to 30.00 ug/L.

3.2.2.3. Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 10.

- Arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on 23 of 59 site visits (39% exceedance rate), exceeded USEPA's secondary MCL for drinking water (50 ug/L) on 37 site visits (63% exceedance rate), and exceeded DHS's secondary MCL for drinking water (200 ug/L) on five site visits (8% exceedance rate). Aluminum concentrations ranged from 26.30 to 280.00 ug/L.

Table 10. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Middle Klamath River HA (ug/L)

	Basin Plan	**Drinking Water Standards - Maximum Contaminant Levels (MCLs)**			
	NCRWQCB	**Ca DHS**		**U.S. EPA**	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	0	0	5	-	37
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	23	-	0

[1] *Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.*
[2] *Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.*

3.2.2.4.______Pesticides and PCBs

The NCR analyzed grab samples for 100 pesticides, pesticide constituents, or pesticide metabolites, and 50 PCB cogeners. Station KLAMCO was the only station analyzed for these constituents. At station KLAMCO there were no PCB detections, but one detection of a pesticide in the water column. One detection of alpha-HCH was found in DNQ concentrations (RL 0.002 ug/L). alpha-HCH (Lindane) is an EPA Severely Restricted Pesticide and is listed by the United Nations as a persistent organic pollutant (POPs). The Basin Plan objective for Lindane is 0.004 mg/L, therefore, this concentration is in compliance.

3.2.3. Shasta River HA

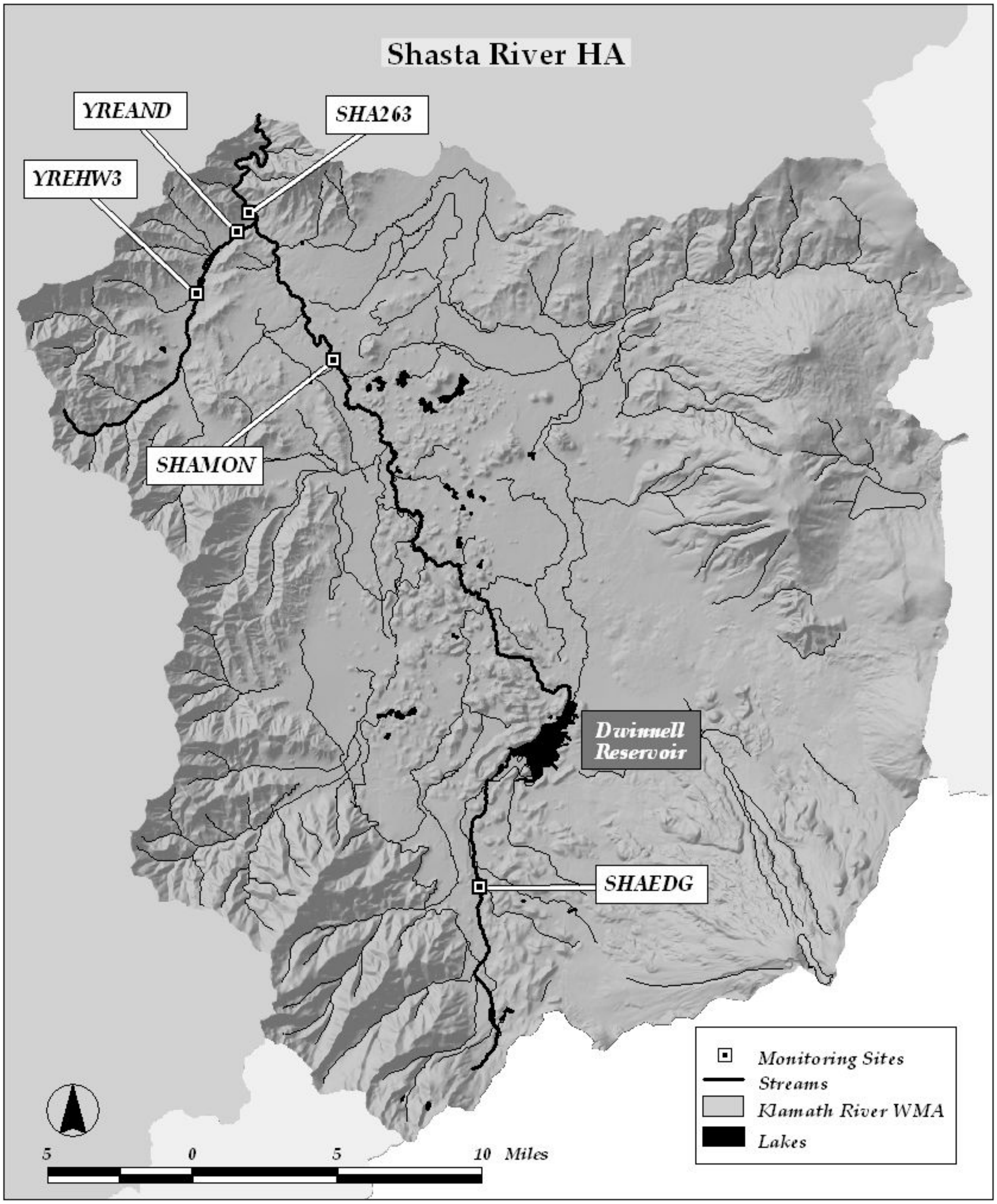

Figure 37. Sampling locations in the Shasta River HA

In the Shasta River HA, there were five sampling locations, three on the mainstem Shasta River and two on Yreka Creek (see Figure 37). Table 6 lists the station names, descriptions, and locations. Station SHA263 is a long-term trend monitoring site, and had 22 site visits during the fiscal years of 2000-06. The other four sampling locations are rotating basin sampling locations. There were a total of 10 site visits to the mainstem sites during the 2002-03 fiscal year, and 13 to the Yreka Creek locations during the fiscal years of 2002-05. The site visits corresponded to Fall, Winter, Spring and Early Summer conditions.

3.2.3.1. Shasta River – Above Dwinnell Reservoir

During the five site visits, the NCR collected standard field parameters (FP), and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), PCBs (PCB), and phenolic compounds (PHEN). Table 11 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the applicable criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 lists the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 11. Summary of sample types, sample numbers, and objective exceedances in the Shasta River HA - above Dwinnell Reservoir.

		FP	CON	MET		PEST	PCB	PHEN
SHAEDG	# Sampling events	5	5	5	# Sampling events	4	4	3
	Total # Analytes	15	45	55	Total # Analytes	369	200	6
	Exceedances				Detections	4		
	Potential Exceedances		8	1	Quantifiable Concentrations	1		

3.2.3.1.1. Field Parameters

Specific conductivity, DO, and pH conditions at the time of sampling were all in compliance with the Basin Plan.

3.2.3.1.2. Conventional Water Quality Parameters

Ammonia-N, chloride, TDS, sulfate, Chl-A, and hardness concentrations at the time of sampling were all in compliance with the Basin Plan objectives, California and USEPA standards for drinking water, and the USEPA recommended criteria for freshwater aquatic life protection.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criterion of 0.12 mg/L on all five site visits (100% exceedance rate), with concentrations ranging from 0.152 to 0.356 mg/L.
- Total-P concentrations exceeded the USEPA's recommended concentration criterion of 0.10 mg/L on one of five site visits (20% exceedance rate), with concentrations ranging from ND (MDL 0.05 mg/L) to 0.117 mg/L.
- O-PO4 concentrations exceeded the USEPA recommended concentration criterion of 0.05 mg/L on two of five site visits (40% exceedance rate), with concentrations ranging from 0.012 to 0.111 mg/L.

3.2.3.1.3. Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with applicable objectives based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 12.

- Arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations exceeded USEPA's secondary MCL for drinking water (50 ug/L) on one of five site visits (20% exceedance rate). Aluminum concentrations ranged from 10.40 to 50.50 ug/L.

Table 12. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Shasta River HA - above Dwinnell Reservoir (ug/L).

	Basin Plan	**Drinking Water Standards - Maximum Contaminant Levels (MCLs)**			
	NCRWQCB	**Ca DHS**		**U.S. EPA**	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	0	0	0	-	1
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	0	-	0

[1] *Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.*
[2] *Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.*

3.2.3.1.4. Pesticides, PCBs, and Phenols

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. No PCBs or phenols were detected, but there were four pesticide detections. Pesticide detections were observed at all three stations.

There were four detections of four pesticides. The detected pesticides were:

- Endosulfan I (RL 0.002 ug/L)
- gamma-HCH (RL 0.002 ug/L)
- Hexachlorobenzene (RL 0.001 ug/L)
- Tedion (RL 0.002 ug/L)

All of the pesticides were detected in DNQ concentrations with the exception of Hexachlorobenzene which was detected in a concentration of 0.001 ug/L.

- Endosulfan I is an organochlorine insecticide. USEPA’s 24-hour average concentration criterion for freshwater aquatic life protection for Endosulfan I is 0.056 ug/L, therefore, this concentration is in compliance.
- HCH (alpha-, delta-, and gamma isomers) is an EPA Severely Restricted Pesticide (Lindane) and is listed by the United Nations as a persistent organic pollutant (POPs). The Basin Plan objective for Lindane is 0.004 mg/L, therefore, these concentrations are in compliance with the objective.
- Hexachlorobenzene is a banned pesticide. USEPA’s toxicity information for freshwater aquatic life protection for Hexachlorobenzene is 50 ug/L, therefore, this concentration is in compliance.
- Tedion is an organochlorine insecticide for which there is no objective.

3.2.3.2. Shasta River – Below Dwinnell Reservoir

During the 27 site visits, the NCR collected standard field parameters (FP), and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), PCBs (PCB), and phenolic compounds (PHEN). Table 13 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the various criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 lists the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 13. Summary of sample types, sample numbers, and objective exceedances in the Shasta River HA - below Dwinnell Reservoir

		FP	CON	MET		PEST	PCB	PHEN
SHAMON	# Sampling events	5	5	5	# Sampling events	4	4	3
	Total # Analytes	15	45	55	Total # Analytes	369	200	6
	Exceedances				Detections	1		1
	Potential Exceedances		20	7	Quantifiable Concentrations			
SHA263	# Sampling events	22	22	21	# Sampling events	16	15	7
	Total # Analytes	63	192	219	Total # Analytes	1362	750	14
	Exceedances	5			Detections	6	7	
	Potential Exceedances	-	71	15	Quantifiable Concentrations			

3.2.3.2.1.____Field Parameters

Specific conductivity conditions at the time of sampling were in compliance with the Basin Plan.

DO values did not meet the Basin Plan objective on one of 26 site visits (4% exceedance rate). The Basin Plan objective for DO is a two-part objective, with an absolute minimum of 7.0 mg/L and a 50% lower limit of 10.0 mg/L. This means that 50% or more of the monthly means in a calendar year must be greater than or equal to 10.0 mg/L. The observed DO values ranged from 2.78 to 13.78 mg/L. The observed concentrations did not meet the absolute minimum criterion on 9/14/2005 at station SHA263 (2.78 mg/L).

pH values did not fully meet the objective at station SHA263 on four of 22 site visits (18% exceedance rate). The Basin Plan objective for pH is a two-part objective with a minimum value of 7.0 and a maximum value of 8.5. The observed pH values ranged from 7.64 to 8.65.

3.2.3.2.2.____Conventional Water Quality Parameters

Ammonia-N, chloride, TDS, sulfate, and hardness concentrations at the time of sampling were all in compliance with the Basin Plan objectives, California and USEPA standards for drinking water, and the USEPA recommended criteria for freshwater aquatic life protection.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criteria of 0.12 mg/L on 25 of 27 site visits (93% exceedance rate), with concentrations ranging from 0.138 to 1.044 mg/L.
- Total-P concentrations exceeded the USEPA's recommended concentration criterion of 0.10 mg/L on 20 of 22 site visits (91% exceedance rate), with concentrations ranging from 0.102 to 0.320 mg/L.
- O-PO4 concentrations exceeded the USEPA recommended concentration criterion of 0.05 mg/L on all 26 site visits (100% exceedance rate), with concentration values ranging from 0.099 to 0.422 mg/L.
- Chl-A concentrations exceeded the USEPA recommended concentration criterion value of 1.08 ug/L on 20 of 27site visits (74% exceedance rate), with concentrations ranging from 0.701 to 3.83 ug/L.

3.2.3.2.3. Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with applicable objectives based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 14.

- Cadmium, chromium, copper, lead, mercury, nickel, selenium, silver and zinc concentrations were all in compliance with every objective at the time of sampling.
- Arsenic concentrations exceeded USEPA's primary MCL for drinking water (10 ug/L) on two of five site visits to station SHAMON (40% exceedance rate) and on three of 18 site visits to SHA263 (17% exceedance rate). Arsenic concentrations ranged from 6.63 to 10.60 ug/L.
- Aluminum concentrations potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on 14 of 23 site visits (61% exceedance rate), exceeded USEPA's secondary MCL for drinking water (50 ug/L) on 17 site visits (74% exceedance rate), and exceeded DHS's secondary MCL for drinking water (200 ug/L) on seven site visits (30% exceedance rate). Aluminum concentrations ranged from 18.50 to 514.00 ug/L.

Table 14. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Shasta River HA - below Dwinnell Reservoir (ug/L).

	Basin Plan	**Drinking Water Standards - Maximum Contaminant Levels (MCLs)**			
	NCRWQCB	**Ca DHS**		**U.S. EPA**	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	0	0	7	-	17
Arsenic Objective	50	50	-	10	-
Exceedances	0	0	-	5	-
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	14	-	0
Arsenic Objective	150	340	150	-	340
Exceedances	0	0	0	-	0

[1] *Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.*
[2] *Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.*

3.2.3.2.4.____Pesticides, PCBs, and Phenols

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. There were one nonylphenol, seven pesticide and seven PCB detections.

The nonylphenol detection was in DNQ concentrations (RL 2.0 ug/L). Nonylphenol is often found as a breakdown product from surfactants and detergents. USEPA's continuous concentration criterion for freshwater aquatic life protection for nonylphenol is 6.6 ug/L, therefore, the observed concentration at SHAMON exceeds the objective (10% exceedance rate).

Seven PCB detections were at station SHA263 on one site visit. The detections were all DNQ values (RL 0.001 ug/L). PCBs are a banned substance. USEPA's continuous concentration criterion for freshwater aquatic life protection for PCB is 0.014 ug/L, therefore, the maximum additive concentration of less than 0.007 ug/L is in compliance.

There were seven detections of seven different pesticides. The detected pesticides were:

- DDT (RL 0.005 ug/L, MDL 0.002 ug/L)
- Diazinon (RL 0.02 ug/L)
- Endosulfan-sulfate (RL 0.002 ug/L)
- Fonofos (RL 0.05 ug/L)
- alpha-HCH (RL 0.002 ug/L)
- Hexachlorobenzene (RL 0.001 ug/L)

- Phosphamidon (RL 0.05 ug/L)

All of these pesticides were detected in DNQ concentrations.

- Fonofos and Phosphamidon are organophosphate pesticides for which there is no objective.
- Diazinon is a nonsystemic organophosphate insecticide removed from residential use in 2004. USEPA's continuous concentration criteria for freshwater aquatic life protection for Diazinon is 0.05 ug/L, therefore, this concentration is in compliance.
- Endosulfan-sulfate is an organochlorine insecticide. USEPA's 24-hour average concentration criteria for freshwater aquatic life protection for Endosulfan-sulfate is 0.056 ug/L, therefore, this concentration is in compliance.
- HCH (alpha-, delta-, and gamma- isomers) is an EPA Severely Restricted Pesticide (Lindane) and is listed by the United Nations as a persistent organic pollutant (POP). The Basin Plan objective for Lindane is 0.004 mg/L, therefore, these concentrations are in compliance with the objective.
- Hexachlorobenzene and DDT are banned pesticides. USEPA's toxicity criterion for freshwater aquatic life protection for Hexachlorobenzene is 50 ug/L, therefore, this concentration is in compliance. USEPA's continuous concentration criterion for freshwater aquatic life protection for DDT is 0.001 ug/L, therefore, this concentration is in exceedance of the objective (5% exceedance rate).

3.2.3.3. Yreka Creek

During the 13 site visits, the NCR collected standard field parameters (FP), and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), PCBs (PCB), and phenolic compounds (PHEN). Table 15 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the various criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 lists the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 15. Summary of sample types, sample numbers, and objective exceedances in the Shasta River HA - Yreka Creek

		FP	CON	MET		PEST	PCB	PHEN
YREHW3	# Sampling events	4	4	3	# Sampling events	4	4	2
	Total # Analytes	12	36	33	Total # Analytes	368	200	4
	Exceedances	1	-	-	Detections	2	-	2
	Potential Exceedances	2	9	-	Quantifiable Concentrations	-	-	2
YREAND	# Sampling events	9	9	7	# Sampling events	8	8	5
	Total # Analytes	27	81	77	Total # Analytes	737	400	10
	Exceedances	1	-	-	Detections	10	-	-
	Potential Exceedances	4	36	-	Quantifiable Concentrations	2	-	-

3.2.3.3.1.____Field Parameters

Specific conductivity did not fully meet the Basin Plan objectives. The Basin Plan objective for specific conductivity is a two-part objective with a 50% upper limit of 400 uS/cm and a 90% upper limit of 700 uS/cm. This means that 50% or more of the monthly means in a calendar year must be less than or equal to 400 uS/cm, and 90% or more of the monthly means must be less than or equal to 700 uS/cm. The observed values ranged from 333 to 557 uS/cm and met the 90% upper limit objective on all occasions, but exceeded the 50% upper limit of 400 uS/cm in 2002, 2003 and 2004.

DO values did not meet the Basin Plan objective on one of four site visits (25% exceedance rate). The Basin Plan objective for DO is a two-part objective, with an absolute minimum of 7.0 mg/L and a 50% lower limit of 10.0 mg/L. This means that 50% or more of the monthly means in a calendar year must be greater than or equal to 10.0 mg/L. The observed DO values ranged from 5.94 to 9.33 mg/L. The observed concentrations did not meet the absolute minimum criterion on 10/21/2004 at station YREHW3 (5.94 mg/L).

pH values did not meet the Basin Plan objective on one of 13 site visits (8% exceedance rate). The Basin Plan objective for pH is a two-part objective with a minimum value of 7.0 and a maximum value of 8.5. The observed values in Yreka Creek met the minimum pH objective on all occasions, but exceeded the maximum objective on one of 13 site visits (8% exceedance rate). The single exceedance in Yreka Creek was observed at station YREAND.

3.2.3.3.2.____Conventional Water Quality Parameters

Ammonia-N, chloride, TDS, and sulfate concentrations at the time of sampling were all in compliance with the Basin Plan objectives, the California and USEPA standards for drinking water, and the USEPA recommended criteria for freshwater aquatic life protection.

Hardness did not fully meet the Basin Plan objective in Yreka Creek. The Basin Plan objective for hardness in Yreka Creek is a 50% upper limit of 200 mg/L. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 200 mg/L. The observed values ranged from 166 to 287 uS/cm and exceeded the 50% upper limit in all years. It is important to note that these results are based on two to five observations made during each calendar year.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criterion of 0.12 mg/L on all 13 site visits (100% exceedance rate), with concentrations ranging from 0.374 to 3.160 mg/L. The largest component of the total-N concentration was nitrate-N.
- Total-P concentrations met the USEPA's recommended concentration criterion of 0.10 mg/L on all four site visits to YREHW3, but failed to meet the criterion on all nine site visits to YREAND (100% exceedance rate). The concentration values at YREAND ranged from 0.103 to 1.140 mg/L.
- O-PO4 concentrations met the USEPA recommended concentration criterion of 0.05 mg/L on all four site visits to YREHW3, but failed to meet the recommendations on all nine site visits to YREAND (100% exceedance rate). The concentration values at YREAND ranged from 0.063 to 1.220 mg/L.
- Chl-A concentrations exceeded the USEPA recommended concentration criterion value of 1.08 ug/L on eight of 13 site visits (62% exceedance rate), with concentration values ranging from 0.189 to 4.48 ug/L.

3.2.3.3.3. Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. Aluminum, arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver and zinc concentrations were all in compliance with every objective at the time of sampling.

3.2.3.3.4. Pesticides, PCBs, and Phenols

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. There were no PCB detections, but there was one nonylphenol, one nonylphenolethoxylate, and 12 pesticide detections.

The nonylphenols were detected in concentrations of 3.7 and 3.85 ug/L respectively. Nonylphenol is often found as a breakdown product from surfactants and detergents. USEPA's continuous concentration criterion for freshwater aquatic life protection for nonylphenol is 6.6 ug/L, therefore, these concentration were in compliance.

There were 12 detections of nine different pesticides. The detected pesticides were:

- Aldrin (RL 0.002 ug/L),
- DDE (RL 0.002 ug/L, MDL 0.001 ug/L)
- DDT (RL 0.005 ug/L, MDL 0.002 ug/L)
- Diazinon (RL 0.02 ug/L)
- Disulfoton (RL 0.002 ug/L)
- Ethion (RL 0.050 ug/L)
- alpha-HCH (RL 0.002 ug/L)
- Heptachlor-epoxide (RL 0.002 ug/L)

All of the pesticides were detected in DNQ concentrations, with the exception of Diazinon in a concentration of 0.062 ug/L and one DDT detection of 0.002 ug/L.

- Aldrin is an organochlorine insecticide. USEPA's Maximum instantaneous criterion for freshwater aquatic life protection for Aldrin is 3.0 ug/L, therefore, this concentration is in compliance.
- DDT is a banned pesticide. DDE is a secondary breakdown product of DDT. USEPA's continuous concentration criterion for freshwater aquatic life protection for DDT is 0.001 ug/L, therefore, this concentration is in exceedance of the objective (25% exceedance rate).
- Diazinon is a nonsystemic organophosphate insecticide removed from residential use in 2004. USEPA's continuous concentration criterion for freshwater aquatic life protection for Diazinon is 0.05 ug/L, therefore, this concentration is in compliance.
- Disulfoton is a systemic organophosphate insecticide for which there is no objective.
- Ethion is an organophosphate pesticide. USEPA's Maximum instantaneous criterion for freshwater aquatic life protection for Ethion is 0.02 ug/L, therefore, compliance with the objective is unknown.
- HCH (alpha-, delta-, and gamma isomers) is an EPA Severely Restricted Pesticide (Lindane) and is listed by the United Nations as a persistent organic pollutant (POP). The Basin Plan objective for Lindane is 0.004 mg/L, therefore, these concentrations are in compliance with the objective.
- Heptachlor-epoxide is a severely restricted organochlorine insecticide. USEPA's continuous concentration criterion for freshwater aquatic life protection for Heptachlor epoxide is 0.0038 ug/L and the Basin Plan objective is 0.01 ug/L, therefore, this concentration is in compliance.

3.2.4.______Scott River HA

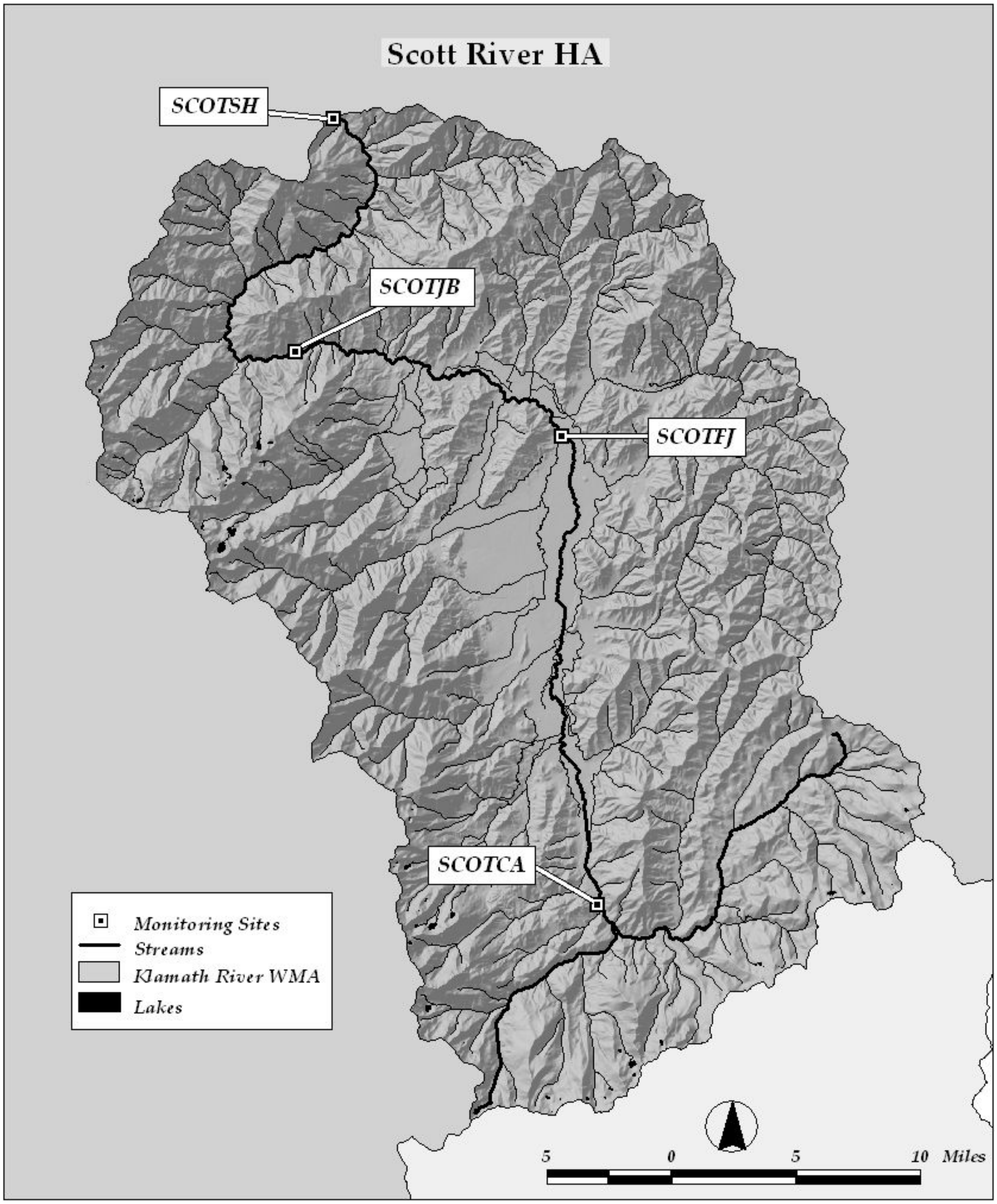

Figure 38. Sampling locations in the Scott River HA

In the Scott River HA, there were four sampling locations (see Figure 38). Table 6 lists the station names, descriptions, and locations. Station SCOTSH is a long-term trend monitoring site and had 23 site visits to these locations during the fiscal years of 2000-06. The other sampling locations are rotating basin sampling locations. There were a total of

19 site visits to these locations during the fiscal years of 2001-03. The site visits corresponded to Fall, Winter, Spring and Early Summer conditions.

During the 42 site visits, the NCR collected standard field parameters (FP), and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), and PCBs (PCB). The NCR did not analyze samples for phenolic compounds (PHEN) at these locations. Table 16 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the various criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 lists the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 16. Summary of sample types, sample numbers, and objective exceedances in the Scott River HA.

		FP	CON	MET		PEST	PCB	PHEN
SCOTCA	# Sampling events	9	9	8	# Sampling events	4	4	0
	Total # Analytes	27	77	88	Total # Analytes	363	200	-
	Exceedances	1	-	-	Detections	-	-	-
	Potential Exceedances	-	8	2	Quantifiable Concentrations	-	-	-
SCOTFJ	# Sampling events	3	3	3	# Sampling events	0	0	0
	Total # Analytes	6	24	33	Total # Analytes			
	Exceedances	-			Detections			
	Potential Exceedances	-	5	3	Quantifiable Concentrations			
SCOTJB	# Sampling events	7	7	6	# Sampling events	4	4	0
	Total # Analytes	21	61	66	Total # Analytes	369	200	
	Exceedances				Detections			
	Potential Exceedances		11	4	Quantifiable Concentrations			
SCOTSH	# Sampling events	22	22	20	# Sampling events	15	16	0
	Total # Analytes	66	192	204	Total # Analytes	1334	800	
	Exceedances	8	2	4	Detections	6	1	
	Potential Exceedances	-	33	10	Quantifiable Concentrations	1		

3.2.4.1.______Field Parameters

Specific Conductivity and DO conditions at the time of sampling were all in compliance with the Basin Plan.

pH values did not meet the Basin Plan objective on nine of 41 site visits (22% exceedance rate). The Basin Plan objective for pH is a two-part objective with a minimum value of 7.0 and a maximum value of 8.5. The observed pH values ranged from 7.72 to 8.83. The observed values met the minimum pH objective on all occasions, but exceeded the maximum Basin Plan objective on nine of 41 site visits. Eight of the nine observed exceedances occurred at station SCOTSH (35% exceedance rate at station

SCOTSH). A more detailed investigation would be required to fully understand and document whether compliance or impairment of water quality objectives is occurring at this site, and if the Scott River is impacting the pH conditions in the Klamath River mainstem.

3.2.4.2. Conventional Water Quality Parameters

Ammonia-N, chloride, OPO4, TDS, and sulfate concentrations at the time of sampling were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, and the USEPA recommended criteria for freshwater aquatic life protection.

Hardness values did not fully meet the Basin Plan objective during all site visits. The Basin Plan objective for hardness is a 50% upper limit of 100 mg/L. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 100 mg/L. The observed hardness concentrations values for 2001-05 varied by site and ranged from 19.9 to 139.0 mg/L. Basin Plan compliance was not met at station SCOTSH in 2004 and 2006. It is important to note that these results are based on two to three grab samples collected during the calendar years and are not a compilation of many samples used to calculate monthly means as the objective suggests.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criterion of 0.12 mg/L on 34 of 41 site visits (83% exceedance rate), with concentrations ranging from ND (MDL 0.10 mg/L) to 3.96 mg/L.
- Total-P concentrations exceeded the USEPA's recommended concentration criterion of 0.10 mg/L on one of 27 site visits (4% exceedance rate), with concentrations ranging from ND (MDL 0.03 mg/L) to 0.110 mg/L.
- Chl-A concentrations exceeded the USEPA recommended concentration criterion of 1.08 ug/L on 20 of 41 site visits (49% exceedance rate), with concentrations ranging from 0.109 to 7.65 ug/L.

3.2.4.3. Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 17.

- Arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on 13 of 37 site visits (35% exceedance rate), exceeded USEPA's secondary MCL for drinking water (50 ug/L) on 19 site visits (51% exceedance rate), and exceeded DHS's secondary MCL for drinking water (200 ug/L) on three site visits (8% exceedance rate). Aluminum concentrations ranged from 1.02 to 361.00 ug/L.

Table 17. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Scott River HA (ug/L).

	Basin Plan	Drinking Water Standards - Maximum Contaminant Levels (MCLs)			
	NCRWQCB	Ca DHS		U.S. EPA	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	0	0	3	-	19
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	13	-	0

[1] Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.
[2] Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.

3.2.4.4. Pesticides, PCBs, and Phenols

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. At stations SCOTCA and SCOTJB there were no PCB detections or pesticide detections. At station SCOTSH there was one nonylphenol detection, one PCB detection and six pesticide detections.

The nonylphenol was detected in a DNQ concentration (RL 2.0 ug/L). Nonylphenol is often found as a breakdown product from surfactants and detergents. USEPA's continuous concentration criteria for freshwater aquatic life protection for nonylphenol is 6.6 ug/L, therefore, this concentration was in compliance.

The PCB detection was a DNQ concentration (RL 0.001 ug/L). PCBs are a banned substance. USEPA's continuous concentration criterion for freshwater aquatic life protection for PCB is 0.014 ug/L, therefore, this concentration is in compliance.

There were six detections of five different pesticides. The detected pesticides were:

- trans-Chlordane (RL 0.002 ug/L)
- DDT (RL 0.005 ug/L)
- Endosulfan-sulfate (RL 0.002 ug/L)
- Fonofos (RL 0.05 ug/L)
- Hexachlorobenzene (RL 0.001 ug/L)

All of these pesticides were detected in DNQ concentrations except trans-Chlordane, which was detected in a concentration of 0.026 ug/L.

- Fonofos is an organophosphate pesticide for which there is no objective.
- Endosulfan-sulfate is an organochlorine insecticide. USEPA's 24-hour average concentration criterion for freshwater aquatic life protection for Endosulfan-sulfate is 0.056 ug/L, therefore, the concentration is in compliance.
- Hexachlorobenzene, trans-Chlordane, and DDT are banned pesticides. USEPA's toxicity information for freshwater aquatic life protection for Hexachlorobenzene is 50 ug/L, therefore, the concentration is in compliance. USEPA's continuous concentration criterion for freshwater aquatic life protection for DDT is 0.001 ug/L, therefore, this concentration is in exceedance of the objective (7% exceedance rate). The Basin Plan objective for Chlordane is 0.10 ug/L, therefore, the concentration was in compliance with the objective.

3.2.5.______Lower Klamath River HA

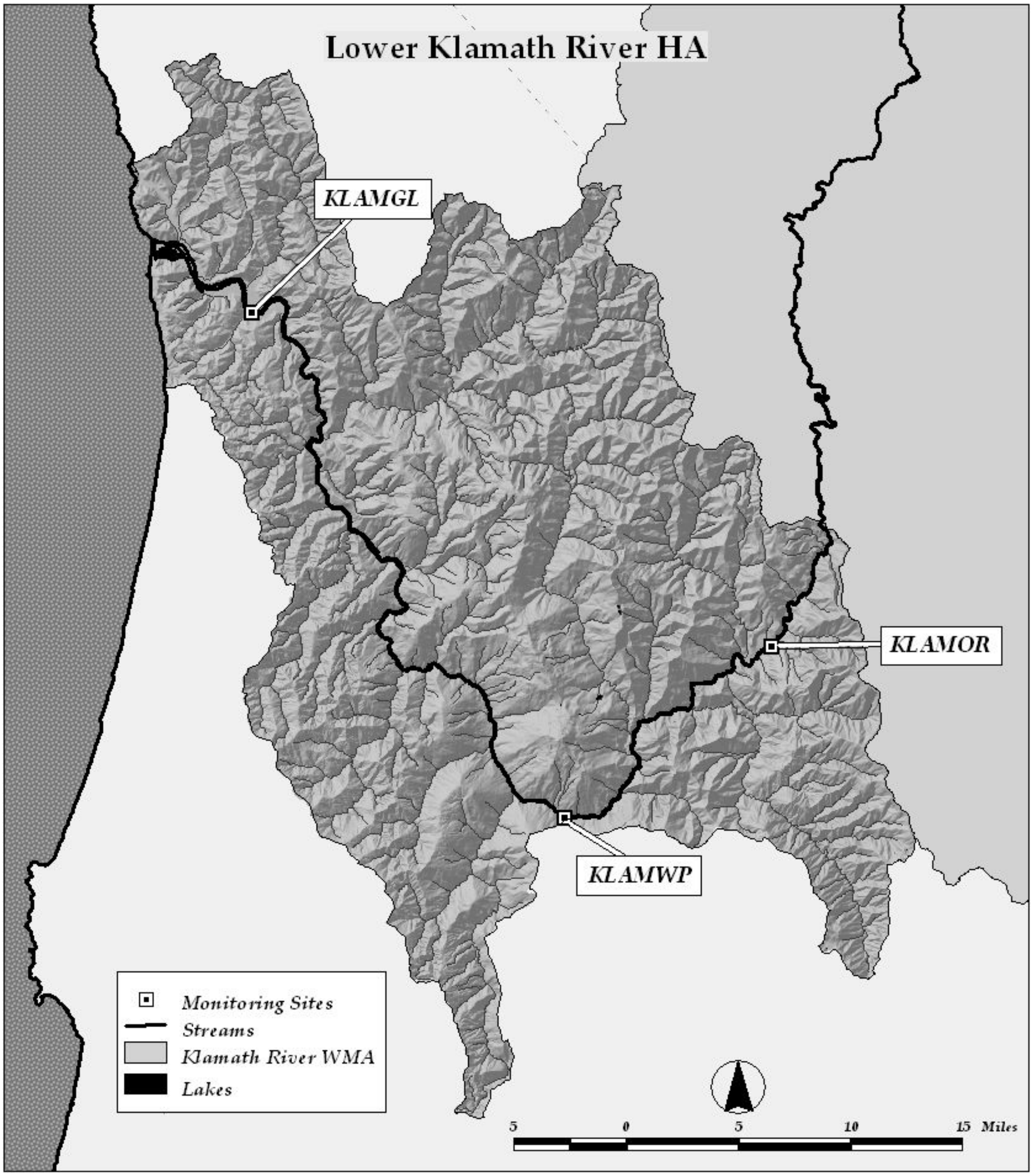

Figure 39. Sampling locations in the Lower Klamath River HA

The Lower Klamath River HA had three sampling locations (see Figure 39). Table 6 lists the station names, locations, number of site visits, and sampling period. Station KLAMWP is a long-term trend monitoring site. The other two sites are rotating basin sampling locations and had five site visits each during the 2002-03 fiscal year (10/2002-6/2003). The site visits corresponded to Fall, Winter, Spring and Early Summer seasonal conditions.

During the 29 site visits, the NCR collected standard field parameters (FP), and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), and PCBs (PCB). The NCR did not analyze samples for phenolic compounds (PHEN) at this location. Table 18 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the various criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 lists the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 18. Summary of sample types, sample numbers, and objective exceedances in the Lower Klamath River HA

		FP	CON	MET		PEST	PCB	PHEN
KLAMGL	# Sampling events	5	5	5	# Sampling events	4	5	0
	Total # Analytes	15	45	52	Total # Analytes	363	250	-
	Exceedances	2	-	-	Detections	1	-	-
	Potential Exceedances	-	8	4	Quantifiable Concentrations	-	-	-
KLAMOR	# Sampling events	5	5	5	# Sampling events	0	0	0
	Total # Analytes	15	45	55	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	10	3	Quantifiable Concentrations	-	-	-
KLAMWP	# Sampling events	19	18	18	# Sampling events	0	0	0
	Total # Analytes	57	155	186	Total # Analytes	-	-	-
	Exceedances	1	-	-	Detections	-	-	-
	Potential Exceedances	-	30	8	Quantifiable Concentrations	-	-	-

3.2.5.1.______Field Parameters

Specific Conductivity and DO conditions at the time of sampling were all in compliance with the Basin Plan. pH values fully meet the Basin Plan objective on 26 of 29 site visits. The Basin Plan objective for pH is a two-part objective with a minimum value of 7.0 and a maximum value of 8.5. The observed pH values ranged from 7.66 to 8.83. The observed values met the minimum pH objective on all occasions, but exceeded the maximum Basin Plan objective on three of 29 site visits (10% exceedance rate).

3.2.5.2.______Conventional Water Quality Parameters

Ammonia-N, chloride, TDS, Total-P, sulfate, and hardness concentrations at the time of sampling were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, and the USEPA recommended criteria for freshwater aquatic life protection.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to

USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criterion of 0.12 mg/L on 22 of 28 site visits (79% exceedance rate), with concentrations ranging from DNQ to 0.430 mg/L. The largest component of the total-N concentrations was nitrate-N.
- Total-P concentrations exceeded the USEPA's recommended concentration criterion of 0.10 mg/L on three of 23 site visits (13% exceedance rate), with concentrations ranging from ND (MDL 0.03 mg/L) to 0.190 mg/L.
- O-PO4 concentrations exceeded the USEPA recommended concentration criterion of 0.05 mg/L on six of 27 site visits (22% exceedance rate), with concentrations ranging from 0.010 to 0.096 mg/L.
- Chl-A concentrations exceeded the USEPA recommended concentration criterion of 1.08 ug/L on 17 of 27 site visits (63% exceedance rate), with concentrations ranging from 0.074 to 13.90 ug/L.

3.2.5.3. Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 19.

- Arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on 12 of 28 site visits (43% exceedance rate), exceeded USEPA's secondary MCL for drinking water (50 ug/L) on 15 site visits (54% exceedance rate), and exceeded DHS's secondary MCL for drinking water (200 ug/L) on four site visits (14% exceedance rate). Aluminum concentrations ranged from 8.80 to 565.00 ug/L.

Table 19. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Lower Klamath River HA (ug/L).

	Basin Plan	Drinking Water Standards - Maximum Contaminant Levels (MCLs)			
	NCRWQCB	Ca DHS		U.S. EPA	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	0	0	4	-	15
	Freshwater Aquatic Life Protection				
	CTR		US EPA		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	12	-	0

[1] *Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.*
[2] *Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.*

3.2.5.4.______Pesticides and PCBs

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. Station KLAMGL was the only station analyzed for these constituents. At station KLAMGL there were no PCB detections, but one detection of a pesticide in the water column. One detection of disulfoton was found in DNQ concentrations (RL 0.050 ug/L). Disulfoton is a systemic organophosphate insecticide for which there is no objective.

3.2.6._____Trend Monitoring – Klamath River WMA

For this report, we are only looking at general trends across sampling years. The long-term monitoring sites were chosen from both impaired and unimpaired waterbodies within each of the WMAs. This component of the SWAMP monitoring plan is designed to monitor water quality trends through time, allowing for the ongoing evaluation of improvements or degradation to water quality. The long-term monitoring sites are located at the bottom of large drainage areas and reflect the impacts of management activities occurring within the respective basins. The long-term sampling locations have had between 10 and 23 site visits over the course of two to five years, dependent upon the timing of station establishment. Each sampling effort was designed so that site visits in the same watershed occurred within the same one to three day period.

In the Klamath River WMA, there are seven long-term trend monitoring sites, five on the mainstem Klamath River, one on the Shasta River, and one on the Scott River.

3.2.6.1. Klamath River Mainstem

3.2.6.1.1. Field Parameters

Only Specific Conductivity and pH values were evaluated for the determination of trends. Specific Conductivity values at all stations varied by season, with the highest values recorded in the spring and the lowest values recorded in the summer and autumn. Specific Conductivity exhibited a general trend of increasing values through the period of record at all locations. pH values at all stations varied by season, with the highest values recorded in the summer and the lowest values recorded in the winter. There is no apparent yearly trend in pH values. The recorded values remained within the same range throughout the period of record.

3.2.6.1.2. Conventional Water Quality Parameters

Hardness, chloride and TDS concentrations at all stations varied by season, with the highest values recorded during the spring and the lowest values recorded in the summer and fall. There was a general trend of increasing concentrations for these constituents through the period of record at all locations. Nitrate and sulfate values at all stations varied by season, with the highest values recorded during the spring and the lowest values recorded in the summer and fall. There was no apparent trend in concentrations; the values remained within the same range throughout the period of record. There was no apparent trend in Chl-A concentrations at each station, but there was a general trend of decreasing concentrations through the period of record at all locations. Total P, Ortho-P, and TKN results did not exhibit a seasonal trend nor did the concentrations demonstrate any trend through the period of record.

3.2.6.1.3. Trace Metals

Aluminum, chromium, copper, lead, nickel, silver, and zinc concentrations at all stations varied by season, with the highest values recorded during the winter and spring and the lowest values recorded in the summer and fall. Arsenic and mercury concentrations demonstrated an inverse relationship with the highest concentrations recorded during the summer and fall and the lowest concentrations recorded during the winter and spring. There was no apparent trend in the concentrations of any trace metals constituent, the values remained within the same range throughout the period of record.

3.2.6.2. Shasta River HA

3.2.6.2.1. Field Parameters

Only Specific Conductivity and pH values were evaluated for the determination of trends. Specific Conductivity and ph values varied by site visit. There is no apparent seasonal trend to the recorded values. There is no apparent yearly trend in values. The recorded values remained within the same range throughout the period of record.

3.2.6.2.2. Conventional Water Quality Parameters

Hardness, chloride, sulfate, and TDS concentrations at all stations varied by season, with the highest values recorded during the spring and the lowest values recorded in the summer and fall. There was no apparent long-term trend in concentrations, the values remained within the same range throughout the period of record. Chl-A, nitrate, Total P, Ortho-P, and TKN results did not exhibit a seasonal trend nor did the concentrations demonstrate any trend through the period of record.

3.2.6.2.3. Trace Metals

Aluminum, arsenic, chromium, copper, lead, mercury, nickel, silver, and zinc concentrations at all stations varied by season. The recorded concentrations did not exhibit a distinct seasonal trend nor did the concentrations demonstrate any long-term trend through the period of record.

3.2.6.3. Scott River HA

3.2.6.3.1. Field Parameters

Only Specific Conductivity and pH values were evaluated for the determination of trends. Specific Conductivity and ph values varied by site visit. There is no apparent seasonal trend to the recorded values. There is no apparent yearly trend in values. The recorded values remained within the same range throughout the period of record.

3.2.6.3.2. Conventional Water Quality Parameters

Hardness, chloride, sulfate and TDS concentrations varied by season, with the highest concentrations recorded during the fall and the lowest values recorded in the spring and summer. There was no apparent trend in concentrations; the values remained within the same range throughout the period of record. There was no apparent seasonal trend in Chl-A concentrations, but there was a general trend of increasing concentrations through the period of record. Nitrate, nitrite, Total P, Ortho-P, and TKN results did not exhibit a seasonal trend nor did the concentrations demonstrate any trend through the period of record.

3.2.6.3.3. Trace Metals

Aluminum and nickel concentrations varied by season, with the highest values recorded during the spring and the lowest values recorded in the fall. Mercury concentrations demonstrated an inverse relationship with the highest concentrations recorded during the fall and the lowest concentrations recorded during the winter and spring. Arsenic, chromium, copper, lead, silver and zinc concentrations did not exhibit a seasonal trend nor did the concentrations demonstrate any trend through the period of record.

3.3.______Trinity River WMA/HU

There are four Hydrologic Areas (HA) within the Trinity River Watershed Management Area/Hydrologic Unit (WMA/HU). The HAs are:

- Upper Trinity River HA
- Middle Trinity River HA
- South Fork Trinity River HA
- Lower Trinity River HA

Within the Trinity River WMA, there are eight sampling locations comprising three long-term trend monitoring stations and five rotating basin sampling stations.

Table 20. Trinity River WMA/HU station types, locations and sampling periods.

Station ID	Station Type	Site Visits	Station Location	Sampling Time Period
Middle Trinity River HA				
TRHTCH	Trend	15	Trinity River downstream of Hatchery	3/2001 - 6/2005
TRINPB	Rotating	10	Trinity River at Poker Bar	2/2002 - 6/2003
TRINDC	Rotating	10	Trinity River at Douglas City	2/2002 - 6/2003
South Fork Trinity River HA				
TRINSF	Trend	15	South Fork Trinity River near Salyer	2/2002 - 6/2005
Lower Trinity River HA				
TRINFH	Rotating	10	North Fork Trinity River at Helena	2/2002 - 6/2003
TRINSL	Rotating	10	Trinity River at Salyer	2/2002 - 6/2003
TRINHP	Rotating	10	Trinity River at Hoopa	2/2002 - 6/2003
TRINWP	Trend	18	Trinity River at Weitchpec	3/2001 - 6/2005

3.3.1.______Middle Trinity River HA

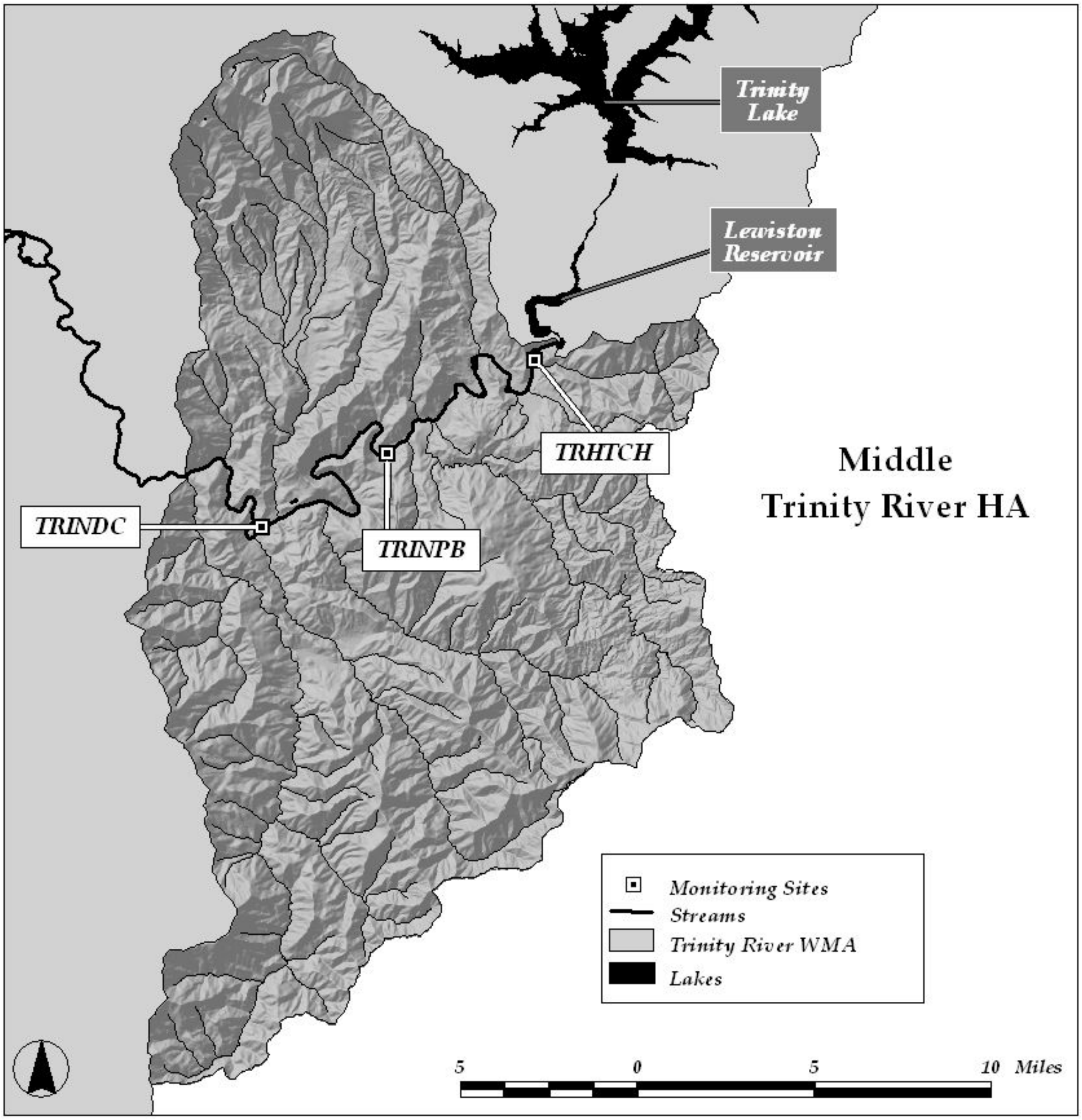

Figure 40. Sampling locations in the Middle Trinity River HA

In the Middle Trinity River HA, there were three sampling locations (see Figure 40). Table 20 lists the station names, locations, number of site visits, and sampling period. Station TRHTCH is a long-term trend monitoring site and had 15 site visits during the fiscal years of 2000-05. The other sampling locations are rotating basin sampling locations. There were a total of 20 site visits to these locations during the fiscal years of 2001-03. The site visits corresponded to Fall, Winter, Spring and Early Summer conditions.

During the site visits, the NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON) and trace metals concentrations (MET). The NCR did not analyze samples for pesticides and pesticide residues (PEST), PCBs (PCB), or phenolic compounds (PHEN) at these locations. Table 21 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the various criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 lists the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 21. Summary of sample types, sample numbers, and objective exceedances in the Middle Trinity River HA

		FP	CON	MET		PEST	PCB	PHEN
TRHTCH	# Sampling events	15	15	15	# Sampling events	0	0	0
	Total # Analytes	45	130	152	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	13	-	Quantifiable Concentrations	-	-	-
TRINPB	# Sampling events	10	10	10	# Sampling events	0	0	0
	Total # Analytes	30	85	109	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	12	1	Quantifiable Concentrations	-	-	-
TRINDC	# Sampling events	10	10	10	# Sampling events	0	0	0
	Total # Analytes	30	85	109	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	10	3	Quantifiable Concentrations	-	-	-

3.3.1.1. Field Parameters

Specific Conductivity, DO, and pH conditions at the time of sampling were all in compliance with the Basin Plan.

3.3.1.2. Conventional Water Quality Parameters

Ammonia-N, chloride, TDS, O-PO4, Total-P, sulfate, and hardness concentrations at the time of sampling were all in compliance with the Basin Plan, California and USEPA standards for drinking water, and the USEPA recommended criteria for freshwater aquatic life protection (see tables 4 and r for numeric criteria, objectives, and standards).

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criterion of 0.12 mg/L on 22 of 35 site visits (63% exceedance rate), with concentrations ranging from ND (MDL 0.005 mg/L) to 1.697 mg/L. The largest component of the total-N concentrations is nitrate-N.
- Chl-A concentrations exceeded the USEPA recommended concentration criterion value of 1.08 ug/L on 13 of 35 site visits (37% exceedance rate), with concentrations ranging from DNQ (RL 0.05 ug/L) to 3.30 ug/L.

3.3.1.3. Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 22.

- Arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations at station TRHTCH were in compliance with every objective at the time of sampling, but at stations TRINPB and TRINDC the concentrations potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on one of 20 site visits (10% exceedance rate at station TRINDC) and exceeded USEPA's secondary MCL for drinking water (50 ug/L) on four site visits (20% exceedance rate). Aluminum concentrations ranged from 8.38 to 154.00 ug/L at stations TRINPB and TRINDC and from 3.50 to 21.70 ug/L at station TRHTCH.

Table 22. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Middle Trinity River HA (ug/L).

	Basin Plan	**Drinking Water Standards - Maximum Contaminant Levels (MCLs)**			
	NCRWQCB	**Ca DHS**		**U.S. EPA**	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	0	0	0	-	4
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum [2]*	*CTS concentration [1]*	*24 hr avg*	*Maximum [2]*
Aluminum objective	-	-	87	-	750
Exceedances	-	-	1	-	0

[1] Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.
[2] Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.

3.3.2.______South Fork Trinity River HA

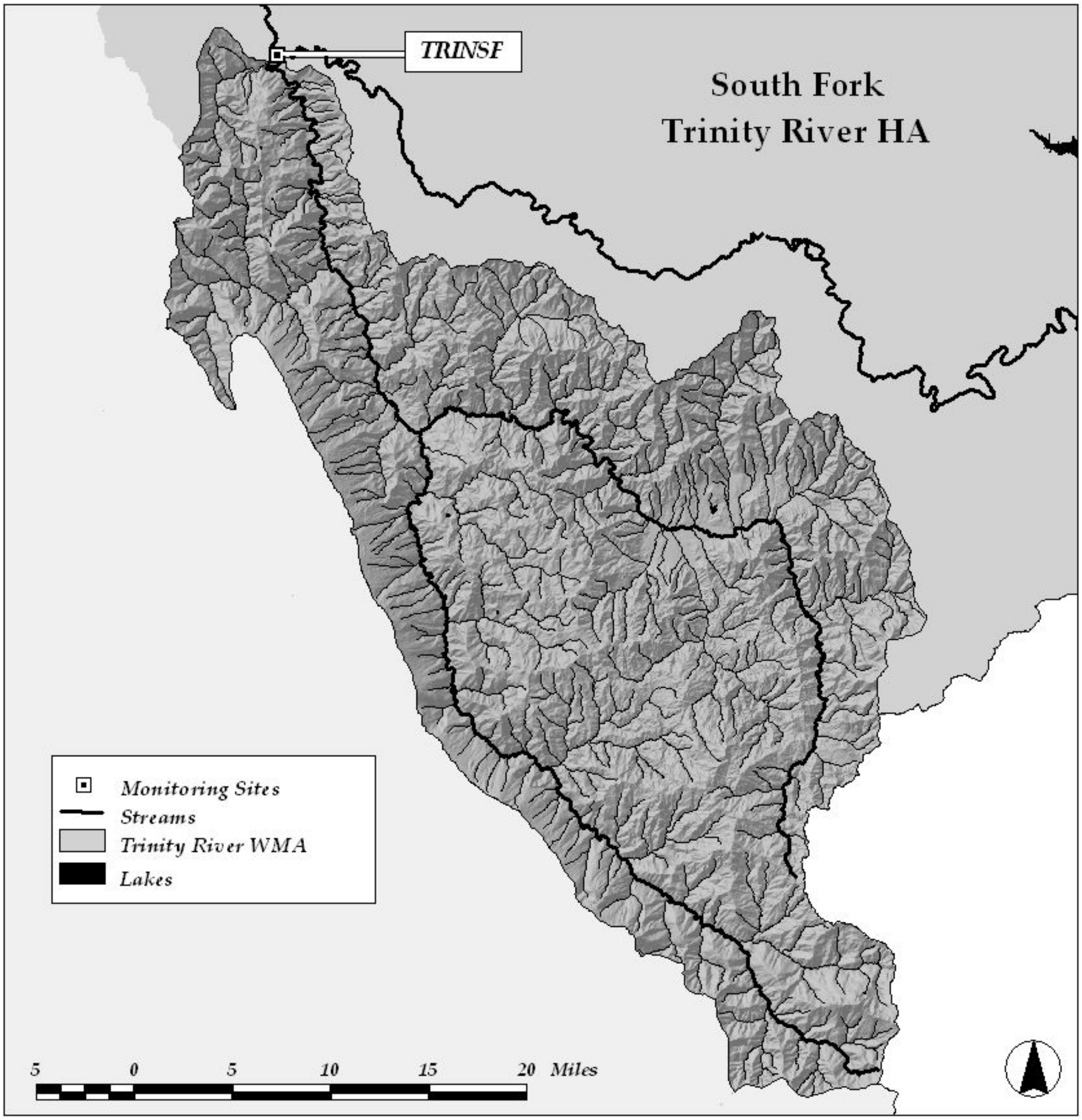

Figure 41. Sampling locations in the South Fork Trinity River HA

In the South Fork Trinity River HA, there was one sampling location (see Figure 41). Table 20 lists the station names, locations, number of site visits, and sampling period. Station TRINSF (South Fork Trinity River near Salyer) is located just upstream of the confluence with the mainstem Trinity River. There were a total of 15 site visits during the fiscal years of 2001-05. The site visits corresponded to Fall, Winter, Spring and Early Summer conditions.

During the site visits, the NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), PCBs (PCB), and phenolic compounds (PHEN). Table 23 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the various criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 lists the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 23. Summary of sample types, sample numbers, and objective exceedances in the South Fork Trinity River HA

		FP	CON	MET		PEST	PCB	PHEN
TRINSF	# Sampling events	15	15	15	# Sampling events	8	8	6
	Total # Analytes	45	130	163	Total # Analytes	750	400	12
	Exceedances	1	-	-	Detections	1	-	3
	Potential Exceedances	-	13	12	Quantifiable Concentrations	1	-	-

3.3.2.1. Field Parameters

Specific Conductivity, DO, and pH conditions at the time of sampling were all in compliance with the Basin Plan.

3.3.2.2. Conventional Water Quality Parameters

Ammonia-N, chloride, TDS, sulfate, total-P, and O-PO4 concentrations at the time of sampling were all in compliance with the Basin Plan, California and USEPA standards for drinking water, and the USEPA recommended criteria for freshwater aquatic life protection.

Hardness values did not fully meet the Basin Plan objective during all site visits. The Basin Plan objective for hardness is a 50% upper limit of 100 mg/L. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 100 mg/L. The observed hardness concentrations values ranged from 70.0 to 134.0 mg/L. Basin Plan compliance was not met in 2004. It is important to note that these results are based on two to three grab samples collected during the calendar years and are not a compilation of many samples used to calculate monthly means as the objective suggests.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criterion of 0.12 mg/L on eight of 15 site visits (53% exceedance rate), with concentrations ranging from ND (MDL 0.01 mg/L) to 0.386 mg/L. The largest component of the total-N concentrations is nitrate-N, with the exception of the maximum recorded value with a TKN concentration of 0.360 mg/L.
- Chl-A concentrations exceeded the USEPA recommended concentration criteria value of 1.08 ug/L on four of 15 site visits (27% exceedance rate), with concentration ranging from DNQ (RL 1.0 ug/L) to 6.61 ug/L.

3.3.2.3. Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 24.

- Arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on 10 of 15 site visits (67% exceedance rate), exceeded USEPA's secondary MCL for drinking water (50 ug/L) on 12 site visits (80% exceedance rate), and exceeded DHS's secondary MCL for drinking water (200 ug/L) on two site visits (2% exceedance rate). Aluminum concentrations ranged from 2.11 to 402.00 ug/L.

Table 24. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the South Fork Trinity River HA

	Basin Plan	Drinking Water Standards - Maximum Contaminant Levels (MCLs)			
	NCRWQCB	Ca DHS		U.S. EPA	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	0	0	2	-	12
	Freshwater Aquatic Life Protection				
	CTR		US EPA		
	CTS concentration [1]	*Maximum [2]*	*CTS concentration [1]*	*24 hr avg*	*Maximum [2]*
Aluminum objective	-	-	87	-	750
Exceedances	-	-	10	-	0

[1] *Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.*
[2] *Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.*

3.3.2.4. Pesticides, PCBs, and Phenols

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. There were no PCB detections, but there were two nonylphenol, one nonylphenolethoxylate, and one DDT (RL 0.005 ug/L, MDL 0.002 ug/L) pesticide detection.

The nonylphenols were detected in concentrations of DNQ (RL 2.0 ug/L). Nonylphenols are often found as breakdown products from surfactants and detergents. USEPA’s continuous concentration criterion for freshwater aquatic life protection for nonylphenol is 6.6 ug/L, therefore, these concentrations were in compliance.

DDT is a banned pesticide. USEPA’s continuous concentration criterion for freshwater aquatic life protection for DDT is 0.001 ug/L, therefore, this concentration is in exceedance of the objective (13% exceedance rate).

3.3.3.______Lower Trinity River HA

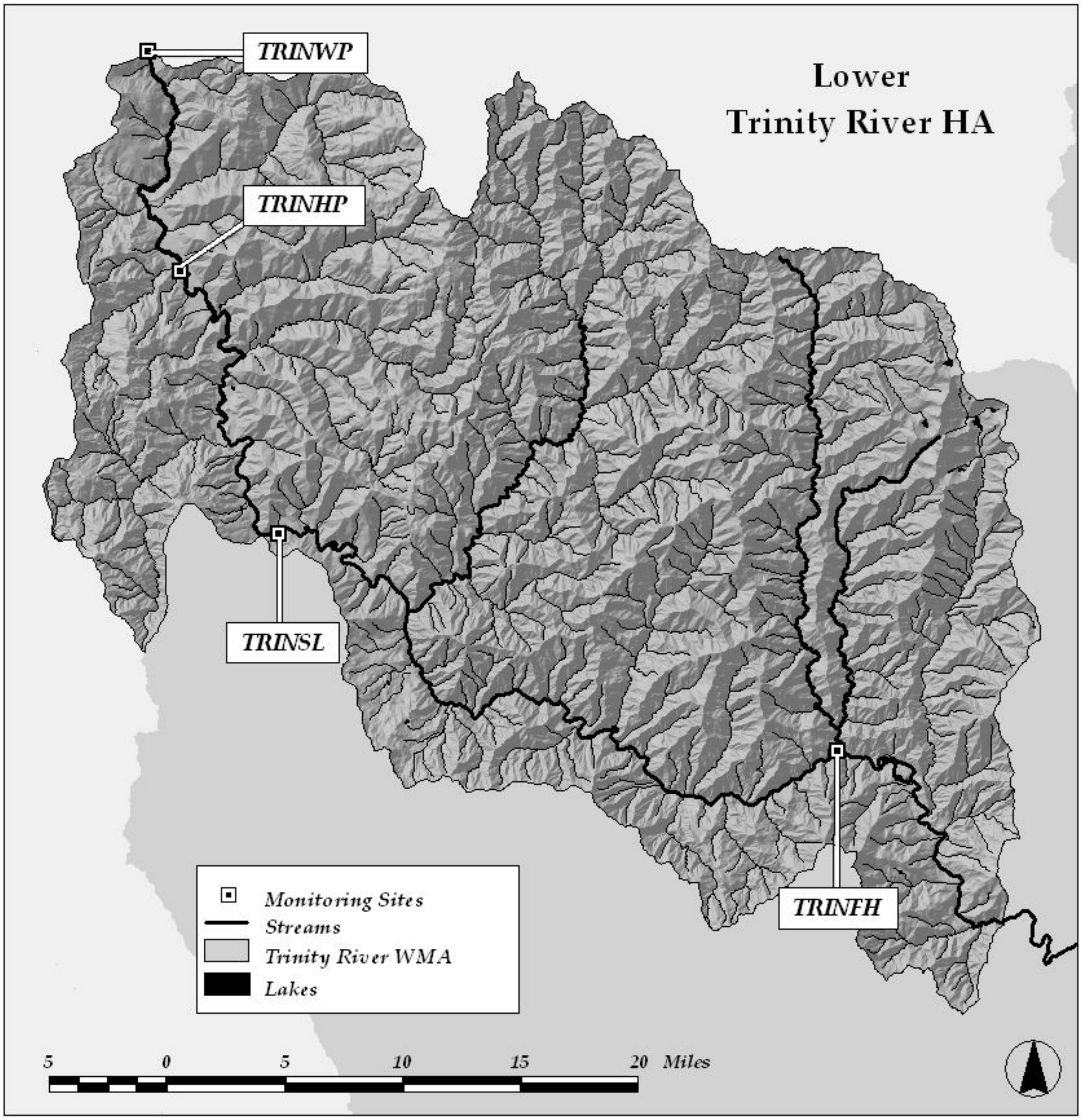

Figure 42. Sampling locations in the Lower Trinity River HA

In the Lower Trinity River HA, there were four sampling locations (see Figure 42). Table 20 lists the station names, locations, number of site visits, and sampling period. Station TRINHP is a long-term trend monitoring site and had 19 site visits during the fiscal years of 2000-05. The other stations are rotating basin sampling location and had 30 site visits during the fiscal years of 2001-03. The site visits corresponded to Fall, Winter, Spring and Early Summer conditions.

During the site visits, the NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), PCBs (PCB), and phenolic compounds (PHEN). Table 25 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the applicable criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 lists the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 25. Summary of sample types, sample numbers, and objective exceedances in the Lower Trinity River HA

		FP	CON	MET		PEST	PCB	PHEN
TRINFH	# Sampling events	10	10	10	# Sampling events	4	4	3
	Total # Analytes	30	85	110	Total # Analytes	369	200	6
	Exceedances	-	-	-	Detections	2	-	1
	Potential Exceedances	-	7	1	Quantifiable Concentrations	-	-	-
TRINSL	# Sampling events	10	10	10	# Sampling events	4	4	3
	Total # Analytes	30	85	110	Total # Analytes	369	200	6
	Exceedances	-	-	-	Detections	1	-	1
	Potential Exceedances	-	9	5	Quantifiable Concentrations	-	-	-
TRINHP	# Sampling events	10	10	10	# Sampling events	0	0	0
	Total # Analytes	30	85	109	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	12	8	Quantifiable Concentrations	-	-	-
TRINWP	# Sampling events	19	18	18	# Sampling events	0	0	0
	Total # Analytes	57	155	186	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	18	12	Quantifiable Concentrations	-	-	-

3.3.3.1.______Field Parameters

Specific Conductivity, DO, and pH conditions at the time of sampling were all in compliance with the Basin Plan.

3.3.3.2.______Conventional Water Quality Parameters

Ammonia-N, chloride, TDS, O-PO4, sulfate, and hardness concentrations at the time of sampling were all in compliance with the Basin Plan, the California and USEPA standards for drinking water, and the USEPA recommended criteria for freshwater aquatic life protection.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criterion of 0.12 mg/L on 29 of 48 site visits (60% exceedance rate), with concentrations ranging from 0.31 mg/L to 0.200 mg/L. The largest component of the total-N concentrations is nitrate-N.
- Total-P concentrations exceeded the USEPA's recommended concentration criteria of 0.10 mg/L on one of 28 site visits (4% exceedance rate), with concentrations ranging from ND (MDL 0.005 mg/L) to 0.120 mg/L.
- Chl-A concentrations exceeded the USEPA recommended concentration criterion of 1.08 ug/L on 16 of 47 site visits (34% exceedance rate), with concentrations ranging from ND (RL 0.045 ug/L) values to 3.43 ug/L.

3.3.3.3. Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 26.

- Arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations potentially exceeded USEPA's continuous concentration criterion for freshwater aquatic life protection (87 ug/L) on 17 of 48 site visits (35% exceedance rate), exceeded USEPA's secondary MCL for drinking water (50 ug/L) on 26 site visits (54% exceedance rate), and exceeded DHS's secondary MCL for drinking water (200 ug/L) on eight site visit (17% exceedance rate). Aluminum concentrations ranged from 2.86 to 488.00 ug/L.

Table 26. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Lower Trinity River HA (ug/L).

	Basin Plan	**Drinking Water Standards - Maximum Contaminant Levels (MCLs)**			
	NCRWQCB	**Ca DHS**		**U.S. EPA**	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	0	0	8	-	26
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	17	-	0

[1] *Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.*
[2] *Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.*

3.3.3.4.______Pesticides, PCBs, and Phenols

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. There were no PCB detections, but there was one nonylphenol, one nonylphenolethoxylate, and three pesticide detections.

The nonylphenols were detected in concentrations of DNQ (RL 2.0 ug/L). Nonylphenols are often found as a breakdown product from surfactants and detergents. USEPA's continuous concentration criterion for freshwater aquatic life protection for nonylphenol is 6.6 ug/L, therefore, the concentrations detected were in compliance.

There were three detections of three different pesticides. The detected pesticides were:

- Diazinon (RL 0.02 ug/L)
- Disulfoton (RL 0.002 ug/L)
- alpha-HCH (RL 0.002 ug/L)

All of the pesticides were detected in DNQ concentrations.

- Diazinon is a nonsystemic organophosphate insecticide removed from residential use in 2004. USEPA's continuous concentration criterion for freshwater aquatic life protection for Diazinon is 0.05 ug/L, therefore, the concentrations detected were in compliance.
- Disulfoton is a systemic organophosphate insecticide for which there is no objective.
- HCH (alpha-, delta-, and gamma isomers) is an EPA Severely Restricted Pesticide (Lindane) and is listed by the United Nations as a persistent organic pollutant

(POPs). The Basin Plan objective for Lindane is 0.004 mg/L, therefore, the concentrations detected are in compliance with the objective.

3.4.______Humboldt Bay WMA

There are four Hydrologic Units (HU) within the Humboldt Bay Watershed Management Area (WMA). The HUs are:

- Redwood Creek HU
- Trinidad HU
- Mad River HU
- Eureka Plan HU

Within the Humboldt Bay WMA, there were 11 sampling locations comprising two long-term trend monitoring stations and nine rotating basin sampling stations

Table 27. Humboldt Bay WMA station types, locations and sampling periods

Station ID	Station Type	Site Visits	Station Location	Sampling Time Period
Redwood Creek HU				
RDWDOR	Trend	23	Redwood Creek at Orick	3/2001 - 6/2006
Trinidad HU				
LITCRN	Rotating	2	Little River at Crannell	3/2002 - 6/2002
Mad River HU				
MADRUT	Rotating	4	Mad River at Ruth	2/2002 - 6/2002
MADBUT	Rotating	5	Mad River at Butler Valley	2/2002 - 6/2002
MADBLU	Trend	23	Mad River at Blue Lake below Hatchery	3/2001 - 6/2006
Eureka Plain HU				
ELKNFK	Rotating	4	North Fork Elk River	3/2002 - 6/2002
ELKSFK	Rotating	5	South Fork Elk River	2/2002 - 6/2002
ELKRIV	Rotating	5	Elk River at Fields Landing	2/2002 - 6/2002
FRESUP	Rotating	4	Upper Freshwater Creek	2/2002 - 6/2002
JACBAY	Rotating	5	Lower Jacoby Creek	2/2002 - 6/2002
SALHY1	Rotating	4	Salmon Creek at Highway 101	2/2002 - 6/2002

3.4.1.______Redwood Creek HU

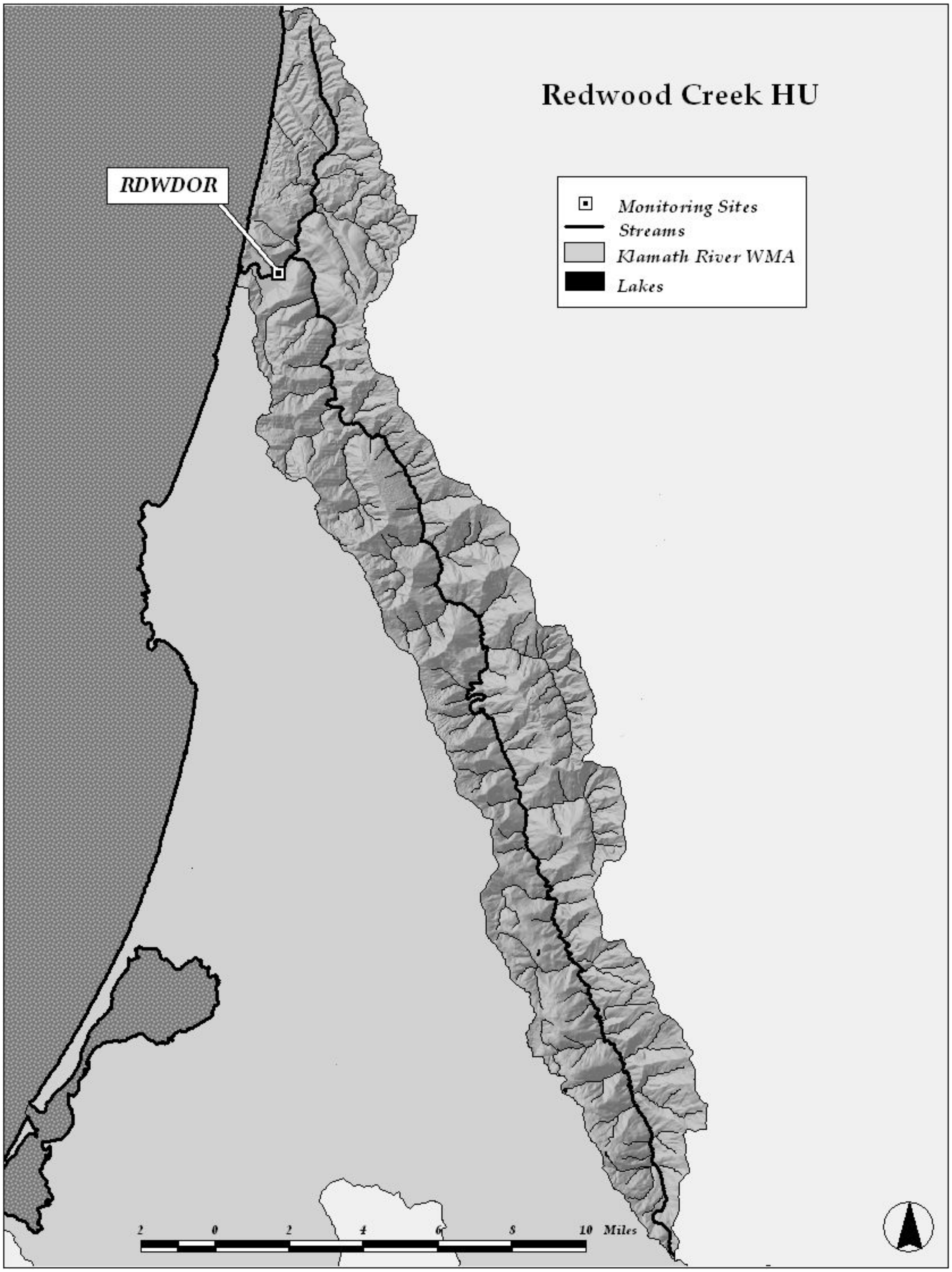

Figure 43. Sampling locations in the Redwood Creek HU

In the Redwood Creek HU, there was one sampling location (see Figure 43). Station RDWDOR (Redwood Creek at Orick), located in the town of Orick. This is a long-term trend monitoring site, and had 23 site visits during the fiscal years 2000-06 fiscal year (3/2001-6/2006). The site visits corresponded to Fall, Winter, Spring and Early Summer seasonal conditions.

During the 23 site visits, the NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), PCBs (PCB), and phenolic compounds (PHEN). Table 28 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the various criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 lists the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 28. Summary of sample types, sample numbers, and objective exceedances in the Redwood Creek HU

		FP	CON	MET		PEST	PCB	PHEN
RDWDOR	# Sampling events	23	23	23	# Sampling events	12	12	8
	Total # Analytes	69	200	240	Total # Analytes	1096	600	16
	Exceedances	1	-	-	Detections	2	-	3
	Potential Exceedances	1	28	14	Quantifiable Concentrations	-	-	-

3.4.1.1.______Field Parameters

Specific Conductivity and DO conditions at the time of sampling were all in compliance with the Basin Plan. pH values did not meet the Basin Plan objective on one of 23 site visits (4% exceedance rate). The Basin Plan objective for pH is a two-part objective with a minimum value of 7.0 and a maximum value of 8.5. The observed pH values ranged from 7.95 to 8.58. The minimum pH objective was met on all occasions, but the maximum Basin Plan objective was exceeded once on 2/1/2003 (8.58).

3.4.1.2.______Conventional Water Quality Parameters

Ammonia-N, chloride, TDS, hardness, and sulfate concentrations, at the time of sampling, were all in compliance with the Basin Plan, the California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criterion of 0.12 mg/L on 19 of 23 site visits (83% exceedance rate), with concentrations ranging from 0.041 to 0.504 mg/L. The largest component of the total-N concentrations was nitrate-N.
- Total-P concentrations exceeded the USEPA's recommended concentration criterion of 0.10 mg/L on one of 18 site visits (6% exceedance rate), with concentrations ranging from ND (MDL 0.03 mg/L) to 0.105 mg/L.
- O-PO4 concentrations exceeded the USEPA recommended concentration criterion of 0.05 mg/L on one of 22 site visits (5% exceedance rate), with concentrations ranging from ND (MDL 0.005 mg/L) to 0.97 mg/L.
- Chl-A concentrations exceeded the USEPA recommended concentration criterion value of 1.08 ug/L on six of 22 site visits (27% exceedance rate), with concentrations ranging from ND (MDL 0.045 ug/L) to 5.100 ug/L.

3.4.1.3. Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 29.

- Arsenic, cadmium, chromium, copper, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on 10 of 20 site visits (50% exceedance rate), exceeded USEPA's secondary MCL for drinking water (50 ug/L) on 12 site visits (60% exceedance rate), and exceeded DHS's secondary MCL for drinking water (200 ug/L) on five site visits (25% exceedance rate). Aluminum concentrations ranged from 14.90 to 502.00 ug/L.
- The California Toxics Rule (CTR) criterion to protect freshwater aquatic life for copper and lead is hardness dependent. Exceedance or compliance is determined through a calculation in which the total metals concentration and the hardness concentration are considered. Copper concentrations potentially exceeded the CTR continuous concentration criterion on one of 20 site visits (5% exceedance rate). Lead concentrations potentially exceeded the CTR continuous concentration criterion on one of 17 site visits (6% exceedance rate).

Table 29. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Redwood Creek HU (ug/L).

	Basin Plan	Drinking Water Standards - Maximum Contaminant Levels (MCLs)			
	NCRWQCB	Ca DHS		U.S. EPA	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	0	0	5	-	12
Copper Objective	-	1300	1000	1300	1000
Exceedances	-	0	0	0	0
Lead Objective	50	15	-	15	-
Exceedances	0	0	-	0	-
	Freshwater Aquatic Life Protection				
	CTR		US EPA		
	CTS concentration [1]	*Maximum [2]*	*CTS concentration [1]*	*24 hr avg*	*Maximum [2]*
Aluminum objective	-	-	87	-	750
Exceedances	-	-	10 [2]	0	0
Copper Objective	Hardness dependent [1]	Hardness dependent [1]	-	-	-
Exceedances	1	0	-	-	-
Lead Objective	Hardness dependent [1]	Hardness dependent [1]	Hardness dependent [1]	-	Hardness dependent [1]
Exceedances	1	0	9	-	0

[1] Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.
[2] Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.
[1] See Appendix C for graphs of these metals based on concentrations, hardness, and EPA criterion.

3.4.1.4.______Pesticides, PCBs, and Phenols

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. There were no PCB detections, but there were two nonylphenol, one nonylphenolethoxylate, and two pesticide detections during the site visits; DDE (RL 0.002 ug/L) in a 0.004 ug/L concentration and DDT (RL 0.005 ug/L, MDL 0.002 ug/L) in a DNQ concentration.

The nonylphenols were detected in concentrations of DNQ (RL 2.0 ug/L). Nonylphenols are often found as a breakdown product from surfactants and detergents. USEPA's continuous concentration criteria for freshwater aquatic life protection for nonylphenol is 6.6 ug/L, therefore, these concentrations were in compliance. DDT is a banned pesticide. DDE is a secondary breakdown product of DDT. USEPA's continuous concentration criterion for freshwater aquatic life protection for DDT is 0.001 ug/L, therefore, this concentration is in exceedance of the objective (8% exceedance rate).

3.4.2. Trinidad HU

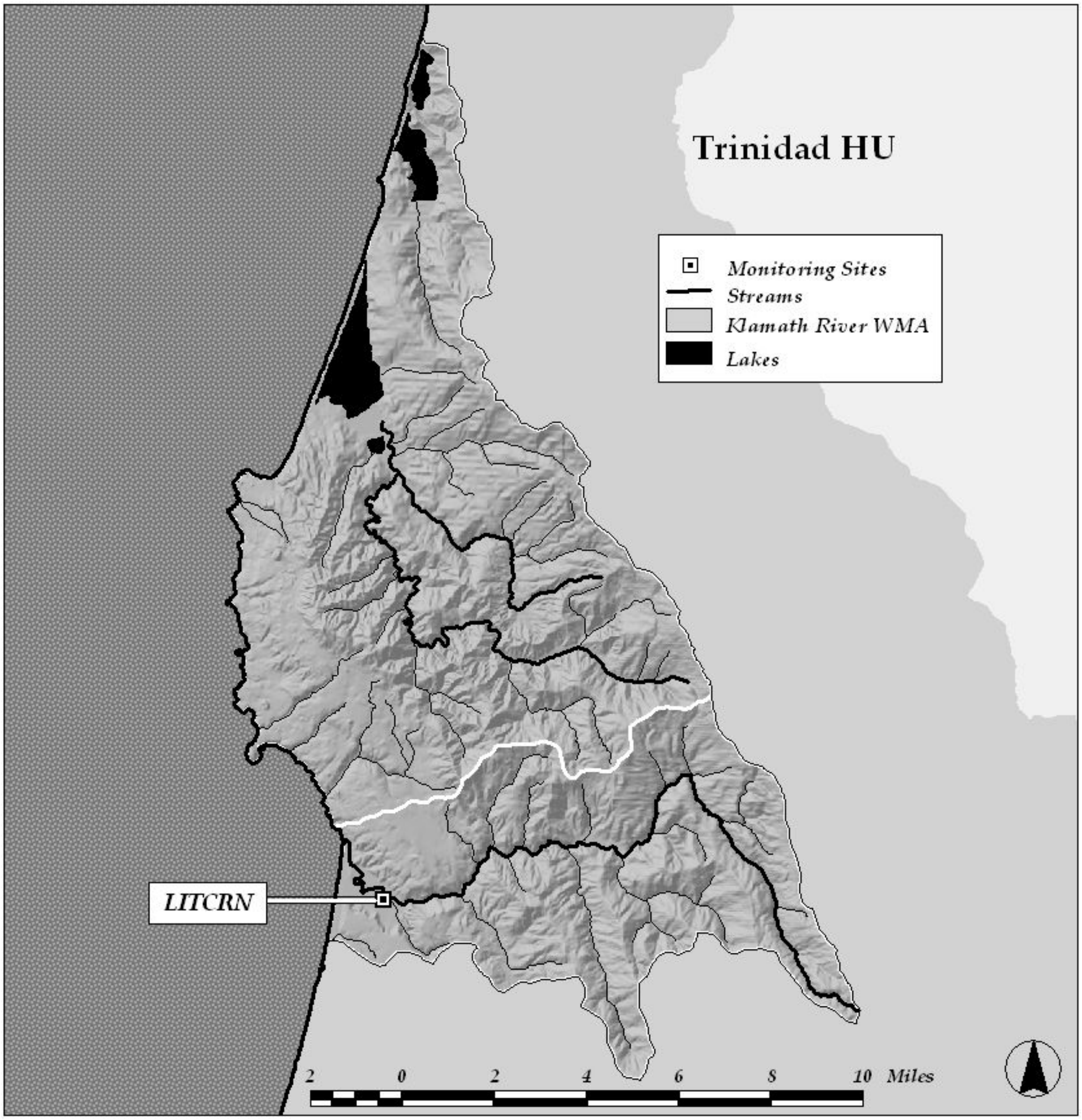

Figure 44. Sampling locations in the Trinidad HU

In the Trinidad HU, there was one sampling location (see Figure 44). Station LITCRN (Little River at Crannell) is located in the town of Crannell. This is a rotating basin sampling location and had two site visits during the 2001-02 fiscal year. The site visits corresponded to Spring and Early Summer seasonal conditions.

During the two site visits, the NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON) and trace metals concentrations (MET). The NCR did not analyze these samples for pesticides and pesticide residues (PEST), PCBs (PCB), or phenolic compounds (PHEN). Table 30 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances of the criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 list the numeric values for the criteria, objectives, and standards utilized in this report.

Table 30. Summary of sample types, sample numbers, and objective exceedances in the Trinidad HU – Little River

		FP	CON	MET		PEST	PCB	PHEN
LITCRN	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	16	22	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	4	2	Quantifiable Concentrations	-	-	-

3.4.2.1. Field Parameters

Specific Conductivity, DO, and pH conditions at the time of sampling were all in compliance with the Basin Plan.

3.4.2.2. Conventional Water Quality Parameters

Ammonia-N, chloride, TDS, hardness, O-PO4, total-P, and sulfate concentrations, at the time of sampling, were all in compliance with the Basin Plan, the California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criterion of 0.12 mg/L on both of the site visits (100% exceedance rate), with concentrations of 0.138 mg/L and 0.183 mg/L. The largest component of the total-N concentrations was nitrate-N.
- Chl-A concentrations exceeded the USEPA recommended concentration criterion value of 1.08 ug/L on both of the site visits (100% exceedance rate), with both concentrations in DNQ concentrations estimated to be 1.25 ug/L (MDL 0.5 ug/L, RL 2.0 ug/L).

3.4.2.3. Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 31.

- Arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on one of two site visits (50% exceedance rate) and exceeded USEPA's secondary MCL for drinking water (50 ug/L) on both site visits (100% exceedance rate). Aluminum concentrations ranged from 73.40 to 157.00 ug/L.

Table 31. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Trinidad HU – Little River (ug/L).

	Basin Plan	**Drinking Water Standards - Maximum Contaminant Levels (MCLs)**			
	NCRWQCB	**Ca DHS**		**U.S. EPA**	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	0	0	0	-	2
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	1	-	0

[1] *Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.*
[2] *Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.*

3.4.3.______Mad River HU

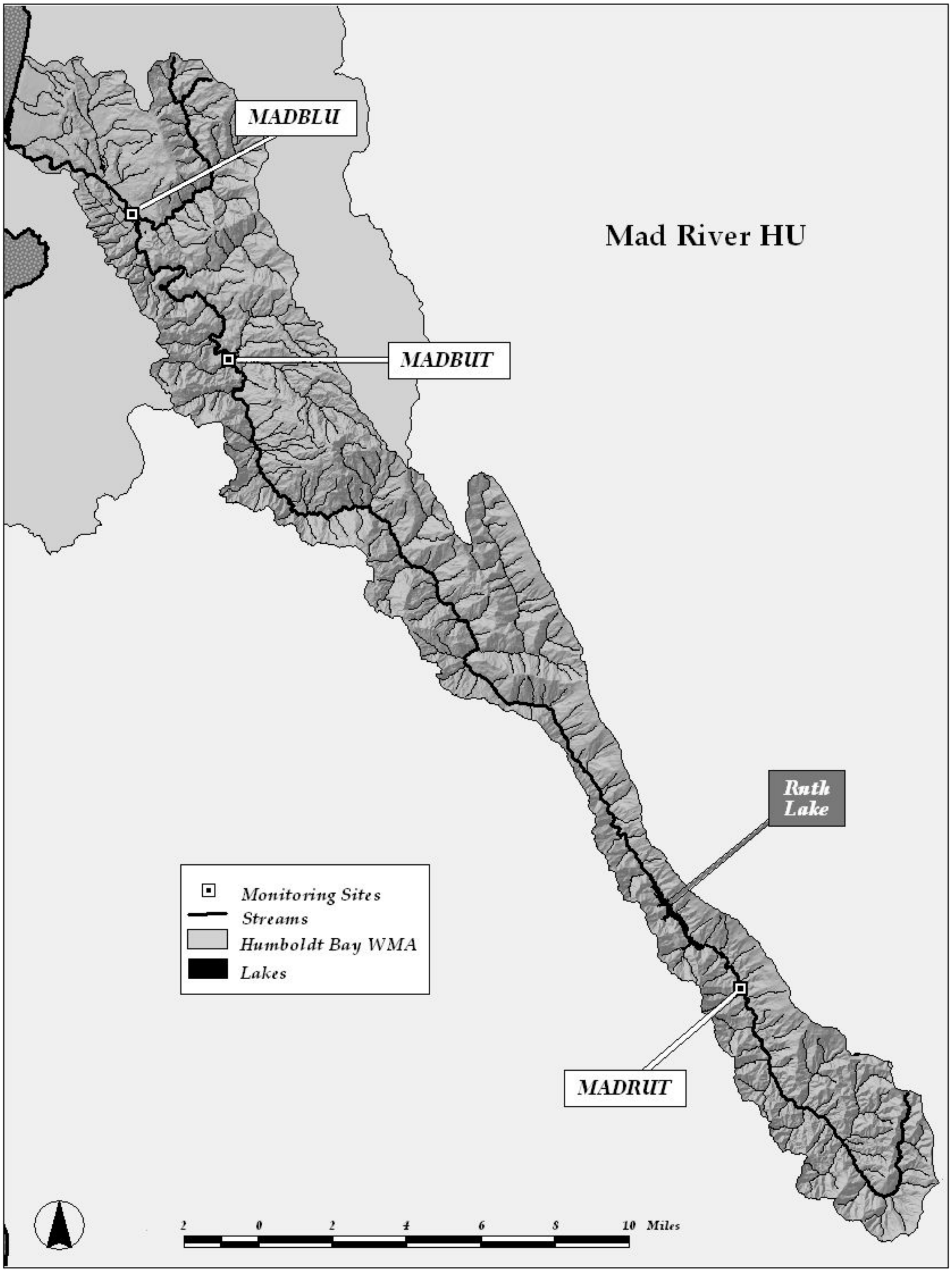

Figure 45. Sampling locations in the Mad River HU

In the Mad River HU, there were three sampling locations (see Figure 45). Table 27 lists the station names, locations, number of site visits, and sampling period. Station MADBLU is a long-term monitoring site and had 23 site visits during the fiscal years 2000-06 fiscal years (3/2001-6/2006). The other two sampling locations are rotating basin sampling locations. Nine site visits were made to these locations during the 2001-02 fiscal year. The site visits corresponded to Fall, Winter, Spring and Early Summer conditions.

3.4.3.1.____Mad River – Above Ruth Lake

During the four site visits, the NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON) and trace metals concentrations (MET). The NCR did not analyze samples for pesticides and pesticide residues (PEST), PCBs (PCB), or phenolic compounds (PHEN) at this location. Table 32 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the various criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 list the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 32. Summary of sample types, sample numbers, and objective exceedances in the Mad River HU - above Ruth Lake

		FP	CON	MET		PEST	PCB	PHEN
MADRUT	# Sampling events	4	4	4	# Sampling events	0	0	0
	Total # Analytes	12	32	44	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	6	1	Quantifiable Concentrations	-	-	-

3.4.3.1.1.____Field Parameters

Specific conductivity, DO, and pH conditions at the time of sampling were all in compliance with the Basin Plan.

3.4.3.1.2.____Conventional Water Quality Parameters

Ammonia-N, chloride, TDS, O-PO4, Total-P, hardness, and sulfate concentrations, at the time of sampling, were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criterion of 0.12 mg/L on all four site visits (100% exceedance rate), with concentrations of 0.430 mg/L and 0.487 mg/L.
- Chl-A concentrations exceeded the USEPA recommended concentration criterion value of 1.08 ug/L on two of four site visits (100% exceedance rate), with all concentrations in DNQ concentrations estimated to be between 0.75 ug/L and 1.5 ug/L (MDL 0.5 ug/L, RL 2.0 ug/L).

3.4.3.1.3. Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 33.

- Arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on one of four site visits (25% exceedance rate) and exceeded USEPA's secondary MCL for drinking water (50 ug/L) on one site visit. Aluminum concentrations ranged from 9.50 to 84.30 ug/L.

Table 33. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Mad River HU - above Ruth Lake (ug/L).

	Basin Plan	**Drinking Water Standards - Maximum Contaminant Levels (MCLs)**			
	NCRWQCB	**Ca DHS**		**U.S. EPA**	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	0	0	0	-	1
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	1	-	2

[1] *Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.*
[2] *Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.*

3.4.3.2.____Mad River – Below Ruth Lake

During the 28site visits, the NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), PCBs (PCB), and phenolic compounds (PHEN). Table 34 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 lists the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 34. Summary of sample types, sample numbers, and objective exceedances in the Mad River HU - below Ruth Lake

		FP	CON	MET		PEST	PCB	PHEN
MADBUT	# Sampling events	5	5	5	# Sampling events	0	0	0
	Total # Analytes	15	40	54	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	9	4	Quantifiable Concentrations	-	-	-
MADBLU	# Sampling events	23	23	23	# Sampling events	12	11	2
	Total # Analytes	68	200	240	Total # Analytes	1062	550	4
	Exceedances	2	-	2	Detections	3	-	-
	Potential Exceedances	-	23	14	Quantifiable Concentrations	1	-	-

3.4.3.2.1.____Field Parameters

Specific conductivity conditions at the time of sampling were all in compliance with the Basin Plan.

DO values did not meet the Basin Plan objective on one of 23 site visits (4% exceedance rate). The Basin Plan objective for DO is a two-part objective, with an absolute minimum of 7.0 mg/L and a 50% lower limit of 10.0 mg/L. This means that 50% or more of the monthly means in a calendar year must be greater than or equal to 10.0 mg/L. The observed DO values ranged from 6.13 to 14.03 mg/L. The observed concentrations did not meet the absolute minimum criterion on 4/22/2002 at station MADBLU (6.13 mg/L).

pH values did not meet the Basin Plan objective on one of 28 site visits (4% exceedance rate). The Basin Plan objective for pH is a two-part objective with a minimum value of 7.0 and a maximum value of 8.5. The observed pH values ranged from 7.95 to 8.93. The minimum pH objective was met on all occasions, but the maximum Basin Plan objective was exceeded on 10/1/2002 (8.93).

3.4.3.2.2.____Conventional Water Quality Parameters

Ammonia-N, chloride, hardness, and sulfate concentrations, at the time of sampling, were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection.

TDS fully met the Basin Plan objectives at station MADBUT, did not fully meet the Basin Plan objective during all site visits at station MADBLU. The Basin Plan objective for TDS is a two-part objective with a 50% upper limit of 90 mg/L and a 90% upper limit of 160 mg/L. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 90 mg/L and 90% or more of the monthly means within a calendar year must be less than or equal to 160 mg/L. The observed TDS concentrations at MADBLU ranged from 38 to 365 mg/L. The observed values met the 90% upper limit each year, but failed to meet the 50% upper limit in 2002 and 2004. It is important to note that these results are based on two to seven grab samples collected at each location during the calendar year and are not a compilation of many samples used to calculate monthly means as the objective suggests.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criterion of 0.12 mg/L on 20 of 28 site visits (71% exceedance rate), with concentrations ranging from DNQ (RL 0.010 mg/L) to 0.166 mg/L. The largest component of the total-N concentrations was nitrate-N.
- Total-P concentrations exceeded the USEPA's recommended concentration criterion of 0.10 mg/L on one of 18 site visits (6% exceedance rate), with concentration ranging from ND (MDL 0.03 mg/L) to 0.162 mg/L.
- O-PO4 concentrations exceeded the USEPA recommended concentration criterion of 0.05 mg/L on one of 27 site visits (4% exceedance rate), with concentrations ranging from ND (MDL 0.005 mg/L) to 0.060 mg/L.
- Chl-A concentrations exceeded the USEPA recommended concentration criterion value of 1.08 ug/L on eight of 27 site visits (30% exceedance rate), with concentrations ranging from ND (MDL 0.045 ug/L) to 2.590 ug/L.

3.4.3.2.3.____Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA

recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 35.

- Arsenic, cadmium, chromium, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on 17 of 25 site visits (68% exceedance rate), exceeded USEPA's secondary MCL for drinking water (50 ug/L) on 18 site visits (72% exceedance rate), exceeded DHS's secondary MCL for drinking water (200 ug/L) on 10 site visits (40% exceedance rate), exceeded USEPA's maximum instantaneous concentration for freshwater aquatic life protection (750 ug/L) on two site visits (8% exceedance rate), and exceeded the Basin Plan (1000 ug/L) on two site visits (8% exceedance rate). Aluminum concentrations ranged from 4.29 to 1738.00 ug/L.
- The California Toxics Rule (CTR) criterion to protect freshwater aquatic life for copper and lead is hardness dependent. Exceedance or compliance is determined through a calculation in which the total metals concentration and the hardness concentration are considered. Copper concentrations potentially exceeded the CTR continuous concentration criteria on one of 20 site visits (5% exceedance rate). Lead concentrations potentially exceeded the CTR continuous concentration criteria on one of 15 site visits (7% exceedance rate).

Table 35. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Mad River HU - below Ruth Lake (ug/L).

	Basin Plan	**Drinking Water Standards - Maximum Contaminant Levels (MCLs)**			
	NCRWQCB	**Ca DHS**		**U.S. EPA**	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	2	2	10	-	18
Copper Objective	-	1300	1000	1300	1000
Exceedances	-	0	0	0	0
Lead Objective	50	15	-	15	-
Exceedances	0	0	-	0	-
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum [2]*	*CTS concentration [1]*	*24 hr avg*	*Maximum [2]*
Aluminum objective	-	-	87	-	750
Exceedances	-	-	17 [2]	-	2
Copper Objective	Hardness dependent [1]	Hardness dependent [1]	-	-	-
Exceedances	1 [2]	0	-	-	-
Lead Objective	Hardness dependent [1]	Hardness dependent [1]	Hardness dependent [1]	-	Hardness dependent [1]
Exceedances	1	0	1	-	0

[1] *Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.*

[2] *Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.*

[1] *See Appendix C for graphs of these metals based on concentrations, hardness, and EPA criterion.*

3.4.3.2.4.____Pesticides, PCBs, and Phenols

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. There were no PCB or phenol detections, but there were three detections of two different pesticides. The detected pesticides were DDE (RL 0.002 ug/L, MDL 0.001 ug/L) in a DNQ concentration and a concentration of 0.004 ug/L, and DDT (RL 0.005 ug/L, MDL 0.002 ug/L) in a DNQ concentration. DDT is a banned pesticide. DDE is a secondary breakdown product of DDT. USEPA's continuous concentration criterion for freshwater aquatic life protection for DDT is 0.001 ug/L, therefore, the additive concentrations are in exceedance of the objective (17% exceedance rate).

3.4.4. Eureka Plain HU

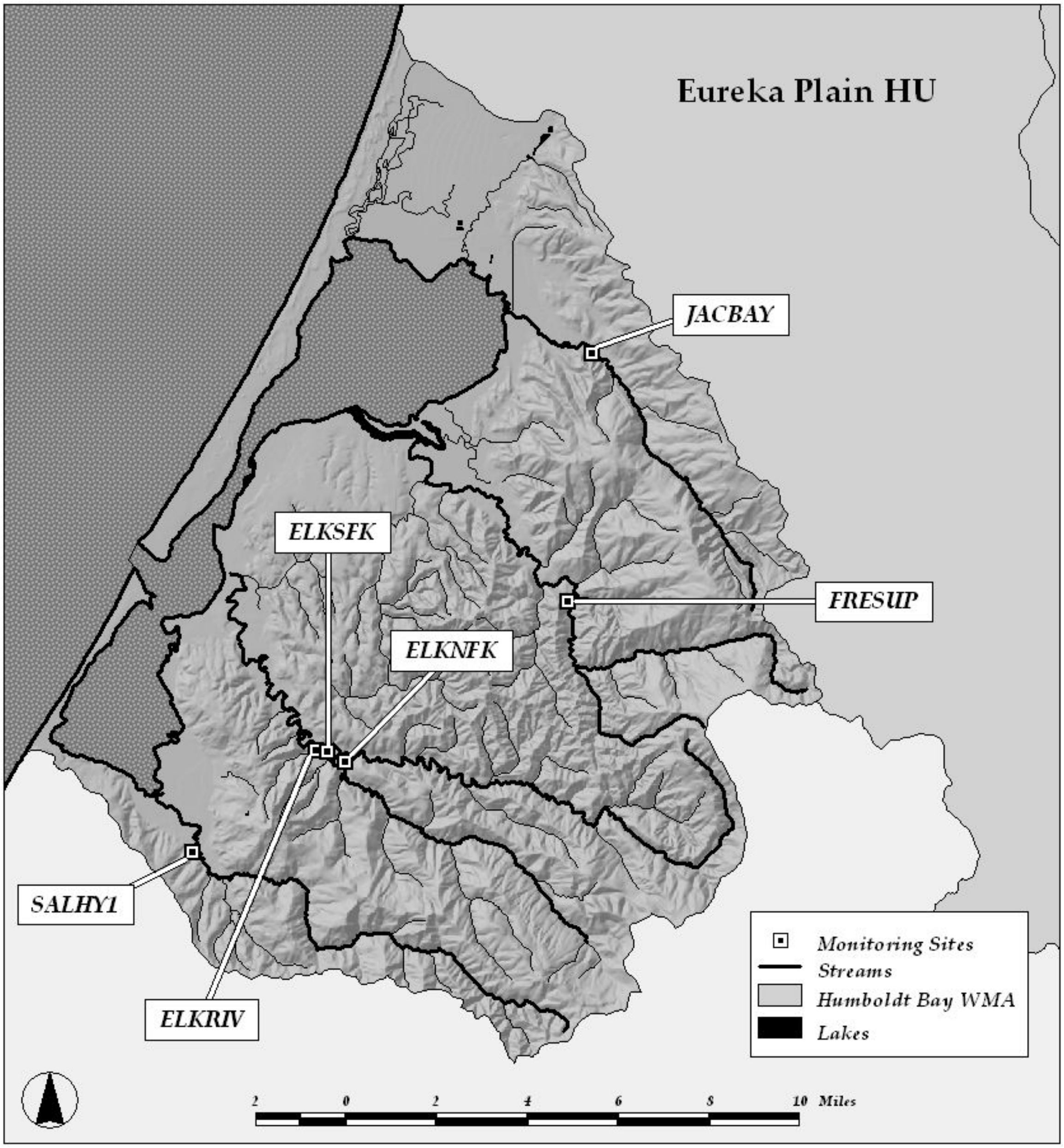

Figure 46. Sampling locations in the Eureka Plain HU

There are four Super Planning Watersheds (SPW) within the Eureka Plain HU. The SPWs are the Jacoby Creek SPW, Freshwater Creek SPW, Elk River SPW, and Salmon River SPW. Within the Eureka Plain HU, there were six sampling locations of which all were rotating basin sampling stations (see Figure 46). Table 27 lists the station names, locations, number of site visits, and sampling period. These stations had 27 site visits during the 2001-02 fiscal year. The site visits corresponded to Fall, Winter, Spring and Early Summer conditions.

During the 27 site visits, the NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON) and trace metals concentrations (MET). The NCR did not analyze samples for pesticides and pesticide residues (PEST), PCBs (PCB), or phenolic compounds (PHEN) at these locations. Table 36 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the various criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 list the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 36. Summary of sample types, sample numbers, and objective exceedances in the Eureka Plain HU

		FP	CON	MET		PEST	PCB	PHEN
ELKNFK	# Sampling events	4	4	4	# Sampling events	0	0	0
	Total # Analytes	12	32	44	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	8	3	Quantifiable Concentrations	-	-	-
ELKSFK	# Sampling events	5	5	5	# Sampling events	0	0	0
	Total # Analytes	15	40	55	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	9	4	Quantifiable Concentrations	-	-	-
ELKRIV	# Sampling events	5	5	5	# Sampling events	0	0	0
	Total # Analytes	15	40	55	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	10	5	Quantifiable Concentrations	-	-	-
FRESUP	# Sampling events	4	4	4	# Sampling events	0	0	0
	Total # Analytes	12	32	44	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	8	3	Quantifiable Concentrations	-	-	-
JACBAY	# Sampling events	5	5	5	# Sampling events	0	0	0
	Total # Analytes	15	40	50	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	9	3	Quantifiable Concentrations	-	-	-
SALHY1	# Sampling events	4	4	4	# Sampling events	0	0	0
	Total # Analytes	12	32	44	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	9	3	Quantifiable Concentrations	-	-	-

3.4.4.1. Field Parameters

Specific conductivity, DO, and pH conditions at the time of sampling were all in compliance with the Basin Plan.

3.4.4.2. Conventional Water Quality Parameters

Ammonia-N, chloride, TDS, hardness, Chl-A, and sulfate concentrations, at the time of sampling, were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. These stations were not analyzed for Total-P.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criterion of 0.12 mg/L on all 28 site visits (100% exceedance rate), with concentrations ranging from 0.441 to 0.5096 mg/L.
- O-PO4 concentrations exceeded the USEPA recommended concentration criterion of 0.05 mg/L on one of 28 site visits with concentrations ranging from DNQ values (RL 0.010 mg/L) to 0.060 mg/L. The only exceedance of the USEPA recommendations was recorded at station SALHY1 (25% exceedance rate).
- Chl-A concentrations exceeded the USEPA recommended concentration criterion value of 1.08 ug/L on two of four site visits (100% exceedance rate), with all concentrations in DNQ concentrations estimated to be between 0.75 ug/L and 10.3 ug/L (MDL 0.5 ug/L, RL of up to 20 ug/L).

3.4.4.3. Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The results from each of the SPWs was very similar. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 37.

- Arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.

- Aluminum concentrations potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on 17 of 27 site visits (63% exceedance rate), exceeded USEPA's secondary MCL for drinking water (50 ug/L) on 20 site visits (74% exceedance rate), exceeded DHS's secondary MCL for drinking water (200 ug/L) on 15 site visits (56% exceedance rate), and exceeded USEPA's maximum instantaneous concentration for freshwater aquatic life protection (750 ug/L) on one site visit (4% exceedance rate). Aluminum concentrations ranged from 15.70 to 810.00 ug/L.

Table 37. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Eureka Plain HU (ug/L).

	Basin Plan	**Drinking Water Standards - Maximum Contaminant Levels (MCLs)**			
	NCRWQCB	**Ca DHS**		**U.S. EPA**	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	0	0	16	-	21
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	18	-	1

[1] *Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.*
[2] *Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.*

3.4.5.____Trend Monitoring – Humboldt Bay WMA

For this report, we are only looking at general trends across sampling years. The long-term monitoring sites were chosen from both impaired and unimpaired waterbodies within each of the WMAs. This component of the SWAMP monitoring plan is designed to monitor water quality trends through time, allowing for the ongoing evaluation of improvements or degradation to water quality. The long-term monitoring sites are located at the bottom of large drainage areas and reflect the impacts of management activities occurring within the respective basins. The long-term sampling locations have had between 10 and 23 site visits over the course of two to five years, dependent upon the timing of station establishment. Each sampling effort was designed so that site visits in the same watershed occurred within the same one to three day period.

3.4.5.1.____Redwood Creek

3.4.5.1.1.____Field Parameters

Only Specific Conductivity and pH values were evaluated for the determination of trends. Specific Conductivity values at all stations varied by season, with the highest values recorded in the fall and the lowest values recorded in the winter. The recorded values remained within the same range throughout the period of record. pH values at this station did not exhibit a seasonal trend nor did the concentrations demonstrate any trend through the period of record.

3.4.5.1.2. Conventional Water Quality Parameters

Hardness, chloride, sulfate, and TDS concentrations at all stations varied by season, with the highest values recorded during the fall. There was no apparent trend in concentrations. The values remained within the same range throughout the period of record. Chl-A, Nitrate, Ortho-P, Total P, and TKN results did not exhibit a seasonal trend nor did the concentrations demonstrate any trend through the period of record.

3.4.5.1.3. Trace Metals

Aluminum, arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc concentrations at all stations varied by season, with the highest values recorded during the winter and spring and the lowest values recorded in the summer and fall. There was no apparent trend in the concentrations of any trace metals constituent; the values remained within the same range throughout the period of record.

3.4.5.2. Mad River

3.4.5.2.1. Field Parameters

Only Specific Conductivity and pH values were evaluated for the determination of trends. Specific Conductivity values at all stations varied by season, with the highest values recorded in the autumn and the lowest values recorded in the winter. The recorded values remained within the same range throughout the period of record. pH values at this station did not exhibit a seasonal trend nor did the concentrations demonstrate any trend through the period of record.

3.4.5.2.2. Conventional Water Quality Parameters

Hardness, sulfate, and TDS concentrations at all stations varied by season, with the highest values during the fall and the lowest concentrations in the spring. There was no apparent trend in concentrations, the values remained within the same range throughout the period of record. Chloride, Chl-A, Nitrate, Ortho-P, Total, P and TKN results did not exhibit a seasonal trend nor did the concentrations demonstrate any trend through the period of record.

3.4.5.2.3. Trace Metals

Aluminum, arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc concentrations at all stations varied by season, with the highest values for recorded during the winter and spring and the lowest values recorded in the summer and fall. There was no apparent yearly trend in the concentrations of any trace metals constituent, the values remained within the same range throughout the period of record.

3.5______Eel River WMA/HU

In California, there are seven Hydrologic Areas (HA) within the Klamath River Watershed Management Area/Hydrologic Unit (WMA/HU). The HAs are the:

- Upper Main Eel River HA
- Middle Fork Eel River HA
- North Fork Eel River HA
- Middle Main Eel River HA
- South Fork Eel River HA
- Lower Eel River HA
- Van Duzen River HA

Within the Eel River WMA are 16 sampling locations comprising nine long-term trend monitoring stations and seven rotating basin sampling stations.

Table 38. Eel River WMA station types, locations and sampling periods

Station ID	Station Type	Site Visits	Station Location	Sampling Time Period
Upper Main Eel River HA				
EELVAN	Trend	14	Eel River downstream of Van Arsdale Reservoir	2/2002 - 4/2005
EELHST	Rotating	5	Eel River near Hearst	2/2002 - 6/2002
EELMAN	Trend	22	Eel River above Dos Rios	3/2001 - 6/2006
Middle Fork Eel River HA				
MFKEEL	Trend	21	Middle Fork Eel River at Dos Rios	3/2001 - 6/2006
North Fork Eel River HA				
NFELMI	Trend	16	North Fork Eel River near Mina	4/2001 - 4/2005
Middle Main Eel River HA				
EELALD	Rotating	4	Eel River near Alder Point	3/2002 - 6/2002
EELMDV	Trend	23	Eel River above Dyerville	3/2001 - 6/2006
South Fork Eel River HA				
EELBRN	Trend	13	South Fork Eel River near Branscomb	2/2002 - 4/2005
EELBEN	Rotating	5	South Fork Eel River near Benbow	2/2002 - 6/2002
EELSFK	Trend	23	South Fork Eel River downstream of Bull Creek	3/2001 - 6/2006
Tributary to South Fork Eel River				
ELDRCR	Rotating	19	Elder Creek at Eel River	2/2002 - 6/2006
Lower Eel River HA				
EELHOL	Trend	15	Eel River at Holmes	2/2002 - 6/2005
Van Duzen River HA				
VANDIN	Rotating	5	Van Duzen River near Dinsmore	2/2002 - 6/2002
VANBRG	Rotating	5	Van Duzen River downstream of Yager Creek	2/2002 - 6/2002
VAN101	Rotating	2	Van Duzen River at Bridgeville	5/2002 - 6/2002
Tributary to Van Duzen River				
YAGCAR	Rotating	5	Yager Creek at Carlotta	2/2002 - 6/2002

3.5.1._____Upper Main Eel River HA

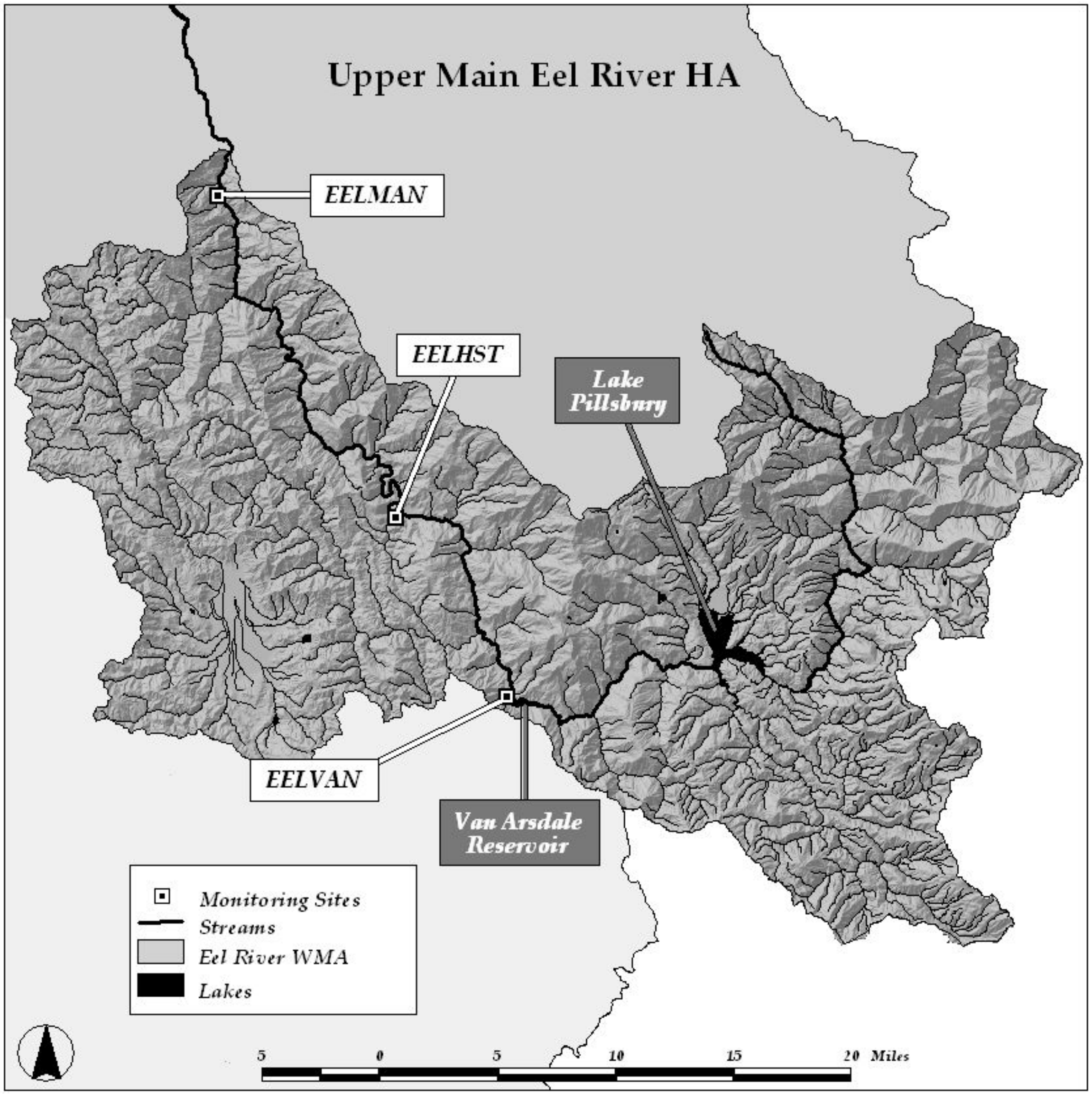

Figure 47. Sampling locations in the Upper Main Eel River HA

In the Upper Main Eel River HA were three sampling locations (see Figure 47). Table 38 lists the station names, descriptions, and locations. Station EELHST is a rotating basin sampling location, and had five site visits during the 2001-02 fiscal year. The other sampling locations are long-term trend monitoring sites. There were 36 site visits to these locations during fiscal years 2000-05. The site visits corresponded to Fall, Winter, Spring and Early Summer conditions.

During the 41 site visits, the NCR collected standard field parameters (FP) and grab samples for analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), PCBs (PCB), and phenolic compounds (PHEN). Table 39 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 list the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 39. Summary of sample types, sample numbers, and objective exceedances in the Upper Main Eel River HA

		FP	CON	MET		PEST	PCB	PHEN
EELVAN	# Sampling events	14	14	14	# Sampling events	9	9	3
	Total # Analytes	42	121	154	Total # Analytes	796	450	6
	Exceedances	-	-	-	Detections	2	13	-
	Potential Exceedances	-	18	7	Quantifiable Concentrations	-	-	-
EELHST	# Sampling events	5	5	5	# Sampling events	2	2	2
	Total # Analytes	15	40	55	Total # Analytes	171	100	8
	Exceedances	-	-	-	Detections	2	8	4
	Potential Exceedances	0	7	2	Quantifiable Concentrations	-	-	-
EELMAN	# Sampling events	22	22	22	# Sampling events	0	0	0
	Total # Analytes	66	191	230	Total # Analytes	-	-	-
	Exceedances	1	-	1	Detections	-	-	-
	Potential Exceedances	1	18	7	Quantifiable Concentrations	-	-	-

3.5.1.1.______Field Parameters

DO conditions at the time of sampling were all in compliance with the Basin Plan.

Specific conductivity did not fully meet the Basin Plan objective during all site visits. The Basin Plan objective for specific conductivity is a two-part objective with a 50% upper limit of 225 mS/cm2 and a 90% upper limit of 375 mS/cm2. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 225 mS/cm2 and 90% or more of the monthly means within a calendar year must be less than or equal to 375 mS/cm2. The observed specific conductivity values for 2001-06 ranged from 111 to 247 mS/cm2. The observed values met the 90% upper limit each year, but failed to meet the 50% upper limit at station EELMAN in 2004. It is important to note that these results are based on six grab samples collected during the calendar year and are not a compilation of many samples used to calculate monthly means as the objective suggests.

pH values did not meet the Basin Plan objective on one of 41 site visits (3% exceedance rate). The Basin Plan objective for pH is a two-part objective with a minimum value of 7.0 and a maximum value of 8.5. The observed pH values ranged from 7.67 to 8.73. The minimum pH objective was met on all occasions, but the maximum Basin Plan objective was exceeded on 6/18/2003 (8.73).

3.5.1.2. Conventional Water Quality Parameters

Ammonia-N, chloride, TDS, hardness, O-PO4, chlorophyll-A, and sulfate concentrations, at the time of sampling, were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criterion of 0.12 mg/L on 32 of 41 site visits (78% exceedance rate), with concentrations ranging from ND (MDL 0.005 mg/L) to 0.320 mg/L.
- Total-P concentrations exceeded the USEPA's recommended concentration criteria of 0.10 mg/L on one of 26 site visits (4% exceedance rate), with concentrations ranging from ND (MDL 0.03 mg/L) to 0.143 mg/L.
- Chl-A concentrations exceeded the USEPA recommended concentration criterion value of 1.08 ug/L on ten of 40 site visits (25% exceedance rate), with concentrations ranging from ND (MDL 0.50 ug/L) to an DNQ concentrations estimated to be 3.6 ug/L (RL up to 6.70 ug/L).

3.5.1.3. Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 40.

- Arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on 15 of 38 site visits (39% exceedance rate), exceeded USEPA's secondary MCL for drinking water (50 ug/L) on 17 site visits (45% exceedance rate), exceeded DHS's secondary MCL for drinking water (200 ug/L) on seven site visits (18% exceedance rate), exceeded USEPA's maximum instantaneous concentration for freshwater aquatic life protection (750 ug/L) on one site visit (3% exceedance rate), and exceeded the Basin Plan (1000 ug/L) on one site visit (3% exceedance rate). Aluminum concentrations ranged from 4.29 to 1737.00 ug/L.

Table 40. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Upper Main Eel River HA (ug/L).

	Basin Plan	Drinking Water Standards - Maximum Contaminant Levels (MCLs)			
	NCRWQCB	Ca DHS		U.S. EPA	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	1	1	7	-	17
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	15	-	1

[1] Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.
[2] Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.

3.5.1.4.______Pesticides, PCBs, and Phenols

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. There was one pentachlorophenol detection (RL 0.001 ug/L), three tetrachlorophenol detections (RL 0.002 ug/L), 21 PCB detections, and four pesticide detections.

All of the phenols were detected in DNQ concentrations. Pentachlorophenol and tetrachlorophenol are wood preservatives. USEPA's continuous concentration criteria for freshwater aquatic life protection for pentachlorophenol is pH dependent, of which no samples exceeded USEPA's recommendations. There is no objective for tetrachlorophenol.

Thirteen PCB detections were at station EELVAN on one site visit, and eight detections were at station EELHST on one site visit. The detections were all DNQ values (RL 0.001 ug/L). PCBs are a banned substance. USEPA's continuous concentration criteria for freshwater aquatic life protection for PCB is 0.014 ug/L, therefore, the maximum additive concentration of less than 0.013 ug/L is in compliance.

There were four detections of two different pesticides. The detected pesticides were Dimethoate (RL 0.05 ug/L) and Endosulfan-sulfate (RL 0.002 ug/L). Both of the pesticides were detected in DNQ concentrations.

- Dimethoate is an organophosphate insecticide, for which there is no objective.
- Endosulfan-sulfate is an organochlorine insecticide. USEPA's 24-hour average concentration criteria for freshwater aquatic life protection for Endosulfan-sulfate is 0.056 ug/L, therefore, these concentrations are in compliance.

3.5.2.______Middle Fork Eel River HA

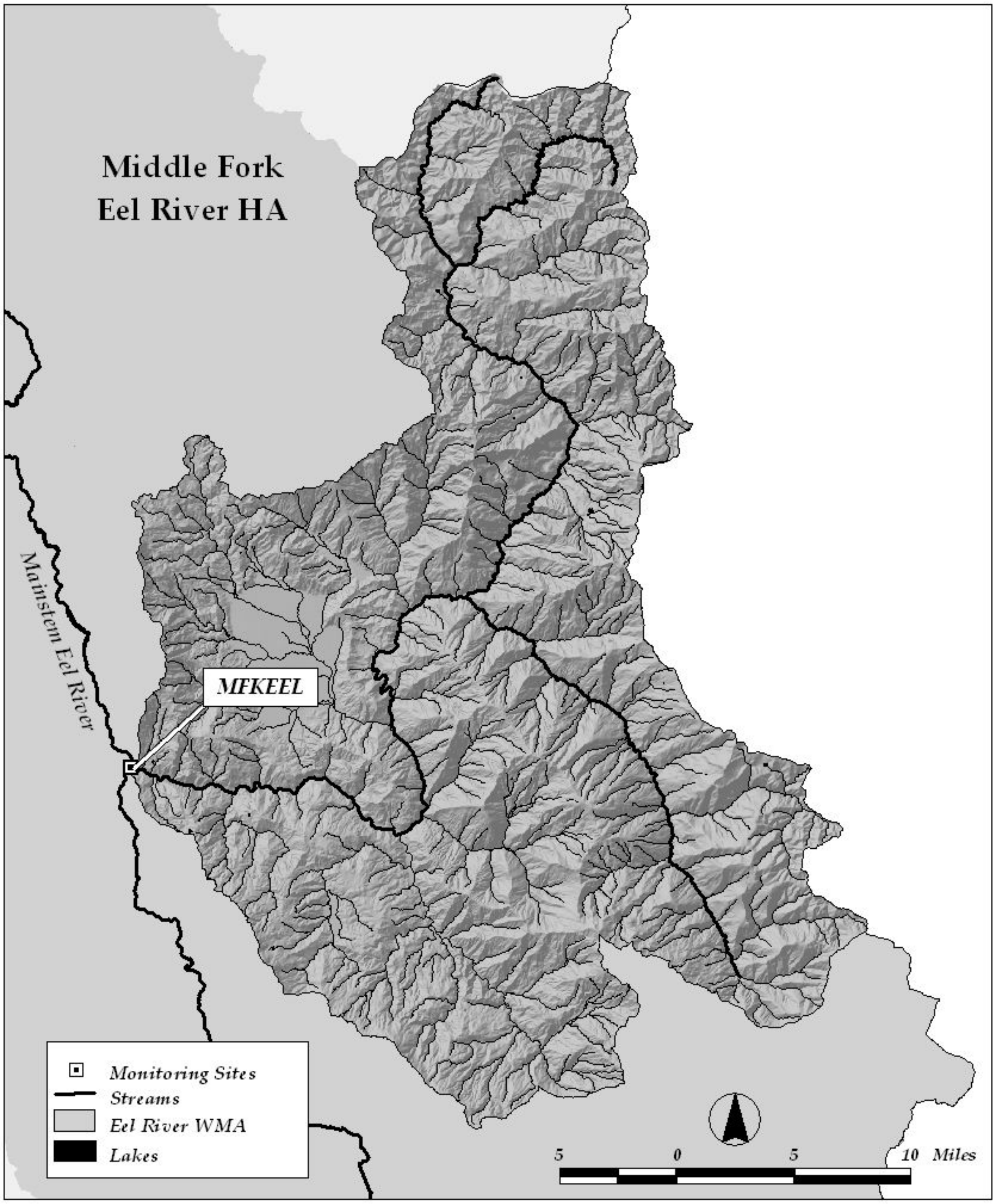

Figure 48. Sampling locations in the Middle Fork Eel River HA

The Middle Fork Eel River HA contains one sampling location (see Figure 48). Station MFKEEL (Middle Fork Eel River at Dos Rios) is located on the Middle Fork Eel River upstream of the confluence with the Eel River mainstem. This is a long-term trend monitoring site and had 21 site visits during the 2000-06 fiscal years. The site visits corresponded to Fall, Winter, Spring and Early Summer seasonal conditions.

During the 21 site visits, NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON) and trace metals concentrations (MET). The NCR did not analyze samples for pesticides and pesticide residues (PEST), PCBs (PCB), or phenolic compounds (PHEN) at this location. Table 41 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances of criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 list the numeric values for the criteria, objectives, and standards utilized in this report.

Table 41. Summary of sample types, sample numbers, and objective exceedances in the Middle Fork Eel River HA

		FP	CON	MET		PEST	PCB	PHEN
MFKEEL	# Sampling events	21	21	21	# Sampling events	0	0	0
	Total # Analytes	63	182	219	Total # Analytes	-	-	-
	Exceedances	2	-	3	Detections	-	-	-
	Potential Exceedances	2	18	7	Quantifiable Concentrations	-	-	-

3.5.2.1. Field Parameters

DO conditions at the time of sampling were all in compliance with the Basin Plan.

Specific conductivity did not fully meet the Basin Plan objective during all site visits. The Basin Plan objective for specific conductivity is a two-part objective with a 50% upper limit of 200 mS/cm2 and a 90% upper limit of 450 mS/cm2. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 200 mS/cm2 and 90% or more of the monthly means within a calendar year must be less than or equal to 450 mS/cm2. The observed specific conductivity values for 2001-06 ranged from 92 to 376. The observed values met the 90% upper limit each year, but failed to meet the 50% upper limit in 2004. It is important to note that these results are based on two grab samples collected during the calendar year and are not a compilation of many samples used to calculate monthly means as the objective suggests. Therefore, a more detailed investigation is required to fully understand and document whether compliance or impairment of water quality objectives is occurring at this site.

pH values did not meet the Basin Plan objective on two of 21 site visits (10% exceedance rate). The Basin Plan objective for pH is a two-part objective with a minimum value of 7.0 and a maximum value of 8.5. The observed pH values ranged from 7.80 to 8.64. The minimum pH objective was met on all occasions, but the maximum Basin Plan objective was exceeded on 10/5/2004 (8.57) and on 4/19/2005 (8.64).

3.5.2.2. Conventional Water Quality Parameters

Ammonia-N, chloride, hardness, O-PO4, chlorophyll-A, and sulfate concentrations, at the time of sampling, were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection.

TDS did not fully meet the Basin Plan objective during all site visits. The Basin Plan objective for TDS is a two-part objective with a 50% upper limit of 130 mg/L and a 90% upper limit of 230 mg/L. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 130 mg/L and 90% or more of the monthly means within a calendar year must be less than or equal to 230 mg/L. The observed TDS concentrations ranged from 65 to 218 mg/L. The observed values met the 90% upper limit each year, but failed to meet the 50% upper limit in 2004. It is important to note that these results are based on one grab sample collected at each location during the calendar year and are not a compilation of many samples used to calculate monthly means as the objective suggests.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criteria of 0.12 mg/L on three of 18 site visits (17% exceedance rate), with concentrations ranging from ND (MDL 0.005 mg/L) to 0.300 mg/L.
- Total-P concentrations exceeded the USEPA's recommended concentration criteria of 0.10 mg/L on two of 16 site visits (13% exceedance rate), with concentrations ranging from ND (MDL 0.03 mg/L) to 0.199 mg/L.
- O-PO4 concentrations exceeded the USEPA recommended concentration criterion of 0.05 mg/L on one of 21 site visits (5% exceedance rate), with concentrations ranging from ND values (MDL 0.005 mg/L) to 0.060 mg/L
- Chl-A concentrations exceeded the USEPA recommended concentration criterion value of 1.08 ug/L on two of 20 site visits (10% exceedance rate), with with concentrations ranging from ND values (MDL 0.045 ug/L) to DNQ concentrations estimated to be 2.30 ug/L (RL of up to 4.0 ug/L).

3.5.2.3. Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA

recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 42.

- Arsenic, cadmium, chromium, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations potentially exceeded USEPA’s continuous concentration for freshwater aquatic life protection (87 ug/L) on six of 18 site visits (33% exceedance rate), exceeded USEPA’s secondary MCL for drinking water (50 ug/L) on eight site visits (44% exceedance rate), exceeded DHS’s secondary MCL for drinking water (200 ug/L) on six site visits (33% exceedance rate), exceeded USEPA’s maximum instantaneous concentration for freshwater aquatic life protection (750 ug/L) on two site visits (11% exceedance rate), and exceeded the Basin Plan (1000 ug/L) on two site visits (11% exceedance rate). Aluminum concentrations ranged from 5.78 to 2548.00 ug/L.
- The California Toxics Rule (CTR) criterion to protect freshwater aquatic life for copper and lead is hardness dependent. Exceedance or compliance is determined through a calculation in which the total metals concentration and the hardness concentration are considered. Copper concentrations exceeded the CTR maximum concentration criteria on one of 19 site visits (5% exceedance rate). Lead concentrations potentially exceeded the CTR continuous concentration criteria on one of 10 site visits (10% exceedance rate).

Table 42. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Middle Fork Eel River HA (ug/L).

	Basin Plan	**Drinking Water Standards - Maximum Contaminant Levels (MCLs)**			
	NCRWQCB	**Ca DHS**		**U.S. EPA**	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	2	2	6	-	8
Copper Objective	-	1300	1000	1300	1000
Exceedances	-	0	0	0	0
Lead Objective	50	15	-	15	-
Exceedances	0	0	-	0	-

	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	6	-	2
Copper Objective	Hardness dependent [1]	Hardness dependent [1]	-	-	-
Exceedances	1	1	-	-	-
Lead Objective	Hardness dependent [1]	Hardness dependent [1]	Hardness dependent [1]	-	Hardness dependent [1]
Exceedances	1	0	1	-	0

[1] Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.
[2] Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.
[1] See Appendix C for graphs of these metals based on concentrations, hardness, and EPA criterion.

3.5.3. North Fork Eel River HA

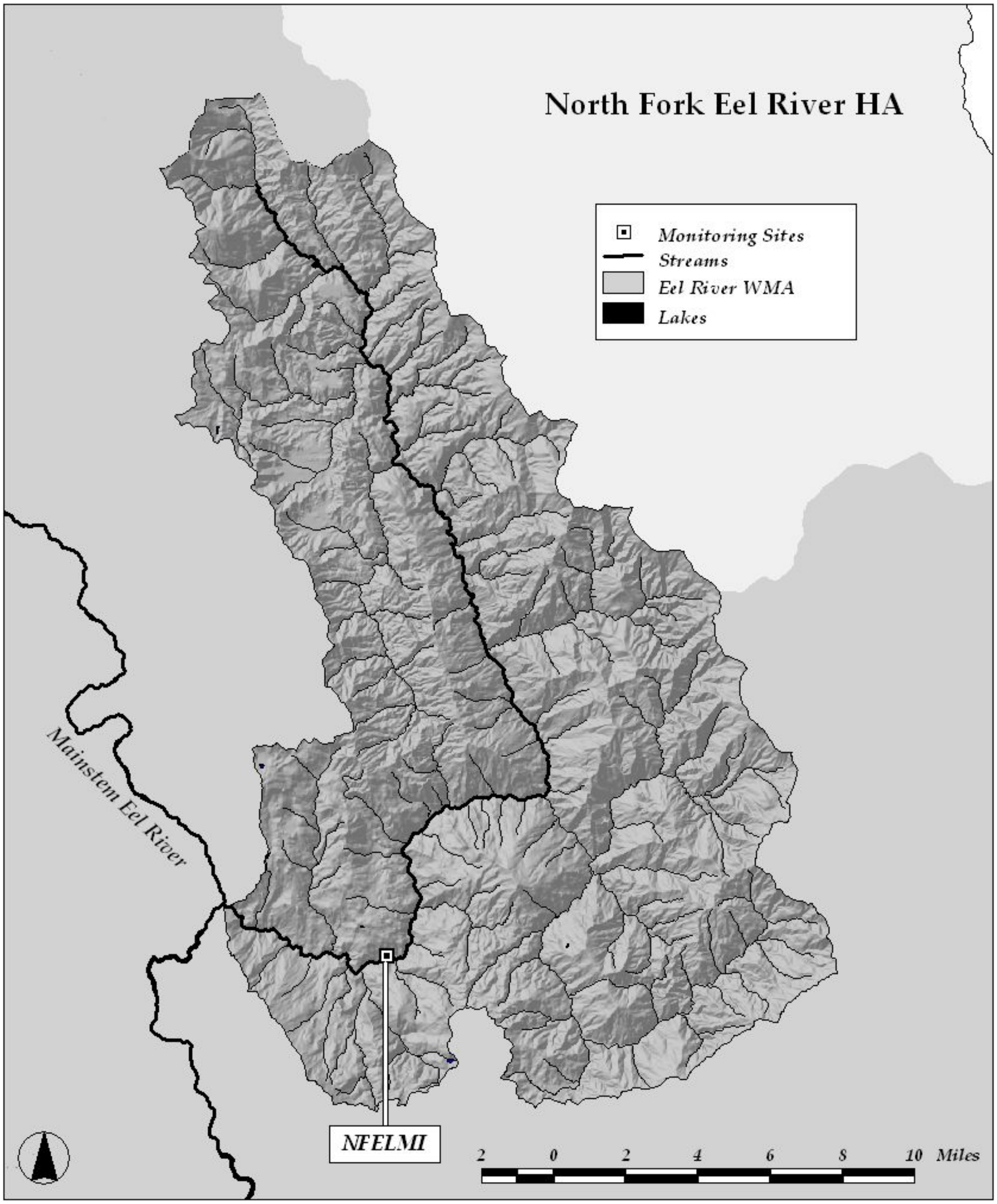

Figure 49. Sampling locations in the North Fork Eel River HA

In the North Fork Eel River HA, there was one sampling location (see Figure 49). Station NFELMI (North Fork Eel River at Mina) is located approximately 6.5 river miles upstream of the confluence of the North Fork Eel River and the Eel River mainstem. This is a long-term trend monitoring site and had 16 site visits during the 2000-05 fiscal years. The site visits corresponded to Fall, Winter, Spring and Early Summer seasonal conditions.

During the 16 site visits, the NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), and phenolic compounds (PHEN). The NCR did not analyze samples from this location for PCBs (PCB). Table 43 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances of criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 lists the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 43. Summary of sample types, sample numbers, and objective exceedances in the North Fork Eel River HA

		FP	CON	MET		PEST	PCB	PHEN
NFELMI	# Sampling events	16	16	16	# Sampling events	5	0	5
	Total # Analytes	48	137	168	Total # Analytes	65	-	10
	Exceedances	1	-	1	Detections	-	-	2
	Potential Exceedances	-	14	4	Quantifiable Concentrations	-	-	1

3.5.3.1.______Field Parameters

Specific conductivity and DO conditions at the time of sampling were all in compliance with the Basin Plan.

pH values did not meet the Basin Plan objective on one of 16 site visits (6% exceedance rate). The Basin Plan objective for pH is a two-part objective with a minimum value of 7.0 and a maximum value of 8.5. The observed pH values ranged from 7.81 to 8.61. The minimum pH objective was met on all occasions, but the maximum Basin Plan objective was exceeded on 10/5/2004 (8.61).

3.5.3.2.______Conventional Water Quality Parameters

Ammonia-N, chloride, TDS, hardness, O-PO4, total-P, and sulfate concentrations, at the time of sampling, were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, California Toxics Rule (CTR) and the USEPA recommended criteria for freshwater aquatic life protection.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criteria of 0.12 mg/L on ten of 16 site visits (63% exceedance rate), with concentrations ranging from ND (MDL 0.005 mg/L) to 0.846 mg/L.
- Chl-A concentrations exceeded the USEPA recommended concentration criteria value of 1.08 ug/L on four of 15 site visits (27% exceedance rate), with concentrations ranging from ND (MDL 0.045 ug/L) to 4.600 ug/L.

3.5.3.3. Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 44.

- Arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on five of 14 site visits (36% exceedance rate), exceeded USEPA's secondary MCL for drinking water (50 ug/L) on five site visits (36% exceedance rate), exceeded DHS's secondary MCL for drinking water (200 ug/L) on three site visits (21% exceedance rate), exceeded USEPA's maximum instantaneous concentration for freshwater aquatic life protection (750 ug/L) on one site visit (7% exceedance rate), and exceeded the Basin Plan (1000 ug/L) on one site visit (7% exceedance rate). Aluminum concentrations ranged from 2.41 to 1159.00 ug/L.

Table 44. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the North Fork Eel River HA (ug/L).

	Basin Plan	Drinking Water Standards - Maximum Contaminant Levels (MCLs)			
	NCRWQCB	Ca DHS		U.S. EPA	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	1	1	3	-	5
	Freshwater Aquatic Life Protection				
	CTR		US EPA		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	5	-	1

[1] *Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.*
[2] *Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.*

3.5.3.4.______Pesticides, PCBs, and Phenols

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. Pesticides were not detected and we did not sample for PCBs. Two nonylphenol detections were observed during the five site visits. Nonylphenol was detected in a DNQ concentration and at a concentration of 2.88 ug/L. Nonylphenol is often found as a breakdown product from surfactants and detergents. USEPA's continuous concentration criterion for freshwater aquatic life protection for nonylphenol is 6.6 ug/L, therefore, these concentrations were in compliance.

3.5.4. Middle Main Eel River HA

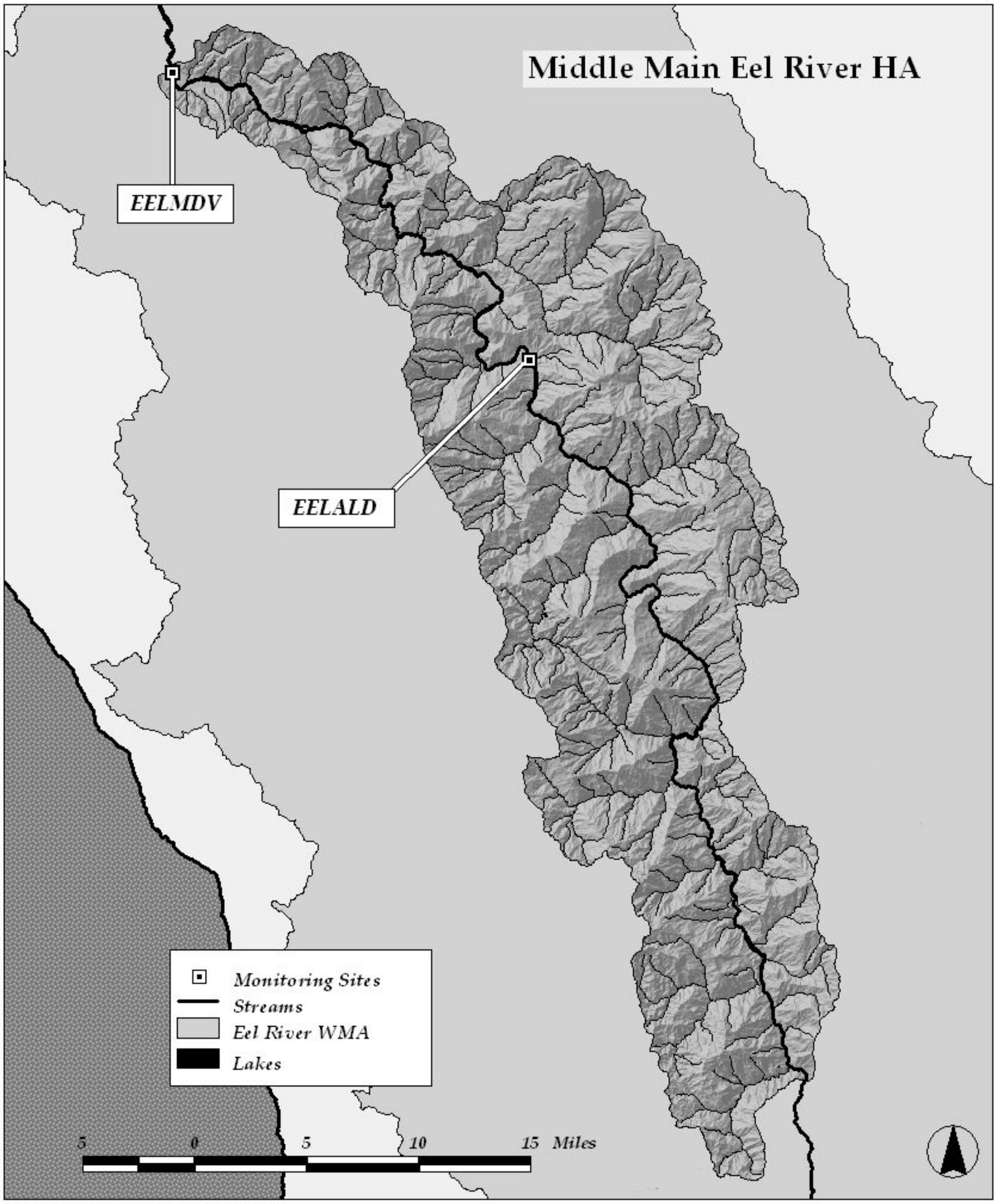

Figure 50. Sampling locations in the Middle Main Eel River HA

In the Middle Main Eel River HA there were two sampling locations (see Figure 50). Table 38 lists the station names, descriptions, and locations. Station EELALD is a rotating basin sampling location, and had four site visits during the 2001-02 fiscal year. Station EELMDV is a long-term trend monitoring site, and had 23 site visits to these locations during the fiscal years of 2000-06. The site visits corresponded to Fall, Winter, Spring and Early Summer conditions.

During the 27 site visits, the NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), PCBs (PCB), and phenolic compounds (PHEN). Table 45 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances based on the criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 list the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 45. Summary of sample types, sample numbers, and objective exceedances in the Middle Main Eel River HA

		FP	CON	MET		PEST	PCB	PHEN
EELALD	# Sampling events	4	4	4	# Sampling events	0	0	0
	Total # Analytes	12	32	44	Total # Analytes	-	-	-
	Exceedances	1	-	-	Detections	-	-	-
	Potential Exceedances	-	6	2	Quantifiable Concentrations	-	-	-
EELMDV	# Sampling events	23	23	21	# Sampling events	1	1	6
	Total # Analytes	69	201	227	Total # Analytes	80	50	18
	Exceedances	-	-	4	Detections	4	7	4
	Potential Exceedances	-	22	10	Quantifiable Concentrations	-	-	1

3.5.4.1.______Field Parameters

Specific Conductivity and pH conditions at the time of sampling were all in compliance with the Basin Plan.

DO values did not meet the Basin Plan objective on one of four site visits (25% exceedance rate). The Basin Plan objective for DO is a two-part objective, with an absolute minimum of 7.0 mg/L and a 50% lower limit of 10.0 mg/L. This means that 50% or more of the monthly means in a calendar year must be greater than or equal to 10.0 mg/L. The observed DO values ranged from 5.03 to 12.00 mg/L. The observed concentrations did not meet the absolute minimum criterion on 4/21/2002 at station EELALD (5.03 mg/L).

3.5.4.2.______Conventional Water Quality Parameters

Ammonia-N, chloride, hardness, O-PO4, and sulfate concentrations, at the time of sampling, were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection.

TDS did not fully meet the Basin Plan objective during all site visits. The Basin Plan objective for TDS is a two-part objective with a 50% upper limit of 140 mg/L and a 90% upper limit of 275 mg/L. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 140 mg/L and 90% or more of the monthly means within a calendar year must be less than or equal to 275 mg/L. The observed TDS concentrations ranged from 65 to 218 mg/L. The observed values met the 90% upper limit each year, but failed to meet the 50% upper limit in 2004. It is important to note that these results are based on one grab sample collected at each location during the calendar year and are not a compilation of many samples used to calculate monthly means as the objective suggests.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criterion of 0.12 mg/L on 18 of 27 site visits (67% exceedance rate), with concentrations ranging from ND (MDL 0.005 mg/L) to 0.560 mg/L.
- Total-P concentrations exceeded the USEPA's recommended concentration criterion of 0.10 mg/L on three of 18 site visits (17% exceedance rate), with concentrations ranging from ND (MDL 0.03 mg/L) to 0.171 mg/L.
- Chl-A concentrations exceeded the USEPA recommended concentration criterion value of 1.08 ug/L on six of 27 site visits (22% exceedance rate), with concentrations ranging from ND (MDL 0.045 ug/L) to 2.900 ug/L.

3.5.4.3. Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 46.

- Arsenic, cadmium, chromium, lead, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on 12 of 24 site visits (50% exceedance rate), exceeded USEPA's secondary MCL for drinking water (50 ug/L) on 15 site visits (63% exceedance rate), exceeded DHS's secondary MCL for drinking water (200 ug/L) on nine site visits (38%

exceedance rate), exceeded USEPA's maximum instantaneous concentration for freshwater aquatic life protection (750 ug/L) on five site visits (21% exceedance rate), and exceeded the Basin Plan (1000 ug/L) on four site visits (17% exceedance rate). Aluminum concentrations ranged from 3.69 to 2884.00 ug/L.

- The California Toxics Rule (CTR) criterion to protect freshwater aquatic life for copper is hardness dependent. Exceedance or compliance is determined through a calculation in which the total metals concentration and the hardness concentration are considered. Copper potentially exceeded the CTR continuous concentration criteria on one of 20 site visits (5% exceedance rate).

Table 46. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Middle Main Eel River HA (ug/L).

	Basin Plan	**Drinking Water Standards - Maximum Contaminant Levels (MCLs)**			
	NCRWQCB	**Ca DHS**		**U.S. EPA**	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	4	4	9	-	15
Copper Objective	-	1300	1000	1300	1000
Exceedances	-	0	0	0	0
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum [2]*	*CTS concentration [1]*	*24 hr avg*	*Maximum [2]*
Aluminum objective	-	-	87	-	750
Exceedances	-	-	12	-	5
Copper Objective	Hardness dependent [1]	Hardness dependent [1]	-	-	-
Exceedances	1	0	-	-	-

[1] Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.
[2] Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.
[1] See Appendix C for graphs of these metals based on concentrations, hardness, and EPA criterion.

3.5.4.4.______Pesticides, PCBs, and Phenols

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. There was one pentachlorophenol (RL 0.001 ug/L), three tetrachlorophenol (RL 0.002 ug/L), seven PCB detections, and four pesticide detections.

The pentachlorophenol detection was in a concentration of 0.11 ug/L, and the three tetrachlorophenol detections were in DNQ concentrations. Pentachlorophenol and tetrachlorophenol are wood preservatives. USEPA's continuous concentration criterion for freshwater aquatic life protection for pentachlorophenol is pH dependent, and no samples exceeded USEPA's recommendations.

There is no objective for tetrachlorophenol. The seven PCB detections were all observed on one site visit. The detections were all DNQ values (RL 0.001 ug/L). PCBs are a banned substance. USEPA's continuous concentration criterion for freshwater aquatic life protection for PCB is 0.014 ug/L, therefore, the maximum additive concentration of less than 0.007 ug/L is in compliance.

There were four detections of four different pesticides. The detected pesticides were:

- DDT (RL 0.005 ug/L, MDL 0.002 ug/L)
- Dimethoate (RL 0.05 ug/L)
- Endosulfan-sulfate (RL 0.002 ug/L)
- Hexachlorobenzene (RL 0.002 ug/L)

All of the pesticides were detected in DNQ concentrations.

- Dimethoate is an organophosphate insecticide, for which there is no objective.
- Endosulfan-sulfate is an organochlorine insecticide. USEPA's 24-hour average concentration criteria for freshwater aquatic life protection for Endosulfan-sulfate is 0.056 ug/L, therefore, these concentrations are in compliance.
- Hexachlorobenzene and DDT are banned pesticides. USEPA's toxicity criterion for freshwater aquatic life protection for Hexachlorobenzene is 50 ug/L, therefore, this concentration is in compliance. USEPA's continuous concentration criterion for freshwater aquatic life protection for DDT is 0.001 ug/L, therefore, this concentration is in exceedance of the objective (100% exceedance rate).

3.5.5.______South Fork Eel River HA

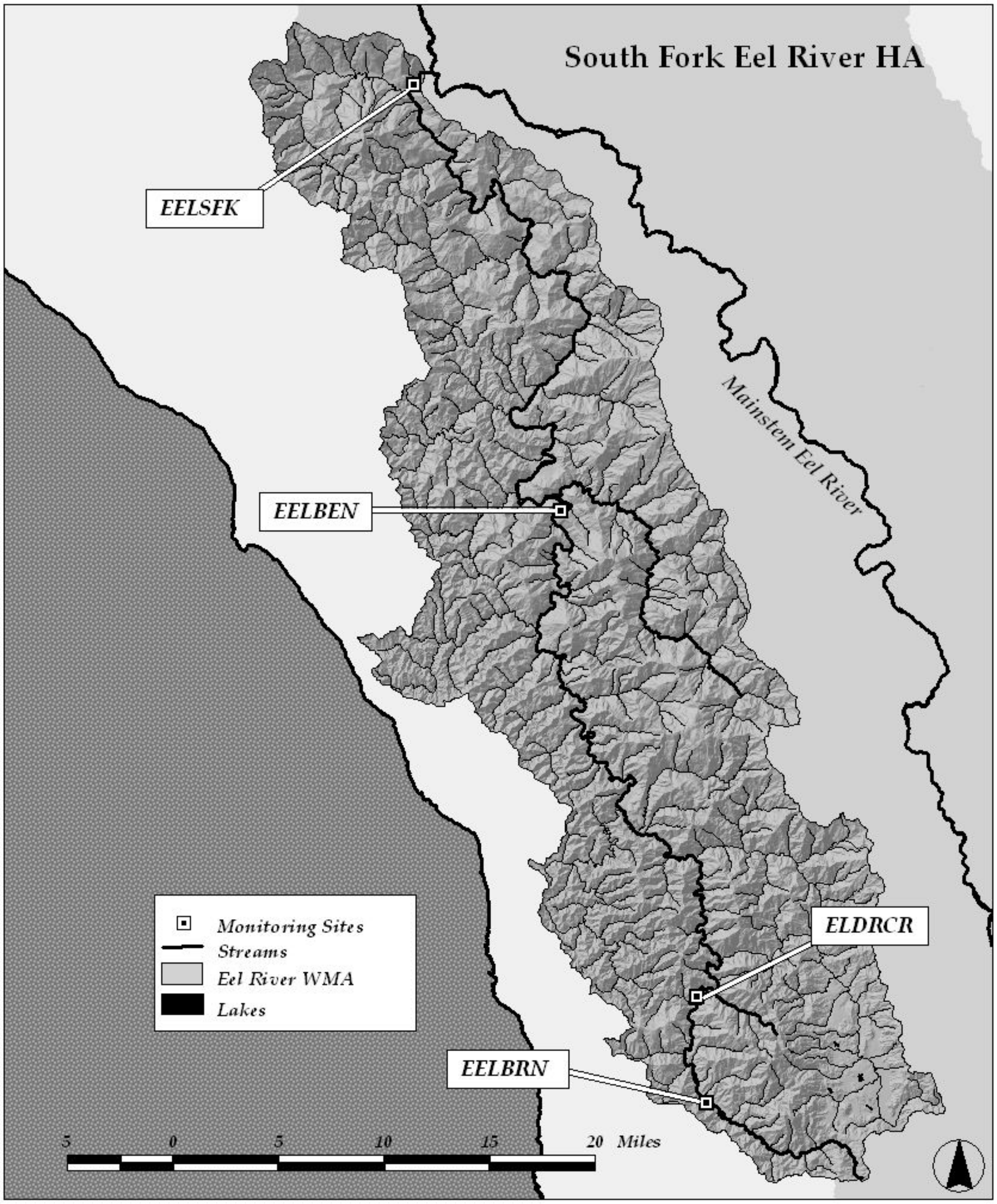

Figure 51. Sampling locations in the South Fork Eel River HA

In the South Fork Eel River HA there were four sampling locations (see Figure 51). Table 38 lists the station names, descriptions, and locations. Station EELBEN is a rotating basin sampling location, and had five site visits during the 2001-02 fiscal year. Station ELDRCR, is located on a tributary to the South Fork Eel River, is considered to be a reference conditions station, and had 19 site visits during the 2001-06 fiscal years.

The other sampling locations are long-term trend monitoring sites. There were a total of 36 site visits to these locations during the fiscal years of 2000-06. The site visits corresponded to Fall, Winter, Spring and Early Summer conditions.

3.5.5.1.____South Fork Eel River

During the 41 site visits, the NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), PCBs (PCB) and phenolic compounds (PHEN). Table 47 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the various criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 list the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 47. Summary of sample types, sample numbers, and objective exceedances in the South Fork Eel River HA

		FP	CON	MET		PEST	PCB	PHEN
EELBRN	# Sampling events	13	13	13	# Sampling events	0	0	0
	Total # Analytes	39	112	138	Total # Analytes	-	-	-
	Exceedances	-	-	1	Detections	-	-	-
	Potential Exceedances	1	15	4	Quantifiable Concentrations	-	-	-
EELBEN	# Sampling events	5	5	5	# Sampling events	0	0	0
	Total # Analytes	15	40	54	Total # Analytes	-	-	-
	Exceedances	1	-	-	Detections	-	-	-
	Potential Exceedances	-	10	2	Quantifiable Concentrations	-	-	-
EELSFK	# Sampling events	23	23	23	# Sampling events	1	1	3
	Total # Analytes	66	201	240	Total # Analytes	80	50	10
	Exceedances	-	-	6	Detections	5	2	8
	Potential Exceedances	1	23	10	Quantifiable Concentrations	-	-	2

3.5.5.1.1.____Field Parameters

pH conditions at the time of sampling were all in compliance with the Basin Plan.

Specific conductivity did not fully meet the Basin Plan objective during all site visits. The Basin Plan objective for specific conductivity is a two-part objective with a 50% upper limit of 200 mS/cm2 and a 90% upper limit of 350 mS/cm2. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 200 mS/cm2 and 90% or more of the monthly means within a calendar year must be less than or equal to 350 mS/cm2. The observed specific conductivity values for 2001-05 ranged from 81 to 282. The observed values met the 90% upper limit each year, but failed to meet the 50% upper limit at stations EELBRN and EELSFK in 2004. It is important to note that these results are based on two grab samples collected during the calendar year and are not a compilation of many samples used to calculate monthly means as the objective suggests.

DO values did not meet the Basin Plan objective on one of five site visits (20% exceedance rate). The Basin Plan objective for DO is a two-part objective, with an absolute minimum of 7.0 mg/L and a 50% lower limit of 10.0 mg/L. This means that 50% or more of the monthly means in a calendar year must be greater than or equal to 10.0 mg/L. The observed DO values ranged from 5.01 to 11.78 mg/L. The observed concentrations did not meet the absolute minimum criterion on 4/21/2002 at station EELBEN (5.01 mg/L).

3.5.5.1.2. Conventional Water Quality Parameters

Ammonia-N, chloride, hardness, total-P, chlorophyll-A, and sulfate concentrations, at the time of sampling, were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection.

TDS did not fully meet the Basin Plan objective during all site visits. The Basin Plan objective for TDS is a two-part objective with a 50% upper limit of 120 mg/L and a 90% upper limit of 200 mg/L. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 120 mg/L and 90% or more of the monthly means within a calendar year must be less than or equal to 200 mg/L. The observed TDS concentrations ranged from 59 to 400 mg/L. The observed values met the 90% upper limit each year, but failed to meet the 50% upper limit at station EELBRN in 2004 and at station EELSFK in 2001 and 2004. It is important to note that these results are based on one grab sample collected at each location during the calendar year and are not a compilation of many samples used to calculate monthly means as the objective suggests.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criterion of 0.12 mg/L on 30 of 41 site visits (73% exceedance rate), with concentrations ranging from ND (MDL 0.005 mg/L) to 0.600 mg/L.
- Total-P concentrations exceeded the USEPA's recommended criterion of 0.10 mg/L on three of 26 site visits (12% exceedance rate), with concentrations ranging from ND (MDL 0.05 mg/L) to 0.236 mg/L.

- O-PO4 concentrations exceeded the USEPA's recommended concentration criterion of 0.05 mg/L on three of 41 site visits (7% exceedance rate), with concentrations ranging from DNQ (RL 0.010 mg/L) to 0.160 mg/L.
- Chl-A concentrations exceeded the USEPA recommended concentration criterion value of 1.08 ug/L on nine of 41 site visits (22% exceedance rate), with concentrations ranging from ND (MDL 0.045 ug/L) to 2.000 ug/L.

3.5.5.1.3. Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 48.

- Arsenic, cadmium, chromium, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on 14 of 37 site visits (38% exceedance rate), exceeded USEPA's secondary MCL for drinking water (50 ug/L) on 21 site visits (57% exceedance rate), exceeded DHS's secondary MCL for drinking water (200 ug/L) on 12 site visits (32% exceedance rate), exceeded USEPA's maximum instantaneous concentration for freshwater aquatic life protection (750 ug/L) on seven site visits (19% exceedance rate), and exceeded the Basin Plan (1000 ug/L) on six site visits (16% exceedance rate). Aluminum concentrations ranged from 3.46 to 3400.00 ug/L.
- The California Toxics Rule (CTR) criteria to protect freshwater aquatic life for copper and lead is hardness dependent. Exceedance or compliance is determined through a calculation in which the total metals concentration and the hardness concentration are considered. Copper exceeded the CTR maximum concentration criteria on one of 21 site visits (5% exceedance rate) to station EELSKFK. Lead potentially exceeded the CTR continuous concentration criteria on one of 13 site visits (7% exceedance rate) to station EELSFK and one of six site visits (17% exceedance rate) to station EELBRN.

Table 48. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the South Fork Eel River HA (ug/L).

	Basin Plan	Drinking Water Standards - Maximum Contaminant Levels (MCLs)			
	NCRWQCB	Ca DHS		U.S. EPA	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	6	6	12	-	21
Copper Objective	-	1300	1000	1300	1000
Exceedances	-	0	0	0	0
Lead Objective	50	15	-	15	-
Exceedances	0	0	-	0	-
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum [2]*	*CTS concentration [1]*	*24 hr avg*	*Maximum [2]*
Aluminum objective	-	-	87	-	750
Exceedances	-	-	14	-	7
Copper Objective	Hardness dependent [1]	Hardness dependent [1]	-	-	-
Exceedances	1	1	-	-	-
Lead Objective	Hardness dependent [1]	Hardness dependent [1]	Hardness dependent [1]	-	Hardness dependent [1]
Exceedances	2	0	2	-	0

[1] Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.
[2] Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.
[1] See Appendix C for graphs of these metals based on concentrations, hardness, and EPA criterion.

3.5.5.1.4.____Pesticides, PCBs, and Phenols

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. There were two pentachlorophenol (RL 0.001 ug/L), six tetrachlorophenol (RL 0.002 ug/L), two PCB, and five pesticide detections.

Pentachlorophenol was detected in a DNQ concentration and at a concentration of 0.500 ug/L. Tetrachlorophenol was detected in a two DNQ concentrations and at a concentration of 0.185 ug/L. Pentachlorophenol and tetrachlorophenol are wood preservatives. USEPA’s continuous concentration criterion for freshwater aquatic life protection for pentachlorophenol is pH dependent, and no samples exceeded USEPA’s recommendations. There is no objective for tetrachlorophenol.

The two PCB detections were both observed on one site visit. The detections were all DNQ values (RL 0.001 ug/L). PCBs are a banned substance. USEPA’s continuous concentration criteria for freshwater aquatic life protection for PCB is 0.002 ug/L, therefore, the maximum additive concentration of less than 0.007 ug/L is in compliance.

There were five detections of five different pesticides. The detected pesticides were:

- DDT (RL 0.005 ug/L, MDL 0.002 ug/L)
- Diazinon (RL 0.02 ug/L)
- Endosulfan-sulfate (RL 0.002 ug/L)
- beta-HCH (RL 0.002 ug/L)
- Hexachlorobenzene (RL 0.001 ug/L)

All of the pesticides were detected in DNQ concentrations.

- Diazinon is a nonsystemic organophosphate insecticide removed from residential use in 2004. USEPA's continuous concentration criterion for freshwater aquatic life protection for Diazinon is 0.05 ug/L, therefore, this concentration is in compliance.
- Endosulfan-sulfate is an organochlorine insecticide. USEPA's 24-hour average concentration criterion for freshwater aquatic life protection for Endosulfan-sulfate is 0.056 ug/L, therefore, these concentrations are in compliance.
- HCH (alpha-, delta-, and gamma- isomers) is an EPA Severely Restricted Pesticide (Lindane) and is listed by the United Nations as a persistent organic pollutant (POPs). The Basin Plan objective for Lindane is 0.004 mg/L, therefore, these concentrations are in compliance with the objective.
- Hexachlorobenzene and DDT are banned pesticides. USEPA's toxicity criterion for freshwater aquatic life protection for Hexachlorobenzene is 50 ug/L, therefore, this concentration is in compliance. USEPA's continuous concentration criterion for freshwater aquatic life protection for DDT is 0.001 ug/L, therefore, this concentration is in exceedance of the objective (100% exceedance rate).

3.5.5.2. Elder Creek

During the 19 site visits, the NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), PCBs (PCB) and phenolic compounds (PHEN). Table 49 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 list the numeric values for the criteria, objectives, and standards utilized in this report.

Table 49. Summary of sample types, sample numbers, and objective exceedances in the South Fork Eel River HA - Elder Creek

		FP	CON	MET		PEST	PCB	PHEN
ELDRCR	# Sampling events	19	19	19	# Sampling events	7	7	7
	Total # Analytes	57	166	195	Total # Analytes	645	350	14
	Exceedances	1	-	-	Detections	1	-	3
	Potential Exceedances	-	10	1	Quantifiable Concentrations	-	-	1

3.5.5.2.1.____Field Parameters

Specific Conductivity and DO conditions at the time of sampling were all in compliance with the Basin Plan.

pH values did not meet the Basin Plan objective on one of 19 site visits (5% exceedance rate). The Basin Plan objective for pH is a two-part objective with a minimum value of 7.0 and a maximum value of 8.5. The observed pH values ranged from 7.74 to 8.71. The observed values met the minimum pH objective on all occasions, but exceeded the maximum Basin Plan objective on 4/25/2006 (8.71).

3.5.5.2.2.____Conventional Water Quality Parameters

Ammonia-N, chloride, TDS, hardness, total-P, chlorophyll-A, and sulfate concentrations, at the time of sampling, were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criteria of 0.12 mg/L on nine of 19 site visits (47% exceedance rate), with concentrations ranging from ND (MDL 0.005 mg/L) to 0.700 mg/L.
- O-PO4 concentrations exceeded the USEPA's recommended criterion of 0.05 mg/L on one of 19 site visits (5% exceedance rate), with concentrations ranging from DNQ values (RL 0.010 mg/L) to 0.160 mg/L.

3.5.5.2.3.____Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 50.

- Arsenic, cadmium, chromium, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on one of 19 site visits (5% exceedance rate) and exceeded USEPA's secondary MCL for drinking water (50 ug/L) on one site visit (5% exceedance rate). Aluminum concentrations ranged from 2.55 to 68.80 ug/L

Table 50. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the South Fork Eel River HA - Elder Creek (ug/L).

	Basin Plan	**Drinking Water Standards - Maximum Contaminant Levels (MCLs)**			
	NCRWQCB	**Ca DHS**		**U.S. EPA**	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	0	0	0	-	1
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	1	-	0

[1] *Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.*
[2] *Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.*

3.5.5.2.4.____Pesticides, PCBs and Phenols

The NCR analyzed grab samples for the presence of 100 pesticides, pesticide constituents, isomers, or metabolites, 50 PCB cogeners, and 4 different phenolic compounds. There were no PCB or pesticide detections, but there were three nonylphenol detections. Two of the nonylphenol detections were in DNQ concentration (RL 2.0 ug/L) and one was in a concentration of 2.88 ug/L. Nonylphenol is often found as a breakdown product from surfactants and detergents. USEPA's continuous concentration criteria for freshwater aquatic life protection for nonylphenol is 6.6 ug/L, therefore, this concentration was in compliance.

3.5.6.______Lower Eel River HA

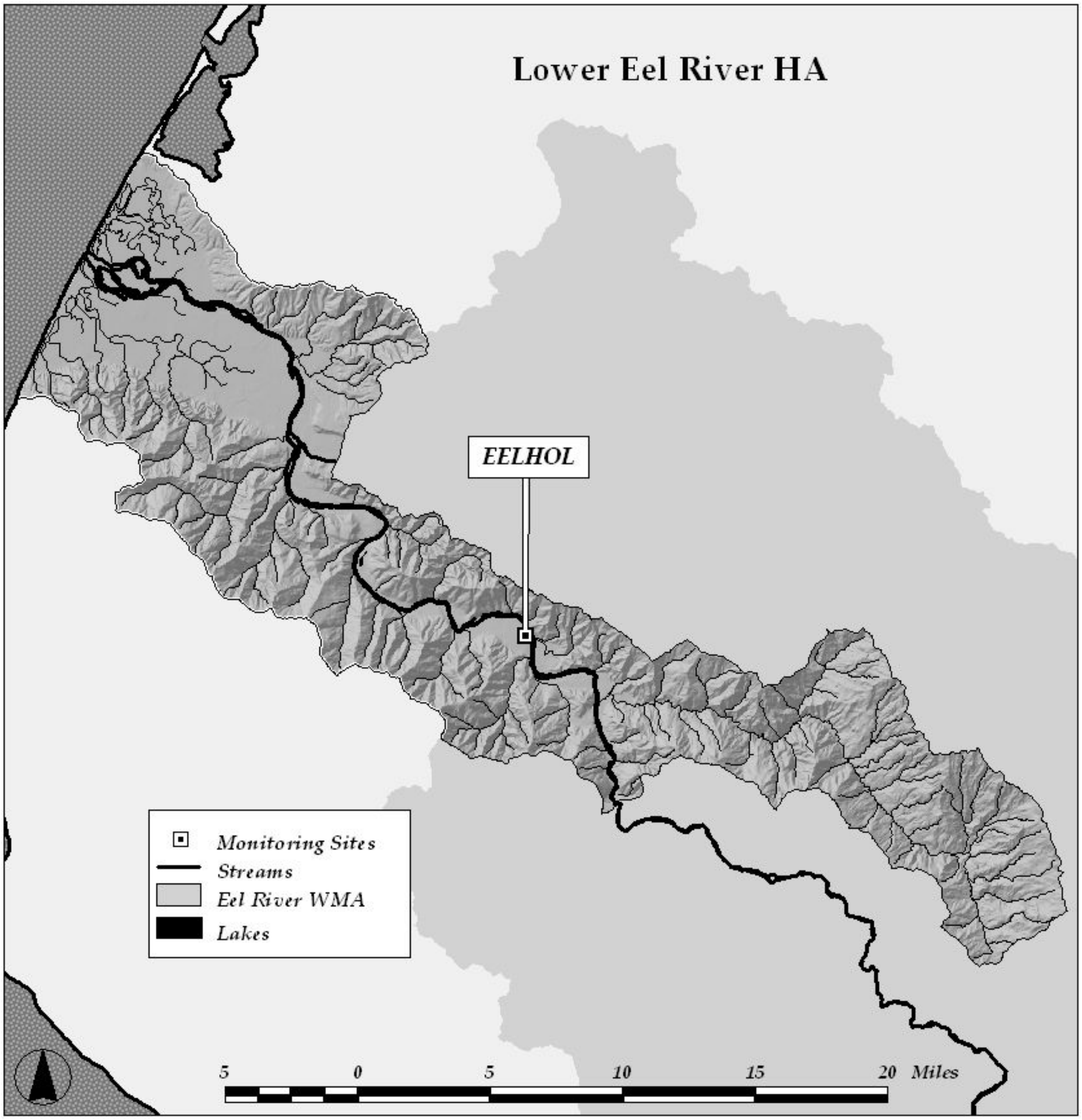

Figure 52. Sampling locations in the Lower Eel River HA

In the Lower Eel River HA, there was one sampling location (see Figure 52). Station EELHOL (Eel River at Holmes) is located adjacent to the town of Holmes approximately 16 miles upstream of the Van Duzen River and 9 miles downstream of the South Fork Eel River. This is a long-term trend monitoring site and had 15 site visits during the 2001-05 fiscal years. The site visits corresponded to Fall, Winter, Spring and Early Summer seasonal conditions.

During the 15 site visits, the NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), PCBs (PCB), and phenolic compounds (PHEN). Table 51 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the various criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 lists the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 51. Summary of sample types, sample numbers, and objective exceedances in the Lower Eel River HA

		FP	CON	MET		PEST	PCB	PHEN
EELHOL	# Sampling events	15	15	15	# Sampling events	10	10	3
	Total # Analytes	45	131	164	Total # Analytes	842	500	6
	Exceedances	1	-	4	Detections	9	5	-
	Potential Exceedances	-	18	10	Quantifiable Concentrations	-	-	-

3.5.6.1. Field Parameters

Specific conductivity and pH conditions at the time of sampling were all in compliance with the Basin Plan.

DO values did not meet the Basin Plan objective on one of 15 site visits (7% exceedance rate). The Basin Plan objective for DO is a two-part objective, with an absolute minimum of 7.0 mg/L and a 50% lower limit of 10.0 mg/L. This means that 50% or more of the monthly means in a calendar year must be greater than or equal to 10.0 mg/L. The observed DO values ranged from 4.58 to 12.00 mg/L. The observed concentrations did not meet the absolute minimum criterion on 4/21/2002 (4.58 mg/L).

3.5.6.2. Conventional Water Quality Parameters

Ammonia-N, chloride, TDS, hardness, O-PO4, and sulfate concentrations, at the time of sampling, were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, California Toxics Rule (CTR) and the USEPA recommended criteria for freshwater aquatic life protection.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criterion of 0.12 mg/L on 13 of 15 site visits (87% exceedance rate), with concentrations ranging from ND (MDL 0.005 mg/L) to 4.287 mg/L.
- Total-P concentrations exceeded the USEPA's recommended concentration criterion of 0.10 mg/L on two of 10 site visits (20% exceedance rate), with concentrations ranging from ND (MDL 0.03 mg/L) to 0.268 mg/L.
- Chl-A concentrations exceeded the USEPA recommended concentration criteria value of 1.08 ug/L on three of 15 site visits (20% exceedance rate), with concentrations ranging from 0.085 to 2.100 ug/L.

3.5.6.3.   Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 52.

- Arsenic, cadmium, chromium, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on eight of 15 site visits (53% exceedance rate), exceeded USEPA's secondary MCL for drinking water (50 ug/L) on 10 site visits (67% exceedance rate), exceeded DHS's secondary MCL for drinking water (200 ug/L) on seven site visits (47% exceedance rate), exceeded USEPA's maximum instantaneous concentration for freshwater aquatic life protection (750 ug/L) on four site visits (27% exceedance rate), and exceeded the Basin Plan (1000 ug/L) on four site visits (27% exceedance rate). Aluminum concentrations ranged from 6.26 to 3618.00 ug/L.
- The California Toxics Rule (CTR) criterion to protect freshwater aquatic life for copper and lead is hardness dependent. Exceedance or compliance is determined through a calculation in which the total metals concentration and the hardness concentration are considered. Copper potentially exceeded the CTR continuous concentration criteria on two of 15 site visits (13% exceedance rate). Lead potentially exceeded the CTR continuous concentration criteria on two of ten site visits (20% exceedance rate).

Table 52. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Lower Eel River HA (ug/L).

	Basin Plan	Drinking Water Standards - Maximum Contaminant Levels (MCLs)			
	NCRWQCB	**Ca DHS**		**U.S. EPA**	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	4	4	7	-	10
Copper Objective	-	1300	1000	1300	1000
Exceedances	-	0	0	0	0
Lead Objective	50	15	-	15	-
Exceedances	0	0	-	0	-
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	8	-	4
Copper Objective	Hardness dependent [1]	Hardness dependent [1]	-	-	-
Exceedances	2	0	-	-	-
Lead Objective	Hardness dependent [1]	Hardness dependent [1]	Hardness dependent [1]	-	Hardness dependent [1]
Exceedances	2	0	2	-	0

[1] Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.
[2] Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.
[1] See Appendix C for graphs of these metals based on concentrations, hardness, and EPA criterion.

3.5.6.4.______Pesticides, PCBs, and Phenols

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. There were no phenol detections, but there were five PCB and nine pesticide detections.

The five PCB detections were all observed on one site visit. The detections were all DNQ values (RL 0.001 ug/L). PCBs are a banned substance. USEPA's continuous concentration criterion for freshwater aquatic life protection for PCB is 0.014 ug/L, therefore, the maximum additive concentration of less than 0.005 ug/L is in compliance.

There were nine detections of seven different pesticides. The detected pesticides were:

- DDT (RL 0.005 ug/L, MDL 0.002 ug/L)
- Diazinon (RL 0.02 ug/L)
- Dimethoate (RL 0.05 ug/L)
- Endosulfan-sulfate (RL 0.002 ug/L)
- Hexachlorobenzene (RL 0.001 ug/L)
- Methidathion (RL 0.002 ug/L)
- Parathion-methyl (RL 0.002 ug/L)

All of the pesticides were detected in DNQ concentrations.

- Diazinon is a nonsystemic organophosphate insecticide removed from residential use in 2004. USEPA's continuous concentration criterion for freshwater aquatic life protection for Diazinon is 0.05 ug/L, therefore, this concentration is in compliance.
- Dimethoate and Methidathion are organophosphate insecticides for which there is no objective.
- Endosulfan-sulfate is an organochlorine insecticide. USEPA's 24-hour average concentration criterion for freshwater aquatic life protection for Endosulfan-sulfate is 0.056 ug/L, therefore, these concentrations are in compliance.
- Parathion-methyl is an organophosphate insecticide. USEPA's Maximum instantaneous criterion for freshwater aquatic life protection for Parathion-methyl is 0.080 ug/L, therefore, this concentration is in compliance.
- Hexachlorobenzene and DDT are banned pesticides. USEPA's toxicity criterion for freshwater aquatic life protection for Hexachlorobenzene is 50 ug/L, therefore, this concentration is in compliance. USEPA's continuous concentration criterion for freshwater aquatic life protection for DDT is 0.001 ug/L, therefore, this concentration is in exceedance of the objective (10% exceedance rate).

3.5.7.______Van Duzen River HA

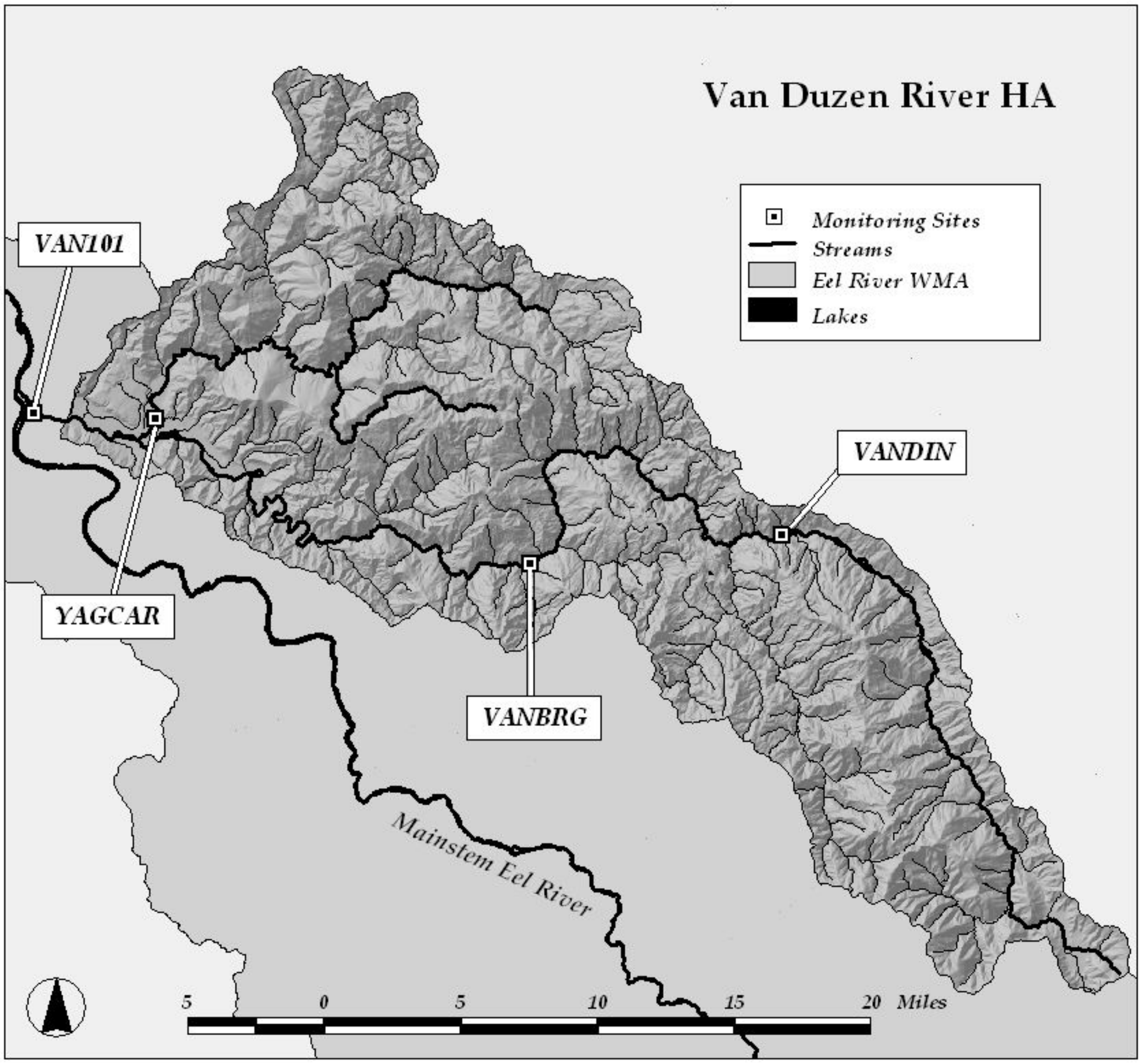

Figure 53. Sampling locations in the Van Duzen River HA

In the Van Duzen River HA there were four sampling locations (see Figure 53). Table 38 lists the station names, descriptions, and locations. Station YAGCAR is a rotating basin sampling location, is located on a tributary to the Van Duzen River, and had five site visits during the 2001-02 fiscal year. The other sampling locations are rotating basin sampling locations. There were a total of 12 site visits to these locations during the of 2001-02 fiscal year. The site visits corresponded to Fall, Winter, Spring and Early Summer conditions.

During the 17 site visits, the NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON) and trace metals concentrations (MET). The NCR did not analyze samples for pesticides and pesticide residues (PEST), PCBs (PCB), or phenolic compounds (PHEN) at these locations. Table 53 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the various criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 list the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 53. Summary of sample types, sample numbers, and objective exceedances in the Van Duzen River HA

		FP	CON	MET		PEST	PCB	PHEN
VANDIN	# Sampling events	5	5	5	# Sampling events	0	0	0
	Total # Analytes	15	40	55	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	7	2	Quantifiable Concentrations	-	-	-
VANBRG	# Sampling events	5	5	5	# Sampling events	0	0	0
	Total # Analytes	15	40	54	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	8	3	Quantifiable Concentrations	-	-	-
YAGCAR	# Sampling events	5	5	5	# Sampling events	0	0	0
	Total # Analytes	15	40	55	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	10	4	Quantifiable Concentrations	-	-	-
VAN101	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	16	22	Total # Analytes	-	-	-
	Exceedances	1	-	-	Detections	-	-	-
	Potential Exceedances	-	4	-	Quantifiable Concentrations	-	-	-

3.5.7.1.______Field Parameters

DO and pH conditions at the time of sampling were all in compliance with the Basin Plan.

Specific conductivity did not fully meet the Basin Plan objective during all site visits. The Basin Plan objective for specific conductivity is a two-part objective with a 50% upper limit of 175 mS/cm2 and a 90% upper limit of 375 mS/cm2. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 175 mS/cm2 and 90% or more of the monthly means within a calendar year must be less than or equal to 375 mS/cm2. The observed specific conductivity values for 2001-05 ranged from 84 to 261 mS/cm2. The observed values met the 90% upper limit each year, but failed to meet the 50% upper limit at station VAN101. It is important to note that these results are based on two grab samples collected during the calendar year and are not a compilation of many samples used to calculate monthly means as the objective suggests.

3.5.7.2.______Conventional Water Quality Parameters

Ammonia-N, chloride, hardness, O-PO4, total-P, chlorophyll-A, and sulfate concentrations, at the time of sampling, were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection.

TDS did not fully meet the Basin Plan objective during all site visits. The Basin Plan objective for TDS is a two-part objective with a 50% upper limit of 100 mg/L and a 90% upper limit of 200 mg/L. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 100 mg/L and 90% or more of the monthly means within a calendar year must be less than or equal to 200 mg/L. The observed TDS concentrations ranged from 50.00 to 153.00 mg/L. The observed values met the 90% upper limit each year, but failed to meet the 50% upper limit at stations VAN101 and YAGCAR. It is important to note that these results are based on two grab samples collected during the calendar year and are not a compilation of many samples used to calculate monthly means as the objective suggests.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criterion of 0.12 mg/L on all 17 site visits (100% exceedance rate), with concentrations ranging from 0.423 to 0.511 mg/L.
- Chl-A concentrations exceeded the USEPA recommended concentration criterion value of 1.08 ug/L on ten of 17 site visits (59% exceedance rate), with estimated DNQ concentrations ranging from 0.75 ug/L to 5.3 ug/L (MDL 0.050 ug/L, RL of up to 10.0 ug/L).

3.5.7.3.______Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 54.

- Arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.

- Aluminum concentrations potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on six of 17 site visits (35% exceedance rate), exceeded USEPA's secondary MCL for drinking water (50 ug/L) on nine site visits (53% exceedance rate), and exceeded DHS's secondary MCL for drinking water (200 ug/L) on four site visits (24% exceedance rate). Aluminum concentrations ranged from 5.27 to 484.00 ug/L.

Table 54. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Van Duzen River HA (ug/L).

	Basin Plan	Drinking Water Standards - Maximum Contaminant Levels (MCLs)			
	NCRWQCB	Ca DHS		U.S. EPA	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	0	0	4	-	9
	Freshwater Aquatic Life Protection				
	CTR		US EPA		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	6	-	0

[1] *Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.*
[2] *Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.*

3.5.8.____Trend Monitoring – Eel River WMA

For this report, we are only looking at general trends across sampling years. The long-term monitoring sites were chosen from both impaired and unimpaired waterbodies within each of the WMAs. This component of the SWAMP monitoring plan is designed to monitor water quality trends through time, allowing for the ongoing evaluation of improvements or degradation to water quality. The long-term monitoring sites are located at the bottom of large drainage areas and reflect the impacts of management activities occurring within the respective basins. The long-term sampling locations have had between 10 and 23 site visits over the course of two to five years, dependent upon the timing of station establishment. Each sampling effort was designed so that site visits in the same watershed occurred within the same one to three day period.

3.5.8.1.______Field Parameters

Only Specific Conductivity and pH values were evaluated for the determination of trends. Specific Conductivity values at all stations varied by season, with the highest values recorded in the autumn and the lowest values recorded in the winter. The recorded values remained within the same range throughout the period of record. pH values at this station did not exhibit a seasonal trend nor did the concentrations demonstrate any trend through the period of record.

3.5.8.2. Conventional Water Quality Parameters

Hardness, sulfate, and TDS concentrations at all stations varied by season, with the highest values during the fall and the lowest concentrations in the spring. There was no apparent trend in concentrations, the values remained within the same range throughout the period of record. Chloride, Chl-A, Nitrate, Ortho-P, Total-P and TKN results did not exhibit a seasonal trend nor did the concentrations demonstrate any trend through the period of record. Elevated Chloride and Sulfate concentrations were recorded at MFKEEL and NFELMI in October 2002 and October 2004. No sampling occurred at these locations during October of 2001 or 2003. It is not evident from the data what may be the cause of the elevated concentrations.

3.5.8.3. Trace Metals

Aluminum, arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc concentrations at all stations varied by season, with the highest values recorded during the winter and spring and the lowest values recorded in the summer and fall. There was no apparent trend in the concentrations of any trace metals constituent; the values remained within the same range throughout the period of record.

3.6.______North Coast Rivers WMA

There are three Hydrologic Units (HU) within the North Coast Rivers WMA. The HUs are:

- Smith River HU
- Cape Mendocino HU
- Mendocino Coast HU

Within the North Coast Rivers WMA, there are 30 sampling locations comprising of four long-term trend monitoring stations and 26 rotating basin stations. Table 55 lists the station names, locations, number of site visits and sampling period.

Table 55. North Coast Rivers WMA station types, locations and sampling periods

Smith River HU				
SMHMAN	Trend	23	Smith River above South Fork Smith River	3/2001 - 6/2006
SMHSFK	Trend	23	South Fork Smith River above Hiouchi	3/2001 - 6/2006
SMHFIS	Trend	23	Smith River below Dr. Fine Bridge	3/2001 - 6/2006
Cape Mendocino HU				
MATETT	Rotating	2	Mattole River at Ettersburg	4/2001 - 5/2001
MATHON	Rotating	2	Mattole River at Honeydew	4/2001 - 5/2001
MATPET	Rotating	2	Mattole River at Petrolia	4/2001 - 5/2001
NFMATP	Rotating	2	North Fork Mattole River at Petrolia	4/2001 - 5/2001
Mendocino Coast HU				
Rockport HA				
WAGHW1	Rotating	2	Wages Creek at Highway 1	5/2001 - 6/2001
TENNFK	Rotating	2	Ten Mile River above South Fork Ten Mile River	5/2001 - 6/2001
Noyo River HA				
NOYHAY	Rotating	2	Noyo River at Hayshed Siding Gage	5/2001 - 6/2001
Big River HA				
SFBIGD	Rotating	2	South Fork Big River at Daugherty Creek	5/2001 - 6/2001
BIGH20	Rotating	2	North Fork Big River at Highway 20	5/2001 - 6/2001
BIGMWD	Rotating	2	Big River at Mendocino Woodlands	5/2001 - 6/2001
Albion River HA				
ALBCOM	Rotating	2	Albion River at Comptche	5/2001 - 6/2001
ALBMST	Rotating	2	Albion River below South Fork Albion River	5/2001 - 6/2001
Coastal watershed within Albion River HA				
LITHW1	Rotating	2	Little River at Highway 1	5/2001 - 6/2001
Navarro River HA				
INDPHO	Rotating	2	Indian Creek at Philo	5/2001 - 6/2001
RNCPHO	Rotating	2	Rancheria Creek near Philo	5/2001 - 6/2001
NAVPHO	Rotating	2	Navarro River at Philo	5/2001 - 6/2001
NFNDIM	Rotating	2	North Fork Navarro River at Dimmick	5/2001 - 6/2001
NAVDIM	Rotating	2	Navarro River below North Fork Navarro at Dimmick	5/2001 - 6/2001
MSNDIM	Rotating	2	Navarro River above North Fork Navarro at Dimmick	5/2001 - 6/2001

Table 55 (cont'd). North Coast Rivers WMA station types, locations and sampling periods

Point Arena HA				
GRNHW1	Rotating	2	Greenwood Creek at Highway 1	5/2001 - 6/2001
Garcia River HA				
GAREHR	Rotating	2	Garcia River at Eureka Hill Road	5/2001 - 6/2001
GARSFK	Rotating	2	South Fork Garcia River	5/2001 - 6/2001
Gualala River HA				
GUAHSE	Rotating	2	Gualala River at House Creek	5/2001 - 6/2001
GUAWHT	Rotating	2	Wheatfield Fork Gualala River	5/2001 - 6/2001
SGUAHB	Rotating	2	South Fork Gualala River at Hauser Bridge	5/2001 - 6/2001
GUASFK	Rotating	2	South Fork Gualala River at Annapolis Road	5/2001 - 6/2001
GUAGRP	Trend	20	Gualala River at Gualala Regional Park	5/2001 - 6/2006

3.6.1.______Smith River HU

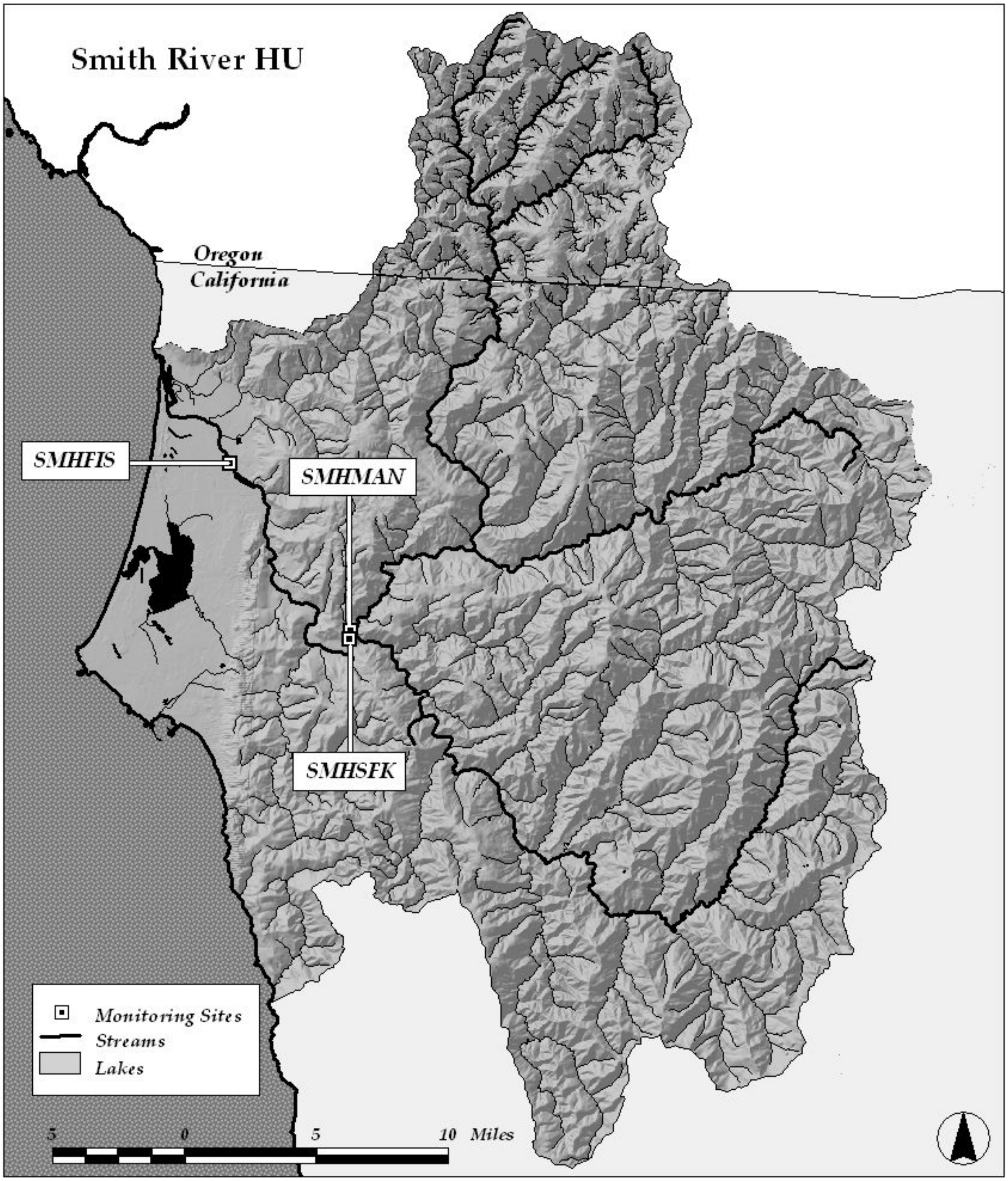

Figure 54. Sampling locations in the Smith River HU

In the Smith River HU, there were three sampling locations (see Figure 54). Table 55 lists the station names, locations, number of site visits, and sampling period. The stations are all long-term trend monitoring sites. There were a total of 69 site visits during the fiscal years of 2000-06. The site visits corresponded to Fall, Winter, Spring and Early Summer conditions.

During the 69 site visits, the NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), PCBs (PCB), and phenolic compounds (PHEN). Table 56 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the applicable criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 lists the numeric values for the criteria, objectives, and standards utilized in this report.

Table 56. Summary of sample types, sample numbers, and objective exceedances in the Smith River HU

		FP	CON	MET		PEST	PCB	PHEN
SMHMAN	# Sampling events	23	23	23	# Sampling events	18	15	2
	Total # Analytes	69	197	240	Total # Analytes	1397	750	4
	Exceedances	1	1	-	Detections	7	5	1
	Potential Exceedances	-	2	-	Quantifiable Concentrations	-	-	1
SMHSFK	# Sampling events	23	23	23	# Sampling events	18	16	2
	Total # Analytes	69	195	239	Total # Analytes	1397	800	4
	Exceedances	1	-	-	Detections	8	3	1
	Potential Exceedances	-	-	-	Quantifiable Concentrations	-	-	-
SMHFIS	# Sampling events	23	23	23	# Sampling events	18	23	8
	Total # Analytes	69	193	218	Total # Analytes	1428	1148	15
	Exceedances	3	-	-	Detections	3	2	3
	Potential Exceedances	-	-	2	Quantifiable Concentrations	-	-	-

3.6.1.1.______Field Parameters

Specific Conductivity and DO conditions at the time of sampling were all in compliance with the Basin Plan.

pH values did not meet the Basin Plan objective on four of 69 site visits (6% exceedance rate). The Basin Plan objective for pH is a two-part objective with a minimum value of 7.0 and a maximum value of 8.5. The observed pH values ranged from 7.95 to 9.73. The minimum pH objective was met on all occasions, but the maximum Basin Plan objective was exceeded once each at stations SMHMAN and SMHSFK on 2/4/2003, (9.35 and 9.73 respectively). Exceedances at SMHFIS were 8.51, 8.54 and 9.35 on 5/15/2002, 10/14/2002 and 2/4/2003.

3.6.1.2.______Conventional Water Quality Parameters

Ammonia-N, chloride, TDS, Chl-A, and sulfate concentrations, at the time of sampling, were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, California Toxics Rule (CTR) and the USEPA recommended criteria for freshwater aquatic life protection.

Hardness values did not meet the Basin Plan objective during all site visits. The Basin Plan objective for hardness is a 50% upper limit of 60 mg/L. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 60 mg/L. The observed hardness concentrations values ranged from 37.4 to 81.6 mg/L. The Basin Plan was exceeded at station SMHMAN in 2001, with two of three recorded concentrations exceeding 60 mg/L. It is important to note that these results are based on three grab samples collected during the calendar year, and are not a compilation of many samples used to calculate monthly means as the objective suggests. Therefore, a more detailed investigation is required to fully understand and document whether compliance or impairment of water quality objectives is occurring at this site.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criteria of 0.12 mg/L on 27 of 69 site visits, (46 % exceedance rate), with concentrations ranging from ND (MDL 0.005 mg/L) to 0.167 mg/L.
- Total-P concentrations exceeded the USEPA's recommended concentration criterion of 0.10 mg/L on one of 54 site visits (2% exceedance rate), with concentrations ranging from ND (MDL 0.030 mg/L) to 0.110 mg/L.
- O-PO4 concentrations exceeded the USEPA recommended concentration criterion of 0.05 mg/L on one of 69 site visits (1% exceedance rate), with concentrations ranging from ND (MDL 0.005 mg/L) to 0.094 mg/L
- Chl-A concentrations exceeded the USEPA recommended concentration criterion value of 1.08 ug/L on five of 66 site visits (8% exceedance rate), with concentrations ranging from ND (MDL 0.045 ug/L) to 1.7 ug/L.

3.6.1.3. Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 57.

- Arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.

- Aluminum concentrations exceeded USEPA's secondary MCL for drinking water (50 ug/L) on two of 58 site visits (3% exceedance rate). Aluminum concentrations ranged from 0.57 to 54.40 ug/L.

Table 57. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Smith River HU (ug/L).

	Basin Plan	**Drinking Water Standards - Maximum Contaminant Levels (MCLs)**			
	NCRWQCB	**Ca DHS**		**U.S. EPA**	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	0	0	0	-	2
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	0	-	0

[1] *Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.*
[2] *Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.*

3.6.1.4. Pesticides, PCBs, and Phenols

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. There were five nonylphenol, 18 pesticide and 10 PCB detections.

Four of the nonylphenol detections were in DNQ concentrations (RL 2.0 ug/L) and one was in a concentration of 3.11 ug/L. Nonylphenol is often found as a breakdown product from surfactants and detergents. USEPA's continuous concentration criterion for freshwater aquatic life protection for nonylphenol is 6.6 ug/L, therefore, this concentration is in compliance.

The 10 PCB detections were observed on three different site visits. The detections were all DNQ values (RL 0.001 ug/L). PCBs are a banned substance. USEPA's continuous concentration criterion for freshwater aquatic life protection for PCB is 0.014 ug/L, therefore, the maximum additive concentration of less than 0.005 ug/L is in compliance.

There were 18 detections of 11 different pesticides. The detected pesticides were:

- DDD (RL 0.002 ug/L, MDL 0.001 ug/L)
- DDE (RL 0.002 ug/L, MDL 0.001 ug/L)
- DDT (RL 0.005 ug/L, MDL 0.002 ug/L)
- Diazinon (RL 0.02 ug/L)
- Dimethoate (RL 0.05 ug/L)
- Dioxathion (RL 0.05 ug/L)
- Endosulfan-sulfate (RL 0.002 ug/L)

- Fonofos (RL 0.05 ug/L)
- Heptachlor-epoxide (RL 0.002 ug/L)
- Hexachlorobenzene (RL 0.001 ug/L)
- Methoxychlor (RL 0.002 ug/L).

All of the pesticides were detected in DNQ concentrations.

- Diazinon is a nonsystemic organophosphate insecticide removed from residential use in 2004. USEPA's continuous concentration criterion for freshwater aquatic life protection for Diazinon is 0.05 ug/L, therefore, this concentration is in compliance.
- Dimethoate, Dioxathion, and Fonofos are organophosphate insecticides for which there is no objective.
- Endosulfan-sulfate is an organochlorine insecticide. USEPA's 24-hour average concentration criterion for freshwater aquatic life protection for Endosulfan-sulfate is 0.056 ug/L, therefore, these concentrations are in compliance.
- Heptachlor-epoxide is a severely restricted organochlorine insecticide. USEPA's continuous concentration criteria for freshwater aquatic life protection for Heptachlor epoxide is 0.0038 ug/L and the Basin Plan objective is 0.01 ug/L, therefore, this concentration is in compliance.
- Methoxychlor is an organochlorine insecticide. USEPA's maximum instantaneous concentration criteria for freshwater aquatic life protection for Methoxychlor is 0.03 ug/L, therefore, this concentration is in compliance.
- Hexachlorobenzene and DDT are banned pesticides. DDD and DDE are secondary breakdown components of DDT. USEPA's toxicity information for freshwater aquatic life protection for Hexachlorobenzene is 50 ug/L, therefore, this concentration is in compliance. USEPA's continuous concentration criterion for freshwater aquatic life protection for DDT is 0.001 ug/L, therefore, this concentration is in exceedance of the objective (6% exceedance rate).

3.6.2.______Cape Mendocino HU – (Mattole River HA)

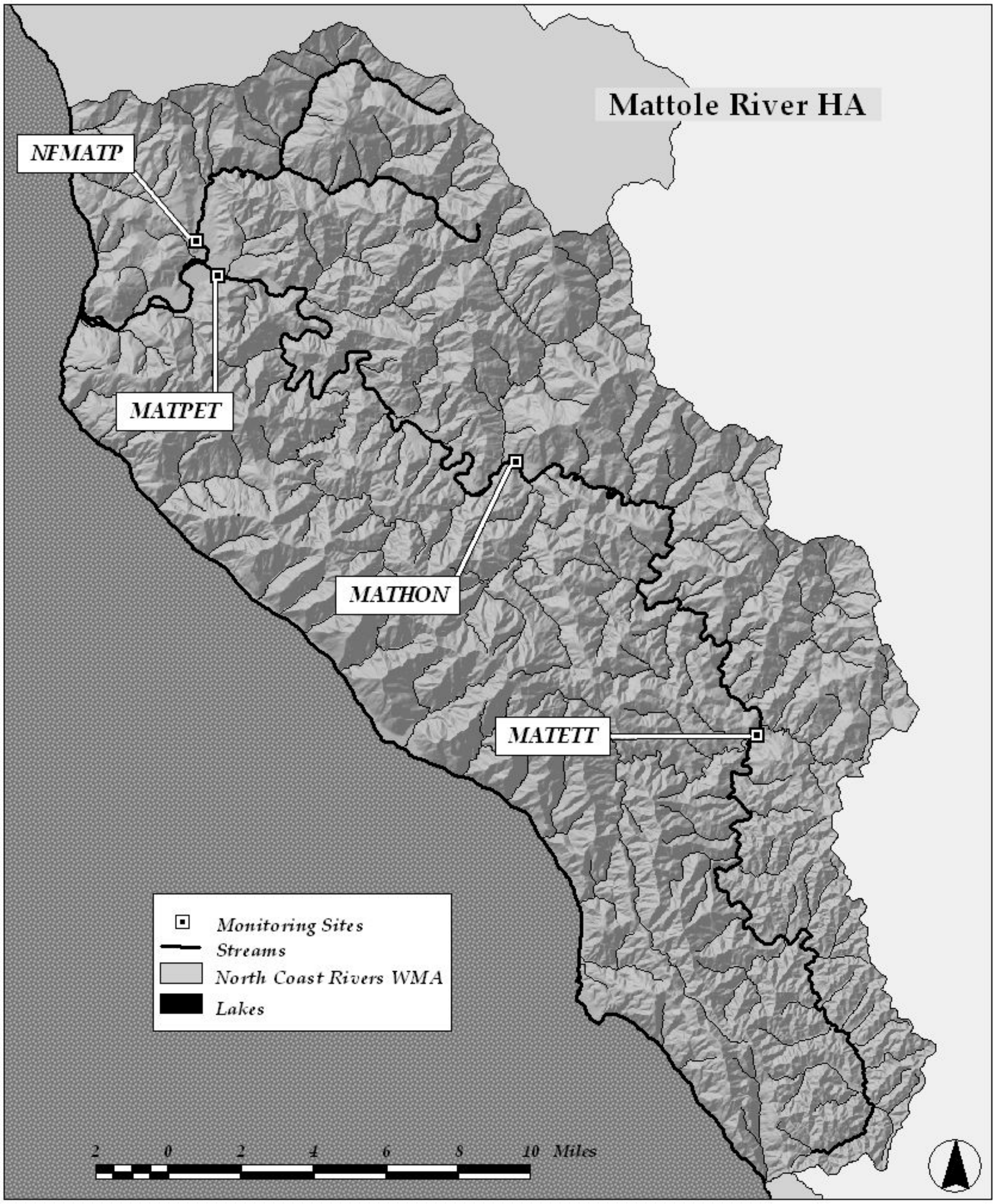

Figure 55. Sampling locations in the Mattole River HA

There are three Hydrologic Areas (HA) within the Cape Mendocino HU. The HAs are:

- Oil Creek HA
- Capetown HA
- Mattole River HA

Within the Cape Mendocino HU, only the Mattole River HA was sampled. There were four sampling locations, all of which were rotating basin sampling stations (see Figure 55). Table 55 lists the station names, descriptions, and locations. There were a total of eight site visits, one site visit to each sampling location in April and in May of 2001.

During the eight site visits, NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON) and trace metals concentrations (MET). The NCR did not analyze samples for pesticides and pesticide residues (PEST), PCBs (PCB), or phenolic compounds (PHEN) at these stations. Table 58 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the various criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 list the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 58. Summary of sample types, sample numbers, and objective exceedances in the Cape Mendocino HU - Mattole River

		FP	CON	MET		PEST	PCB	PHEN
MATETT	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	17	14	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	1	-	Quantifiable Concentrations	-	-	-
MATHON	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	17	14	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	-	-	Quantifiable Concentrations	-	-	-
MATPET	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	17	14	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	1	-	-	Quantifiable Concentrations	-	-	-
NFMATP	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	17	14	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	1	1	-	Quantifiable Concentrations	-	-	-

3.6.2.1.______Field Parameters

DO and pH conditions at the time of sampling were all in compliance with the Basin Plan.

Specific conductivity did not fully meet the Basin Plan objective during all site visits. The Basin Plan objective for specific conductivity is a two-part objective with a 50% upper limit of 170 mS/cm2 and a 90% upper limit of 300 mS/cm2. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 170 mS/cm2 and 90% or more of the monthly means within a calendar year must be less than or equal to 300 mS/cm2. The observed specific conductivity values for 2001 ranged from 107 to 281 mS/cm2. The observed values met the 90% upper limit each year, but failed to meet the 50% upper limit at stations NFMATP and MATPET. It is important to note that these results are based on two grab samples collected at each location during the calendar year and are not a compilation of many samples used to calculate monthly means as the objective suggests. Therefore, a more detailed investigation is required to fully understand and document whether compliance or impairment of water quality objectives is occurring at this site.

3.6.2.2.______Conventional Water Quality Parameters

Ammonia-N, chloride, O-PO4, total-P, hardness, and sulfate concentrations at the time of sampling were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water and the USEPA recommended criteria for freshwater aquatic life protection. Nitrate-N and nitrite-N were not analyzed in this HA.

TDS did not fully meet the Basin Plan objective during all site visits. The Basin Plan objective for TDS is a two-part objective with a 50% upper limit of 105 mg/L and a 90% upper limit of 170 mg/L. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 105 mg/L and 90% or more of the monthly means within a calendar year must be less than or equal to 170 mg/L. The observed TDS concentrations for 2001 ranged from 44 to 270 mg/L. The observed values met the 90% upper limit each year, but failed to meet the 50% upper limit at stations NFMATP and MATETT. It is important to note that these results are based on one grab sample collected at each location during the calendar year and are not a compilation of many samples used to calculate monthly means as the objective suggests.

3.6.2.3.______Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. Cadmium, chromium, copper, lead, mercury, nickel, and zinc concentrations were all in compliance with every objective at the time of sampling.

3.6.3. Mendocino Coast HU

There are nine Hydrologic Areas (HA) within the Mendocino Coast HU. The HAs are:

- Rockport HA
- Noyo River HA
- Big River HA
- Albion River HA
- Navarro River HA
- Point Arena HA
- Garcia River HA
- Gualala River HA
- Russian Gulch HA

Within the Mendocino Coast HU, there were 23 sampling locations comprising one long-term trend monitoring stations and 22 rotating basin sampling stations. The North Coast Regional Board did not conduct any sampling work in the Russian Gulch HA.

3.6.3.1.____Rockport HA

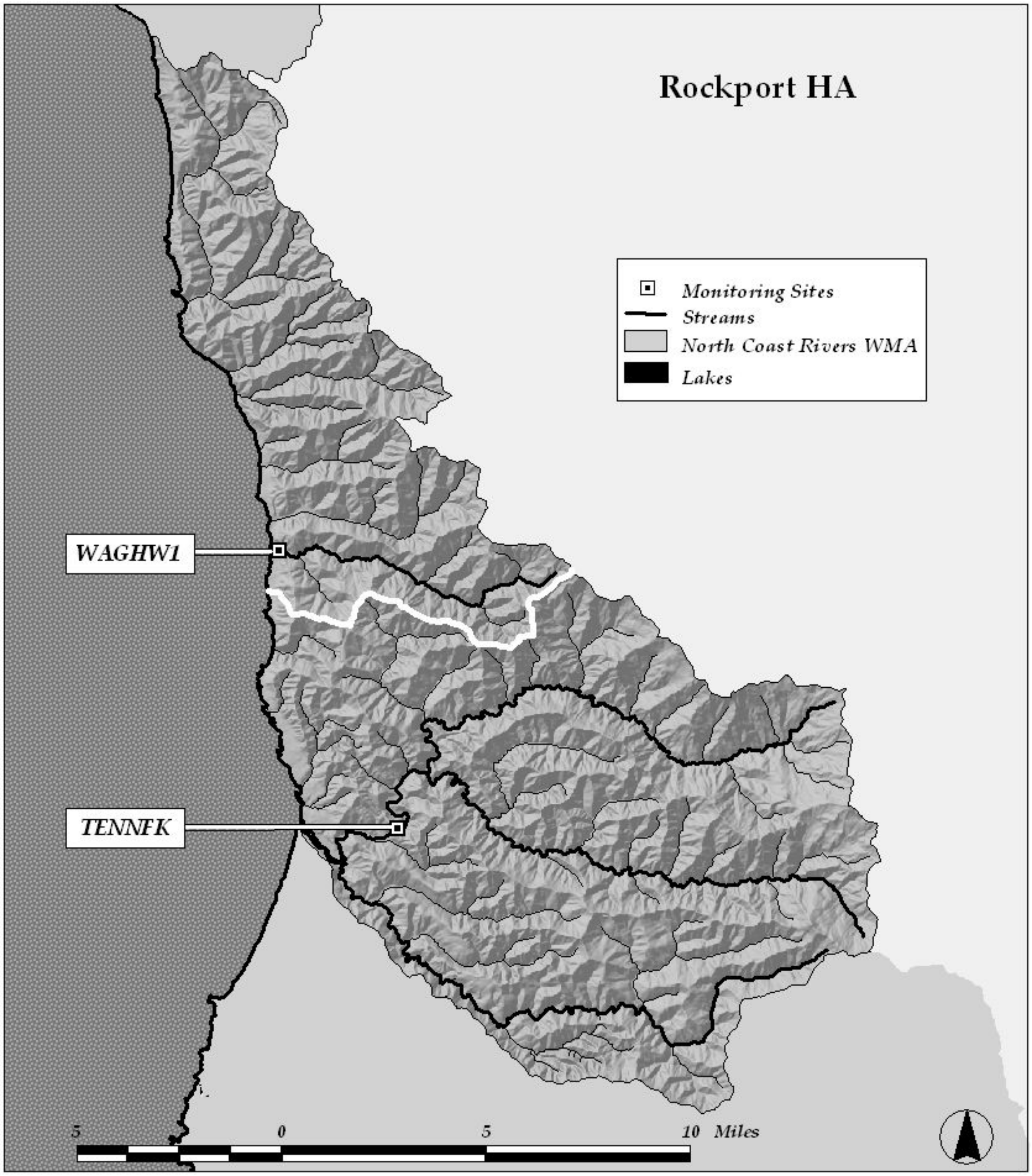

Figure 56. Sampling locations in the Rockport HA

There are three Hydrologic Sub-Areas (HSA) within the Rockport HA. The HSAs are the Usal Creek HSA, Wages Creek HSA, and the Ten Mile River HSA. Within the Rockport HA, there were two rotating basin sampling stations, one in the Wages Creek HSA and one in the Ten Mile River HSA (see Figure 56). There were a total of four site visits, one site visit to each sampling location in May and June of 2001.

During the four site visits, NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON) and trace metals concentrations (MET). The NCR did not analyze samples for pesticides and pesticide residues (PEST), PCBs, (PCB), or phenolic compounds (PHEN). Table 59 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 list the numeric values for the criteria, objectives, and standards utilized in this report.

Table 59. Summary of sample types, sample numbers, and objective exceedances in the Rockport HA

		FP	CON	MET		PEST	PCB	PHEN
WAGHW1	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	19	14	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	-	-	Quantifiable Concentrations	-	-	-
TENNFK	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	19	14	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	-	-	Quantifiable Concentrations	-	-	-

3.6.3.1.1. Field Parameters

Specific conductivity, DO, and pH conditions at the time of sampling were all in compliance with the Basin Plan.

3.6.3.1.2. Conventional Water Quality Parameters

Ammonia-N, chloride, TDS, O-PO4, total-P, hardness, and sulfate concentrations at the time of sampling were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, and the USEPA recommended criteria for freshwater aquatic life protection. Nitrate-N and nitrite-N were not analyzed in this HA.

3.6.3.1.3. Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. Aluminum, arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.

3.6.3.2.____Noyo River HA

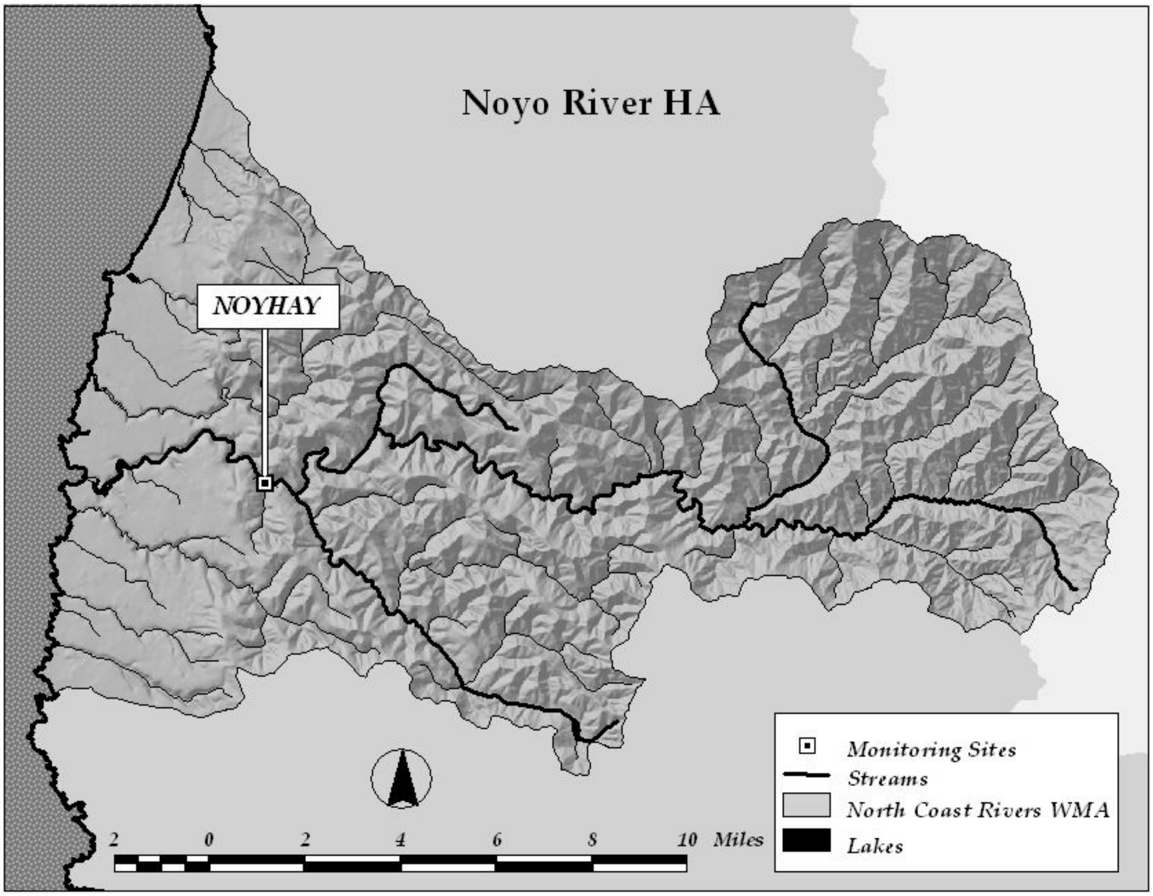

Figure 57. Sampling locations in the Noyo River HA

Within the Noyo River HA, there was one rotating basin sampling station (see Figure 57). There were two site visits, one each in May and June of 2001.

During the two site visits, NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON) and trace metals concentrations (MET). The NCR did not analyze samples from this location for pesticides and pesticide residues (PEST), PCBs (PCB), or phenolic compounds (PHEN). Table 60 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to applicable criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 list the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 60. Summary of sample types, sample numbers, and objective exceedances in the Noyo River HA

		FP	CON	MET		PEST	PCB	PHEN
NOYHAY	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	19	14	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	1	-	-	Quantifiable Concentrations	-	-	-

3.6.3.2.1.____Field Parameters

DO and pH conditions at the time of sampling were all in compliance with the Basin Plan.

Specific conductivity did not fully meet the Basin Plan objective during all site visits. The Basin Plan objective for specific conductivity is a two-part objective with a 50% upper limit of 150 mS/cm2 and a 90% upper limit of 185 mS/cm2. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 150 mS/cm2 and 90% or more of the monthly means within a calendar year must be less than or equal to 185 mS/cm2. The observed specific conductivity values ranged from 161 to 172 mS/cm2. The observed values met the 90% upper limit each year, but failed to meet the 50% upper limit. It is important to note that these results are based on two grab samples collected during the calendar year and are not a compilation of many samples used to calculate monthly means as the objective suggests. Therefore, a more detailed investigation is required to fully understand and document whether compliance or impairment of water quality objectives is occurring at this site.

3.6.3.2.2.____Conventional Water Quality Parameters

Ammonia-N, chloride, TDS, O-PO4, total-P, hardness, and sulfate concentrations at the time of sampling were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, and the USEPA recommended criteria for freshwater aquatic life protection. Nitrate-N and nitrite-N were not analyzed in this HA.

3.6.3.2.3.____Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. Cadmium, chromium, copper, lead, mercury, nickel, and zinc concentrations were all in compliance with every objective at the time of sampling.

3.6.3.3.____Big River HA

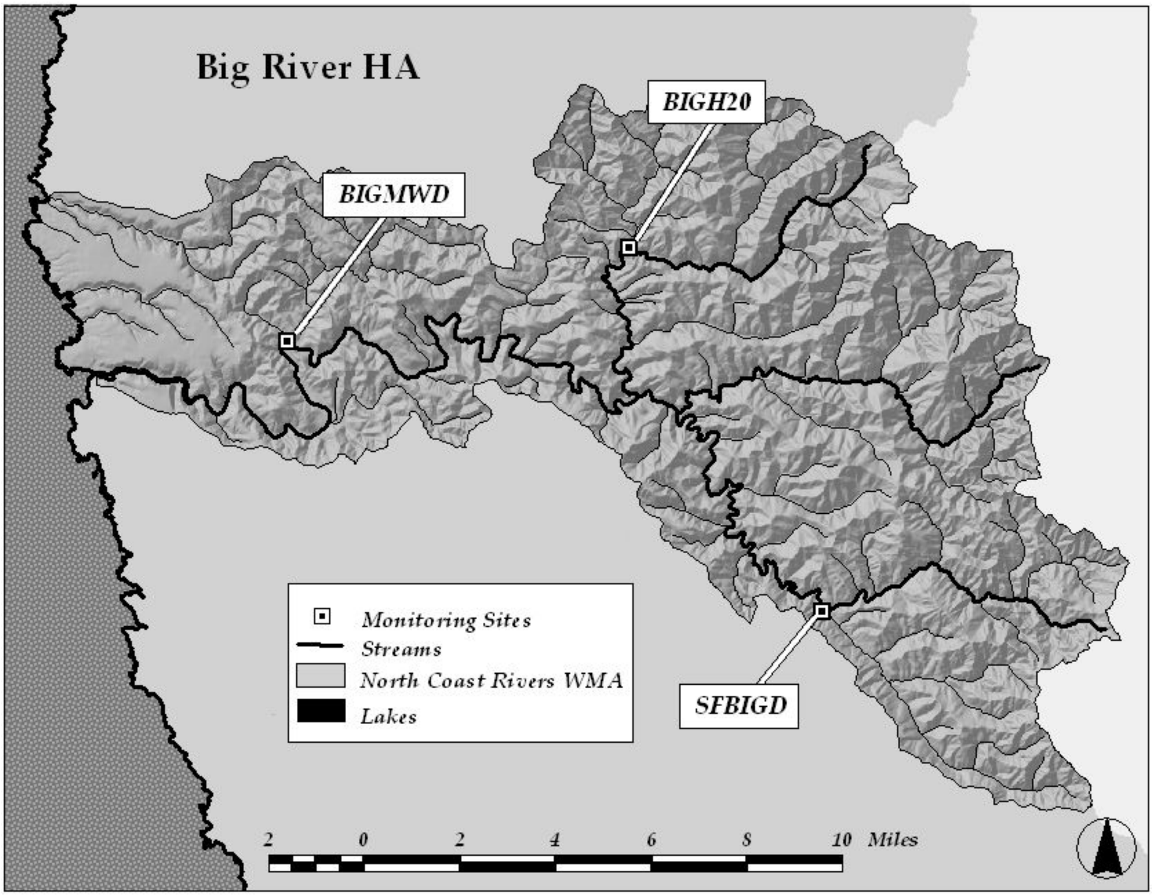

Figure 58. Sampling locations in the Big River HA

Within the Big River HA, there were three rotating basin sampling stations (see Figure 58). There were a total of six site visits, one site visit to each site in May and June of 2001.

During the six site visits, NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON) and trace metals concentrations (MET). The NCR did not analyze samples from these locations for pesticides and pesticide residues (PEST), PCBs (PCB), or phenolic compounds (PHEN). Table 61 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the various criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 list the numeric values for the applicable criteria, objectives, and standards utilized in this report.

Table 61. Summary of sample types, sample numbers, and objective exceedances in the Big River HA

		FP	CON	MET		PEST	PCB	PHEN
SFBIGD	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	14	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	1	1	-	Quantifiable Concentrations	-	-	-
BIGH20	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	19	14	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	1	2	-	Quantifiable Concentrations	-	-	-
BIGMWD	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	19	14	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	1	1	-	Quantifiable Concentrations	-	-	-

3.6.3.3.1.____Field Parameters

DO and pH conditions at the time of sampling were all in compliance with the Basin Plan.

Specific conductivity did not fully meet the Basin Plan objective during all site visits. The Basin Plan objective for specific conductivity is a two-part objective with a 50% upper limit of 195 mS/cm2 and a 90% upper limit of 300 mS/cm2. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 195 mS/cm2 and 90% or more of the monthly means within a calendar year must be less than or equal to 300 mS/cm2. The observed specific conductivity values ranged from 195 to 297 mS/cm2. The observed values met the 90% upper limit each year, but failed to meet the 50% upper limit at all stations in 2001. It is important to note that these results are based on two grab samples collected during the calendar year and are not a compilation of many samples used to calculate monthly means as the objective suggests.

3.6.3.3.2.____Conventional Water Quality Parameters

Ammonia-N, chloride, O-PO4, total-P, hardness, and sulfate concentrations at the time of sampling were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, and the USEPA recommended criteria for freshwater aquatic life protection. Nitrate-N and nitrite-N were not analyzed in this HA.

TDS concentration values did not fully meet the Basin Plan objective during all site visits. The Basin Plan objective for TDS is a two-part objective with a 50% upper limit of 105 mg/L and a 90% upper limit of 120 mg/L. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 105 mg/L and 90% or more of the monthly means within a calendar year must be less than or equal to 120 mg/L. The observed TDS concentrations ranged from 115 to 171 mg/L. The observed values met the 90% upper limit each year, but failed to meet the 50% upper limit at stations SFBIGD and BIGH20. It is important to note that these results are based on one grab sample collected at each location during the calendar year and are not a compilation of many samples used to calculate monthly means as the objective suggests.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

- O-PO4 concentrations exceeded the USEPA recommended concentration criterion of 0.05 mg/L on one of six site visits (17% exceedance rate), with concentrations ranging from ND (MDL 0.005 mg/L) to 0.058 mg/L

3.6.3.3.3. Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. Cadmium, chromium, copper, lead, mercury, nickel, and zinc concentrations were all in compliance with every objective at the time of sampling.

3.6.3.4.____Albion River HA

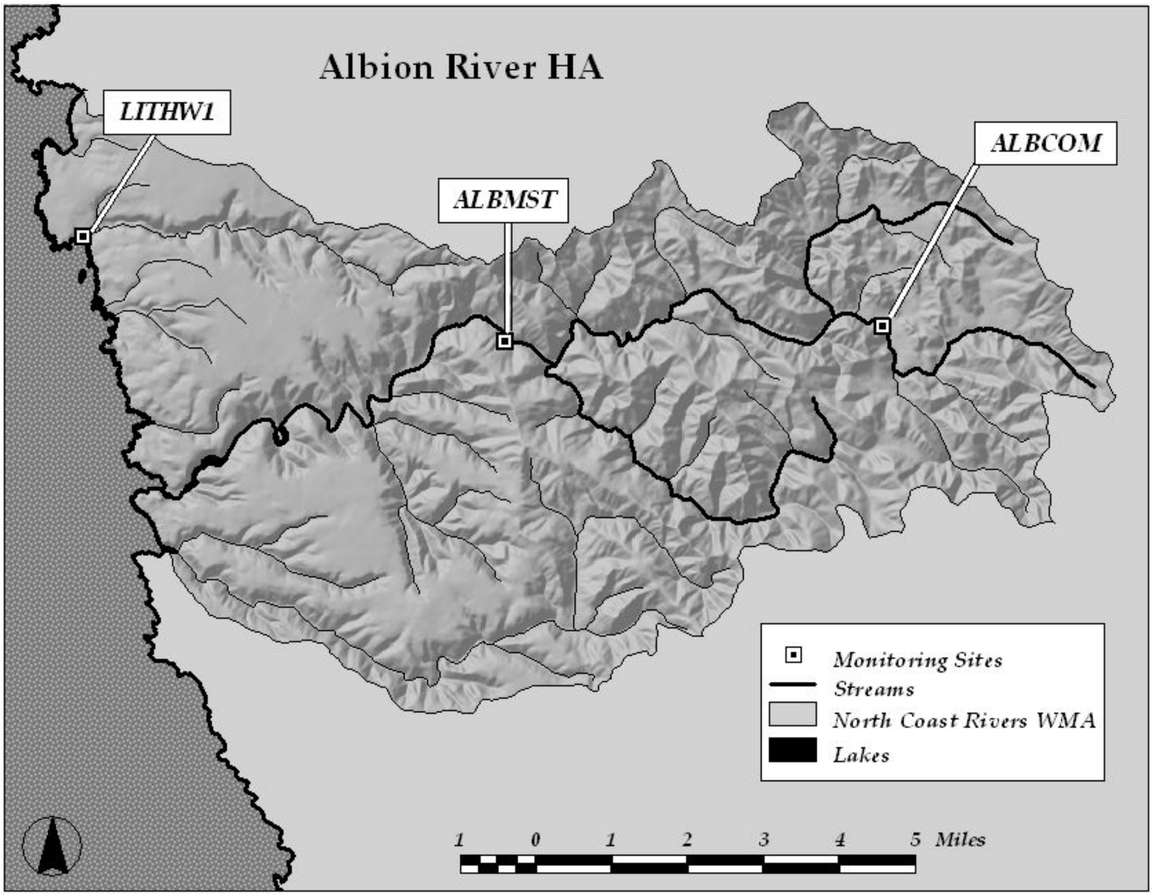

Figure 59. Sampling locations in the Albion River HA

Within the Albion River HA, there were three rotating basin sampling stations, two in the Albion River watershed and one in the coastal Little River Planning Watershed (PWS) (see Figure 59). There were a total of six site visits, one site visit to each site in May and June of 2001.

During the six site visits, NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON) and trace metals concentrations (MET). The NCR did not analyze samples from these locations for pesticides and pesticide residues (PEST), PCBs, (PCB), or phenolic compounds (PHEN). Table 62 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to applicable criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 lists the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 62. Summary of sample types, sample numbers, and objective exceedances in the Albion River HA

		FP	CON	MET		PEST	PCB	PHEN
ALBCOM	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	14	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	-	-	Quantifiable Concentrations	-	-	-
ALBMST	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	14	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	-	-	Quantifiable Concentrations	-	-	-
LITHW1	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	14	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	-	-	Quantifiable Concentrations	-	-	-

3.6.3.4.1.____Field Parameters

Specific conductivity, DO, and pH conditions at the time of sampling were all in compliance with the Basin Plan.

3.6.3.4.2.____Conventional Water Quality Parameters

Ammonia-N, chloride, TDS, O-PO4, total-P, hardness, and sulfate concentrations at the time of sampling were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, and the USEPA recommended criteria for freshwater aquatic life protection. Nitrate-N and nitrite-N were not analyzed in this HA.

3.6.3.4.3.____Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. Cadmium, chromium, copper, lead, mercury, nickel, and zinc concentrations were all in compliance with every objective at the time of sampling.

3.6.3.5.____Navarro River HA

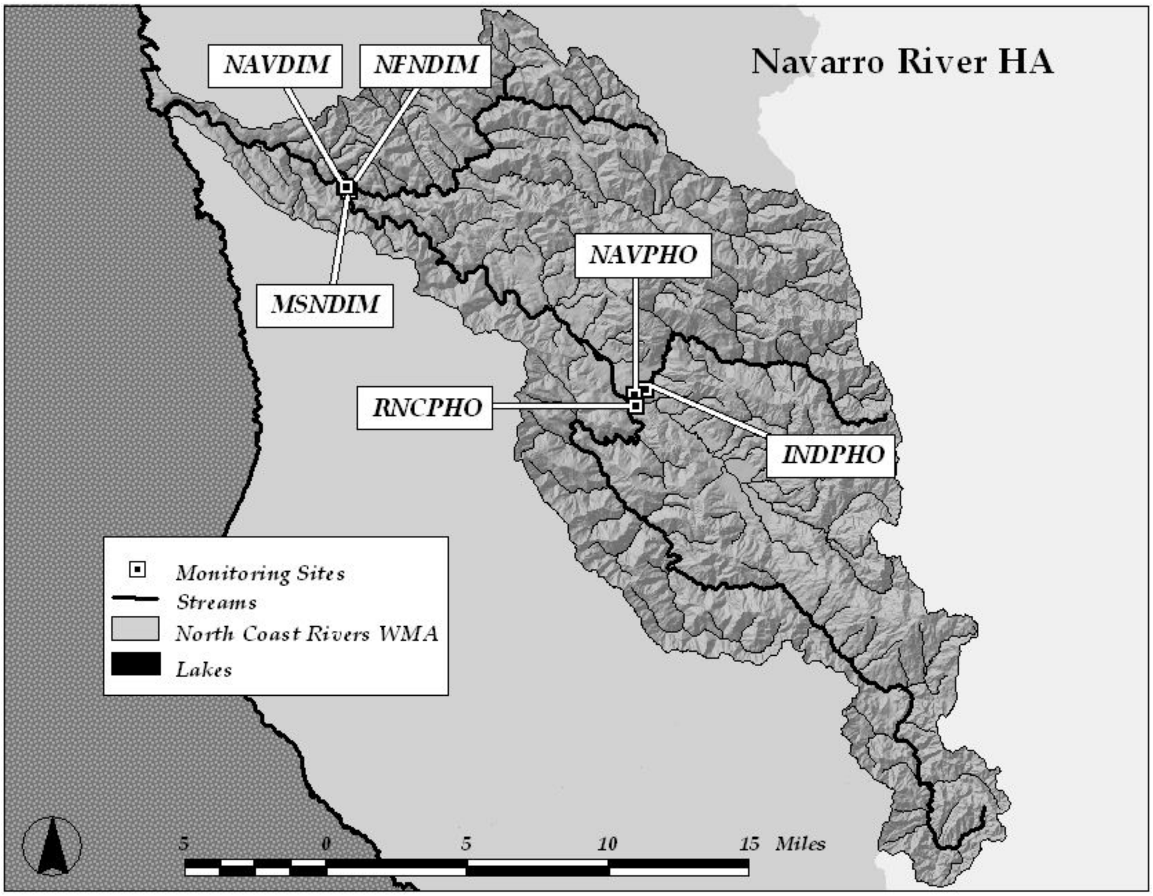

Figure 60. Sampling locations in the Navarro River HA

Within the Navarro River HA, there were six rotating basin sampling stations (see Figure 60). There were a total of 12 site visits, one site visit to each site in May and June of 2001.

During the 12 site visits, NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON) and trace metals concentrations (MET). The NCR did not analyze samples for pesticides and pesticide residues (PEST), PCBs (PCB), or phenolic compounds (PHEN) at these locations. Table 63 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the various criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 lists the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 63. Summary of sample types, sample numbers, and objective exceedances in the Navarro River HA

		FP	CON	MET		PEST	PCB	PHEN
INDPHO	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	14	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	1	1	-	Quantifiable Concentrations	-	-	-
RNCPHO	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	14	Total # Analytes	-	-	-
	Exceedances	1	-	-	Detections	-	-	-
	Potential Exceedances	1	1	-	Quantifiable Concentrations	-	-	-
NAVPHO	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	14	Total # Analytes	-	-	-
	Exceedances	1	-	-	Detections	-	-	-
	Potential Exceedances	1	1	-	Quantifiable Concentrations	-	-	-
NFNDIM	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	14	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	1	1	-	Quantifiable Concentrations	-	-	-
NAVDIM	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	14	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	1	-	-	Quantifiable Concentrations	-	-	-
MSNDIM	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	14	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	1	-	-	Quantifiable Concentrations	-	-	-

3.6.3.5.1.____Field Parameters

DO conditions at the time of sampling were in compliance with the Basin Plan.

pH values did not meet the Basin Plan objective on two of 12 site visits (17% exceedance rate). The Basin Plan objective for pH is a two-part objective with a minimum value of 7.0 and a maximum value of 8.5. The observed pH values ranged from 7.72 to 9.93. The minimum pH objective was met on all occasions, but the maximum Basin Plan objective was exceeded at station NAVPHO on 5/1/2002 (9.93) and at station RNCPHO on 6/1/2001 (8.55).

Specific conductivity did not fully meet the Basin Plan objective during all site visits. The Basin Plan objective for specific conductivity is a two-part objective with a 50% upper limit of 250 mS/cm2 and a 90% upper limit of 285 mS/cm2. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 250 mS/cm2 and 90% or more of the monthly means within a calendar year must be less than or equal to 285 mS/cm2. The observed specific conductivity values ranged from 254 to 331 mS/cm2. The observed values met the 90% upper limit at every station except INDPHO, and failed to meet the 50% upper limit at every station. It is important to note that these results are based on two grab samples collected at each location during the calendar year and are not a compilation of many samples used to calculate monthly means as the objective suggests.

3.6.3.5.2.____Conventional Water Quality Parameters

Ammonia-N, chloride, O-PO4, total-P, hardness, and sulfate concentrations at the time of sampling were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water and the USEPA recommended criteria for freshwater aquatic life protection. Nitrate-N and nitrite-N were not analyzed in this HA.

TDS met the Basin Plan objective during the site visits to stations MSNDIM and NAVDIM, but failed to fully meet the objectives at the other stations. The Basin Plan objective for TDS is a two-part objective with a 50% upper limit of 150 mg/L and a 90% upper limit of 170 mg/L. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 150 mg/L and 90% or more of the monthly means within a calendar year must be less than or equal to 170 mg/L. The observed TDS concentrations ranged from 120 to 200 mg/L. The observed values met the 90% upper limit each year, but failed to meet the 50% upper limit. It is important to note that these results are based on two grab samples collected at each location during the calendar year and are not a compilation of many samples used to calculate monthly means as the objective suggests.

3.6.3.5.3.____Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. Cadmium, chromium, copper, lead, mercury, nickel, and zinc concentrations were all in compliance with every objective at the time of sampling.

3.6.3.6.____Point Arena HA

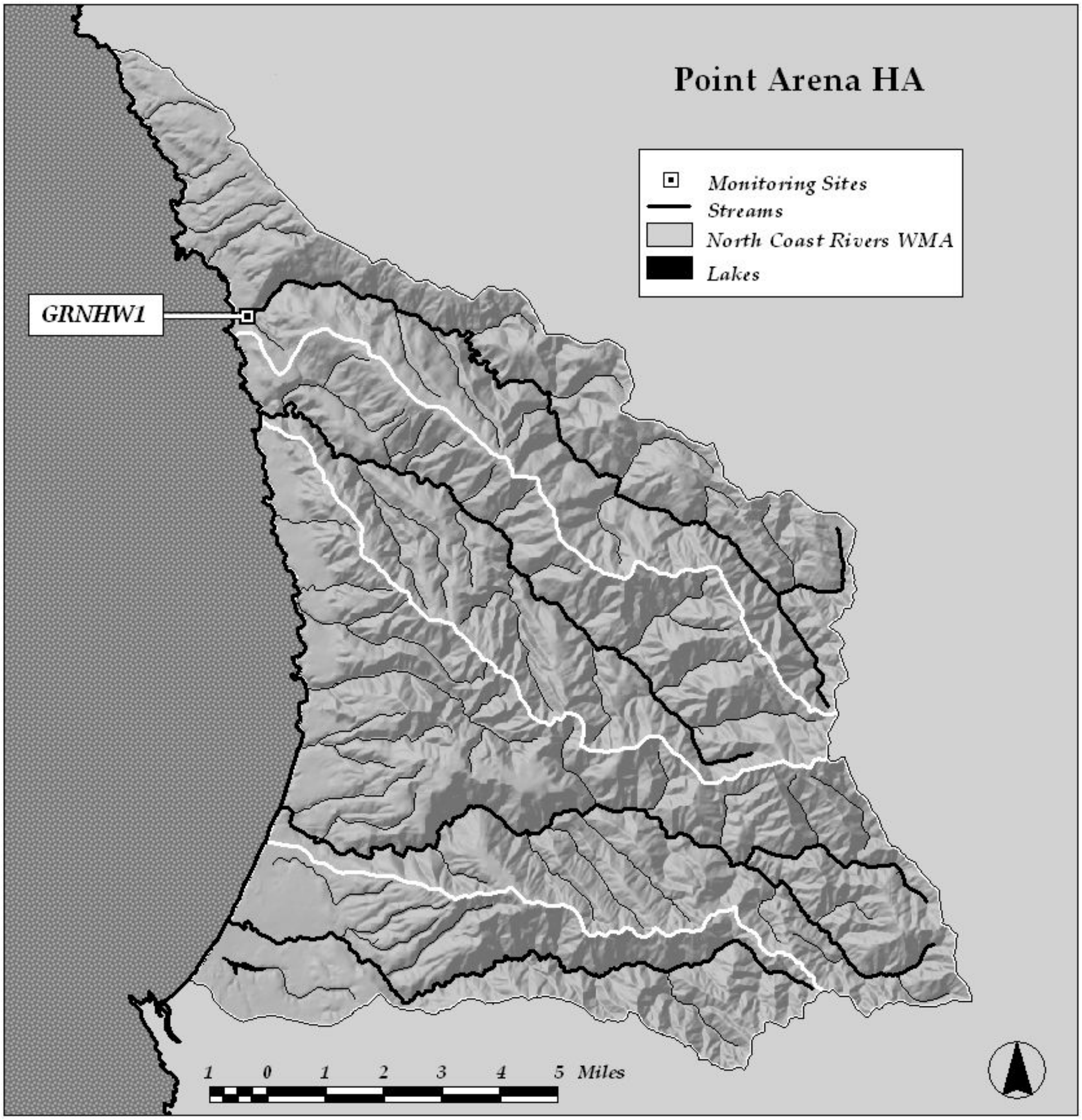

Figure 61. Sampling locations in the Point Arena HA

There are four Hydrologic Sub-Areas (HSA) within the Point Arena HA. The HSAs are:

- Greenwood Creek HSA
- Elk Creek HSA
- Alder Creek HSA
- Brush Creek HSA

Within the Point Arena HA, only the Greenwood Creek HSA was sampled. There was one rotating basin sampling station, GRNHW1 (Greenwood Creek at Highway 1) located just upstream of where Highway 1 crosses Greenwood Creek (see Figure 61). There were a total of two site visits, one site visit in May and one in June of 2001.

During the two site visits, NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON) and trace metals concentrations (MET). The NCR did not analyze samples from this location for pesticides and pesticide residues (PEST), PCBs (PCB), or phenolic compounds (PHEN). Table 64 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to applicable criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 lists the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 64. Summary of sample types, sample numbers, and objective exceedances in the Greenwood Creek HSA

		FP	CON	MET		PEST	PCB	PHEN
GRNHW1	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	14	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	-	-	Quantifiable Concentrations	-	-	-

3.6.3.6.1.____Field Parameters

Specific Conductivity, DO, and pH conditions at the time of sampling were all in compliance with the Basin Plan.

3.6.3.6.2.____Conventional Water Quality Parameters

Ammonia-N, chloride, TDS, O-PO4, total-P, hardness, and sulfate concentrations at the time of sampling were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, and the USEPA recommended criteria for freshwater aquatic life protection. Nitrate-N and nitrite-N were not analyzed in this HA.

3.6.3.6.3.____Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. Cadmium, chromium, copper, lead, mercury, nickel, and zinc concentrations were all in compliance with every objective at the time of sampling.

3.6.3.7.____Garcia River HA

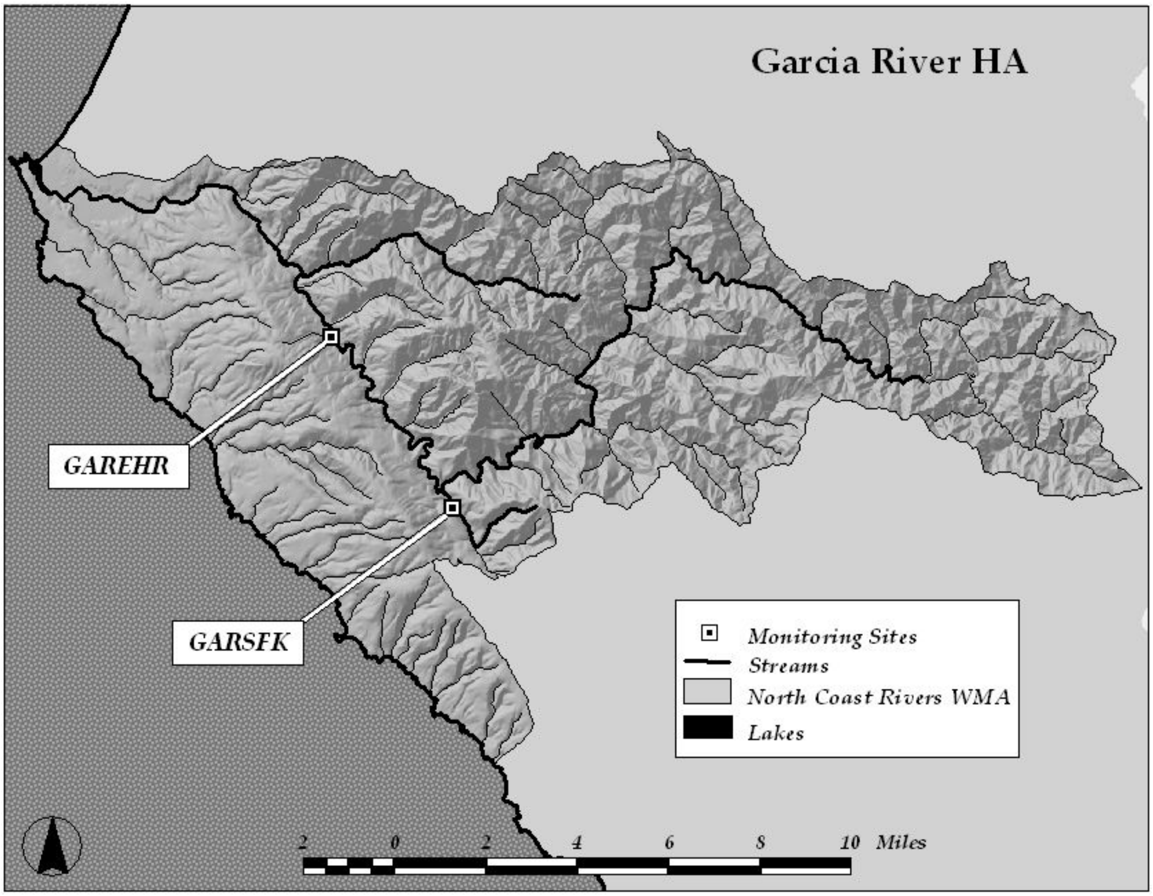

Figure 62. Sampling locations in the Garcia River HA

Within the Garcia River HA, there were two rotating basin sampling stations (see Figure 62). There were a total of four site visits, one site visit to each station in May and June of 2001.

During the four site visits, NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON) and trace metals concentrations (MET). The NCR did not analyze samples from these locations for pesticides and pesticide residues (PEST), PCBs (PCB), or phenolic compounds (PHEN). Table 65 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to applicable criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR, and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 lists the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 65. Summary of sample types, sample numbers, and objective exceedances in the Garcia River HA

		FP	CON	MET		PEST	PCB	PHEN
GARSFK	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	14	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	-	-	Quantifiable Concentrations	-	-	-
GAREHR	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	14	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	-	-	Quantifiable Concentrations	-	-	-

3.6.3.7.1.____Field Parameters

Specific Conductivity, DO, and pH conditions at the time of sampling were all in compliance with the Basin Plan.

3.6.3.7.2.____Conventional Water Quality Parameters

Ammonia-N, chloride, TDS, O-PO4, total-P, hardness, and sulfate concentrations at the time of sampling were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water and the USEPA recommended criteria for freshwater aquatic life protection. Nitrate-N and nitrite-N were not analyzed in this HA.

3.6.3.7.3.____Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. Cadmium, chromium, copper, lead, mercury, nickel, and zinc concentrations were all in compliance with every objective at the time of sampling.

3.6.3.8.____Gualala River HA

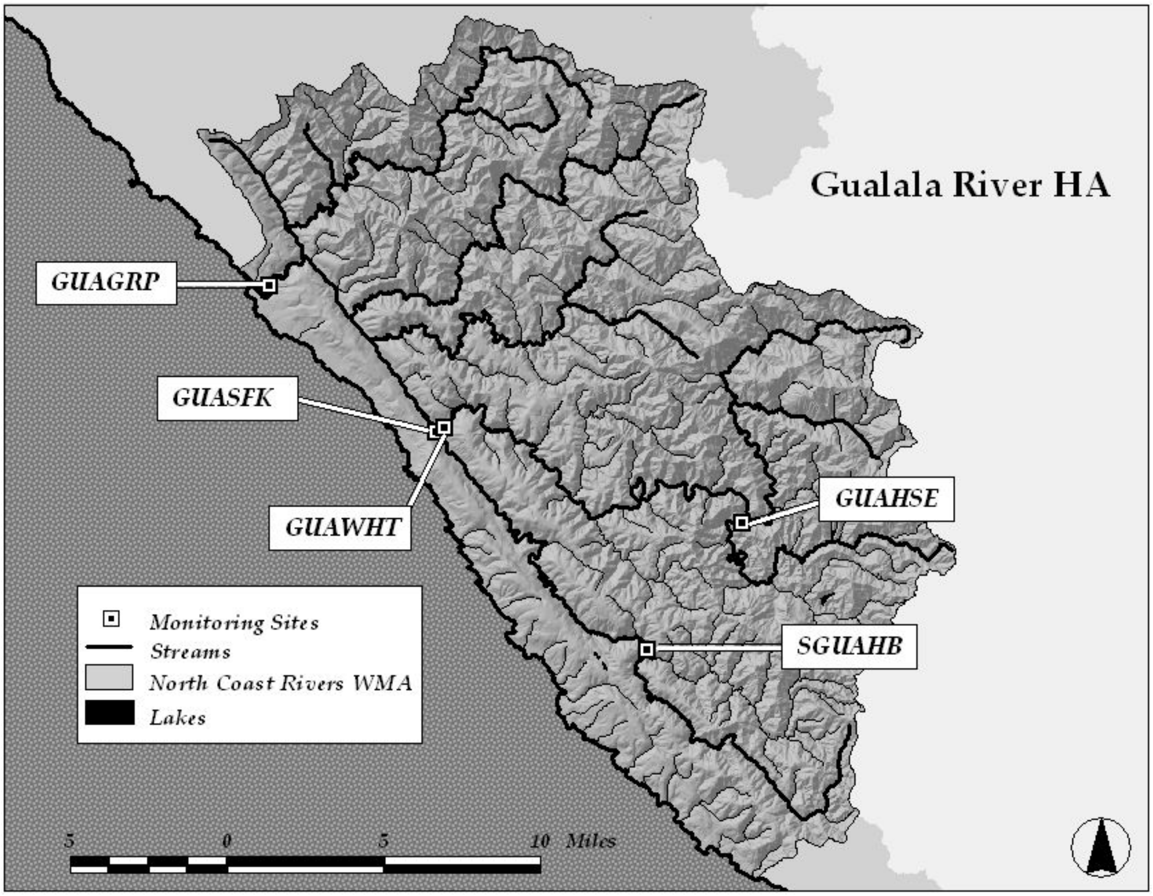

Figure 63. Sampling locations in the Gualala River HA

In the Gualala River HA, there were five sampling locations (see Figure 63). Table 55 lists the station names, locations, number of site visits, and sampling period. Station GUAGRP is a long-term monitoring site, and had 20 site visits during the fiscal years of 2000-06. The site visits corresponded to Fall, Winter, Spring and Early Summer conditions. The other sampling locations are rotating basin sampling locations. There were a total of eight site visits to the four rotating basin sampling locations, one site visit to each station in May and June of 2001.

During the 28 site visits, the NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), PCBs (PCB), and phenolic compounds (PHEN). Table 66 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to applicable criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and

163 lists the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 66. Summary of sample types, sample numbers, and objective exceedances in the Gualala River HA

		FP	CON	MET		PEST	PCB	PHEN
GUAHSE	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	14	Total # Analytes	-	-	-
	Exceedances	1	-	-	Detections	-	-	-
	Potential Exceedances	-	1	-	Quantifiable Concentrations	-	-	-
GUAWHT	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	14	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	1	-	Quantifiable Concentrations	-	-	-
SGUAHB	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	14	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	-	-	Quantifiable Concentrations	-	-	-
GUASFK	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	14	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	-	-	Quantifiable Concentrations	-	-	-
GUAGRP	# Sampling events	20	20	20	# Sampling events	4	4	2
	Total # Analytes	60	176	207	Total # Analytes	346	200	4
	Exceedances	-	’1	3	Detections	-	-	1
	Potential Exceedances	-	19	7	Quantifiable Concentrations	-	-	1

3.6.3.8.1.____Field Parameters

Specific Conductivity and DO conditions at the time of sampling were all in compliance with the Basin Plan.

pH values did not meet the Basin Plan objective on one of 28 site visits (4% exceedance rate). The Basin Plan objective for pH is a two-part objective with a minimum value of 7.0 and a maximum value of 8.5. The observed pH values ranged from 6.78 to 8.56. The minimum pH objective was met on all occasions, but the maximum Basin Plan objective was exceeded at station GUAHSE on 6/1/2002 (8.56).

3.6.3.8.2.____Conventional Water Quality Parameters

At each of the rotating basin sampling locations, ammonia-N, chloride, TDS, O-PO4, total-P, hardness, and sulfate concentrations at the time of sampling were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, and the USEPA recommended criteria for freshwater aquatic life protection. Nitrate-N and nitrite-N were not analyzed in this HA.

At station GUAGRP, ammonia-N, TDS, O-PO4, hardness, and sulfate concentrations at the time of sampling were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, and the USEPA recommended criteria for freshwater aquatic life protection.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criteria of 0.12 mg/L on 12 of 28 site visits (43% exceedance rate), with concentrations ranging from ND (MDL 0.010 mg/L) to 0.929 mg/L.
- Total-P concentrations exceeded the USEPA's recommended concentration criteria of 0.10 mg/L on two of 24 site visits (8% exceedance rate), with concentrations ranging from DNQ (RL 0.05 mg/L) to 0.26 mg/L.
- Chl-A concentrations exceeded the USEPA recommended concentration criteria of 1.08 ug/L on six of 28 site visits (21% exceedance rate), with concentrations ranging from ND (MDL 0.05 ug/L) to 4.48 ug/L.
- Chloride concentrations exceeded the USEPA recommended concentration criteria of 230 ug/L on one of 28 site visits (4% exceedance rate), with concentrations ranging from 3.84 to 390.00 mg/L.

3.6.3.8.3. Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 67.

- Arsenic, cadmium, chromium, mercury, nickel, selenium, silver and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on five of 18 site visits (28% exceedance rate), exceeded USEPA's secondary MCL for drinking water (50 ug/L) on eight site visits (44% exceedance rate), exceeded DHS's secondary MCL for drinking water (200 ug/L) on four site visits (22% exceedance rate), exceeded USEPA's maximum instantaneous concentration for freshwater aquatic life protection (750 ug/L) on three site visits (17% exceedance rate), and

exceeded the Basin Plan (1000 ug/L) on two site visits (11% exceedance rate). Aluminum concentrations ranged from 11.20 to 4015.00 ug/L.

- The California Toxics Rule (CTR) criterion to protect freshwater aquatic life for copper and lead is hardness dependent. Exceedance or compliance is determined through a calculation in which the total metals concentration and the hardness concentration are considered. Copper exceeded the CTR maximum concentration criterion on one of 18 site visits (6% exceedance rate). Lead potentially exceeded the CTR continuous concentration criteria on one of nine site visits (11% exceedance rate).

Table 67. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Gualala River HA (ug/L).

	Basin Plan	**Drinking Water Standards - Maximum Contaminant Levels (MCLs)**			
	NCRWQCB	**Ca DHS**		**U.S. EPA**	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	2	2	4	-	8
Copper Objective	-	1300	1000	1300	1000
Exceedances	-	0	0	0	0
Lead Objective	50	15	-	15	-
Exceedances	0	0	-	0	-
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	5 [2]	-	3
Copper Objective	Hardness dependent [1]	Hardness dependent [1]	-	-	-
Exceedances	1	1	-	-	-
Lead Objective	Hardness dependent [1]	Hardness dependent [1]	Hardness dependent	-	Hardness dependent
Exceedances	1	0	1	-	0

[1] *Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.*
[2] *Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.*
[1] *See Appendix C for graphs of these metals based on concentrations, hardness, and EPA criterion.*

3.6.3.8.4.____Pesticides, PCBs, and Phenols

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. There were no PCB or pesticide detections, but there was one nonylphenolethoxylate detection in a concentration of 2.32 ug/L. Nonylphenols are often found as a breakdown product from surfactants and detergents. USEPA's continuous concentration criterion for freshwater aquatic life protection for nonylphenol is 6.6 ug/L, therefore, this concentration is in compliance.

3.6.4. Trend Monitoring

For this report, we are only looking at general trends across sampling years. The long-term monitoring sites were chosen from both impaired and unimpaired waterbodies within each of the WMAs. This component of the SWAMP monitoring plan is designed to monitor water quality trends through time, allowing for the ongoing evaluation of improvements or degradation to water quality. The long-term monitoring sites are located at the bottom of large drainage areas and reflect the impacts of management activities occurring within the respective basins. The long-term sampling locations have had between 10 and 23 site visits over the course of two to five years, dependent upon the timing of station establishment. Each sampling effort was designed so that site visits in the same watershed occurred within the same one to three day period.

3.6.4.1. Smith River

3.6.4.1.1. Field Parameters

Only Specific Conductivity and pH values were evaluated for the determination of trends. Specific Conductivity values at all stations varied by season, with the highest values recorded in the fall and the lowest values recorded in the winter and spring. There was no apparent trend in concentrations, the values remained within the same range throughout the period of record. pH values did not exhibit a seasonal trend nor did the concentrations demonstrate any trend through the period of record.

3.6.4.1.2. Conventional Water Quality Parameters

Hardness, chloride, sulfate, and TDS concentrations at all stations varied by season, with the highest values recorded during the fall. There was no apparent trend in concentrations, the values remained within the same range throughout the period of record. Chl-A, nitrate, Total P, Ortho-P, and TKN results did not exhibit a seasonal trend nor did the concentrations demonstrate any trend through the period of record.

3.6.4.1.3. Trace Metals

Aluminum, arsenic, chromium, copper, lead, mercury, nickel, silver and zinc concentrations at all stations varied by season, with the highest values recorded during the winter and spring and the lowest values recorded in the summer and fall. There was no apparent trend in the concentrations of any trace metals constituent, the values remained within the same range throughout the period of record.

3.6.4.2. Gualala River

3.6.4.2.1. Field Parameters

Only Specific Conductivity and pH values were evaluated for the determination of trends. Specific Conductivity values at all stations varied by season, with the lowest values recorded in the spring and the highest values recorded in the fall. There was no apparent trend in concentrations, the values remained within the same range throughout the period of record. pH values at this station did not exhibit a seasonal trend nor did the values demonstrate any trend through the period of record.

3.6.4.2.2.____Conventional Water Quality Parameters

Hardness, chloride, sulfate, and TDS concentrations at all stations varied by season, with the highest values recorded during the fall. There was no apparent trend in concentrations; the values remained within the same range throughout the period of record. Chl-A, nitrate, Total P, Ortho-P, and TKN results did not exhibit a seasonal trend nor did the concentrations demonstrate any trend through the period of record.

3.6.4.2.3.____Trace Metals

Aluminum, arsenic, chromium, copper, lead, mercury, nickel, silver, and zinc concentrations at all stations varied by season, with the highest values recorded during the winter and spring and the lowest values recorded in the summer and fall. There was no apparent trend in the concentrations of any trace metals constituent, the values remained within the same range throughout the period of record.

3.7______Russian/Bodega WMA

There are seven Hydrologic Areas (HA) within the Russian/Bodega Watershed Management Area (WMA). The HAs are:

- Upper Russian HA
- Middle Russian River HA
- Lower Russian River HA
- Salmon Creek HA
- Estero Americano HA
- Estero San Antonio HA
- Bodega Harbor HA

Within the Russian/Bodega WMA, there are 29 sampling locations comprising five long-term trend monitoring stations and 24 rotating basin sampling stations. The North Coast Regional Board did not conduct any sampling work in the Salmon Creek, Estero Americano, Estero San Antonio, or Bodega Harbor HAs.

Table 68.. Russian/Bodega WMA. Station types, locations and sampling periods

Station ID	Station Type	Site Visits	Station Location	Sampling Time Period
Upper Russian River HA				
West Fork Russian River				
WFKRR1	Rotating	6	West Fork Russian River at Mendocino Avenue	6/2001 - 4/2005
East Fork Russian River				
EFRRPH	Rotating	5	East Fork Russian River at Powerhouse	10/2004 - 6/2005
EFRR20	Rotating	5	East Fork Russian River at Highway 20	10/2004 - 6/2005
EFRR01	Rotating	6	East Fork Russian River at Coyote Dam	6/2001 - 4/2005
Russian River Mainstem				
RRTAL1	Trend	22	Russian River at Talmage	6/2001 - 6/2006
RRART1	Rotating	3	Russian River downstream Ukiah WTP	10/2004 - 2/2005
RRRRES	Rotating	2	Russian River at Russian River Estates	06/2001
RRHOP1	Rotating	2	Russian River at Hopland	06/2001
Middle Russian River HA				
RRCOMM	Rotating	2	Russian River at Comminski Station	06/2001
RRCLO1	Trend	22	Russian River at Cloverdale	6/2001 - 6/2006
CLOSTP	Rotating	5	Russian River downstream Cloverdale WTP	10/2004 - 6/2005
RRGEYS	Rotating	2	Russian River at Geyserville	06/2001
RRALEX	Rotating	2	Russian River at Alexander Valley Bridge	06/2001
RRHMB1	Trend	22	Russian River at Healdsburg	6/2001 - 6/2006
RRSYPD	Rotating	2	Russian River at Syre Pond	06/2001
RRWOH	Rotating	2	Russian River at Wohler Dam	06/2001
Tributary to Russian River				
BIGSUL	Rotating	5	Big Sulphur Creek at Geysers Road Bridge	10/2004 - 6/2005
Tributary to Russian River				
DRCKWS	Rotating	5	Dry Creek at Warm Springs Dam	10/2004 - 6/2005
DRCRRR	Rotating	2	Dry Creek at Russian River	06/2001
DRYCRK	Rotating	5	Dry Creek at Russian River	10/2004 - 6/2005
Tributary to Russian River				
LAGTRH	Rotating	2	Laguna de Santa Rosa at Trenton-Healdsburg Road	06/2001
LAGMIR	Trend	10	Laguna de Santa Rosa at Mirabel	10/2004 - 6/2006
Tributary to Laguna de Santa Rosa				
SRCWS1	Rotating	5	Santa Rosa Creek at Willowside Road	10/2004 - 6/2005
Lower Russian River HA				
RRODDF	Rotating	2	Russian River at Odd Fellows Crossing	06/2001
RRJB01	Trend	22	Russian River at Johnson's Beach	6/2001 - 6/2006
RRMRIO	Rotating	2	Russian River at Monte Rio	06/2001
RRVACB	Rotating	2	Russian River at Vacation Beach	06/2001
Tributary to Russian River				
AUSCRK	Rotating	4	Austin Creek near Russian River	11/2004 - 6/2005

3.7.1.______Upper Russian River HA

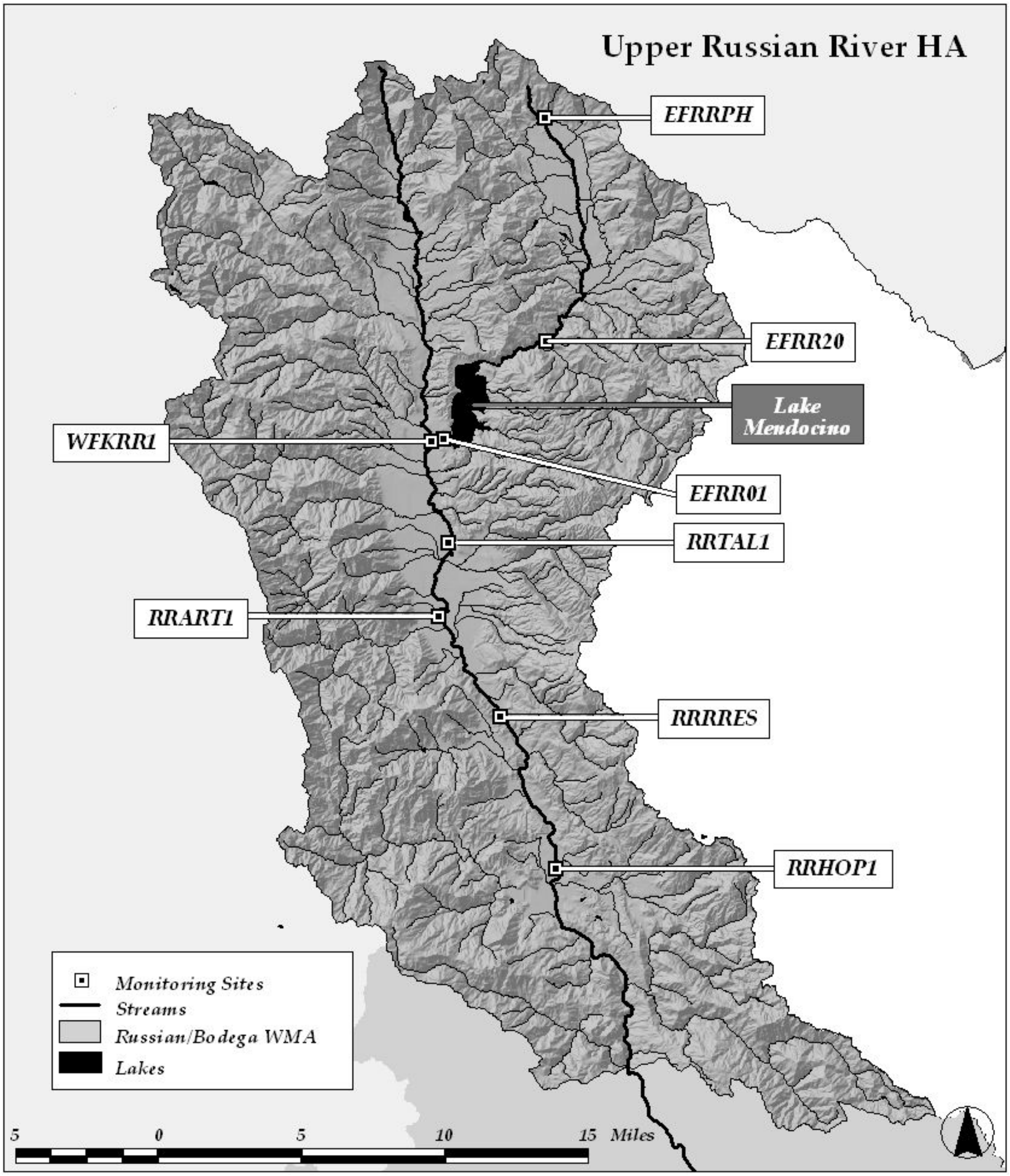

Figure 64. Sampling locations in the Upper Russian River HA

In the Upper Russian River HA, there were eight sampling locations, one in the West Fork Russian River, three in the East Fork Russian River, and four in the Russian River Mainstem downstream of the confluence of the West and East Forks (see Figure 64). Table 68 lists the station names, descriptions, and locations. Station RRTAL1 is a long-term trend monitoring site, and had 22 site visits during the fiscal years of 2000-06. The other sampling locations are rotating basin sampling locations. There were a total of 29 site visits to these locations during the fiscal years of 2000-05. The site visits corresponded to Fall, Winter, Spring, and Early Summer conditions.

3.7.1.1.____West Fork Russian River

During the six site visits, the NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), PCBs (PCB), and phenolic compounds (PHEN). Table 69 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the applicable criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 lists the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 69. Summary of sample types, sample numbers, and objective exceedances in the Upper Russian River HA - West Fork Russian River

		FP	CON	MET		PEST	PCB	PHEN
WFKRR1	# Sampling events	6	6	6	# Sampling events	4	4	2
	Total # Analytes	18	54	66	Total # Analytes	368	200	4
	Exceedances	1	-	-	Detections	-	-	1
	Potential Exceedances	2	9	1	Quantifiable Concentrations	-	-	1

3.7.1.1.1.____Field Parameters

pH conditions at the time of sampling were all in compliance with the Basin Plan.

Specific conductivity did not fully meet the Basin Plan objective during all site visits. The Basin Plan objective for specific conductivity is a two-part objective with a 50% upper limit of 250 mS/cm2 and a 90% upper limit of 320 mS/cm2. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 250 mS/cm2 and 90% or more of the monthly means within a calendar year must be less than or equal to 320 mS/cm2. The observed specific conductivity values range from 160 to 340 mS/cm2. The observed values failed to meet the 90% upper limit in 2004 and failed to meet the 50% upper limit in 2001 and 2004. It is important to note that these results are based on two grab samples collected during each calendar year and are not a compilation of many samples used to calculate monthly means as the objective suggests.

DO values did not meet the Basin Plan objective on one of 48 site visits (2% exceedance rate). The Basin Plan objective for DO is a two-part objective, with an absolute minimum of 7.0 mg/L and a 50% lower limit of 10.0 mg/L. This means that 50% or more of the monthly means in a calendar year must be greater than or equal to 10.0 mg/L. The observed DO values ranged from 6.40 to 12.49 mg/L. The observed concentrations did not meet the absolute minimum criterion on 6/21/2201 at station WFKRR1 (6.40 mg/L).

3.7.1.1.2.____Conventional Water Quality Parameters

Ammonia-N, chloride, hardness, OPO4, Chl-A, and sulfate concentrations, at the time of sampling, were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, California Toxics Rule (CTR) and the USEPA recommended criteria for freshwater aquatic life protection.

TDS did not fully meet the Basin Plan objective during all site visits. The Basin Plan objective for TDS is a two-part objective with a 50% upper limit of 150 mg/L and a 90% upper limit of 170 mg/L. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 150 mg/L and 90% or more of the monthly means within a calendar year must be less than or equal to 170 mg/L. The observed TDS concentrations ranged from 102 to 230 mg/L. The observed values met the 90% upper limit each year, but failed to meet the 50% upper limit in 2001 and 2004. It is important to note that these results are based on one grab sample collected at each location during the calendar year and are not a compilation of many samples used to calculate monthly means as the objective suggests.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criterion of 0.12 mg/L on four of six site visits (67% exceedance rate), with concentrations ranging from ND values (MDL 0.045 mg/L) to 0.259 mg/L.
- Total-P concentrations exceeded the USEPA's recommended concentration criterion of 0.10 mg/L on two of six site visits (33% exceedance rate), with concentrations ranging from ND (MDL 0.030) to 0.420 mg/L.

3.7.1.1.3.____Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 70.

- Arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on one of six site visits (17% exceedance rate) and exceeded USEPA's secondary MCL for drinking water (50 ug/L) on one site visit (17% exceedance rate). Aluminum concentrations ranged from 4.38 to 147.00 ug/L.

Table 70. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Upper Russian River HA – West Fork Russian River (ug/L).

	Basin Plan	**Drinking Water Standards - Maximum Contaminant Levels (MCLs)**			
	NCRWQCB	**Ca DHS**		**U.S. EPA**	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	0	0	0	-	1
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	1	-	0

[1] *Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.*
[2] *Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.*

3.7.1.1.4.____Pesticides, PCBs, and Phenols

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. There were no PCB or pesticide detections, but there was one nonylphenol detection in a concentration of 2.47 ug/L. Nonylphenol is often found as a breakdown product from surfactants and detergents. USEPA's continuous concentration criterion for freshwater aquatic life protection for nonylphenol is 6.6 ug/L, therefore, this concentration is in compliance.

3.7.1.2.____East Fork Russian River

During the 16 site visits, the NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), PCBs (PCB), and phenolic compounds (PHEN). Table 71 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the applicable criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and

163 lists the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 71. Summary of sample types, sample numbers, and objective exceedances in the Upper Russian River HA – East Fork Russian River

		FP	CON	MET		PEST	PCB	PHEN
EFRRPH (above Lake Mendocino)	# Sampling events	5	5	5	# Sampling events	5	5	3
	Total # Analytes	12	45	55	Total # Analytes	461	250	6
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	6	2	Quantifiable Concentrations	-	-	-
EFRR20 (above Lake Mendocino)	# Sampling events	5	5	5	# Sampling events	5	5	3
	Total # Analytes	12	45	55	Total # Analytes	461	250	6
	Exceedances	-	-	-	Detections	-	-	2
	Potential Exceedances	-	6	3	Quantifiable Concentrations	-	-	1
EFRR01 (below Lake Mendocino)	# Sampling events	6	6	6	# Sampling events	4	4	2
	Total # Analytes	18	54	66	Total # Analytes	368	200	4
	Exceedances	-	-	-	Detections	-	-	2
	Potential Exceedances	-	13	3	Quantifiable Concentrations	-	-	1

3.7.1.2.1. Field Parameters

Specific conductivity, DO, and pH conditions at the time of sampling were all in compliance with the Basin Plan.

3.7.1.2.2. Conventional Water Quality Parameters

Ammonia-N, chloride, hardness, TDS, OPO4, and sulfate concentrations, at the time of sampling, were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection.

TDS did not fully meet the Basin Plan objective during all site visits. The Basin Plan objective for TDS is a two-part objective with a 50% upper limit of 150 mg/L and a 90% upper limit of 170 mg/L. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 150 mg/L and 90% or more of the monthly means within a calendar year must be less than or equal to 170 mg/L. The observed TDS concentrations ranged from 102 to 230 mg/L. The observed values met the 90% upper limit each year, but failed to meet the 50% upper limit at station EFRR01 in 2004. It is important to note that these results are based on one grab sample collected at each location during the calendar year and are not a compilation of many samples used to calculate monthly means as the objective suggests.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criteria of 0.12 mg/L on all 16 site visits (100% exceedance rate), with concentrations ranging from 0.15 mg/L to 0.445 mg/L.
- Total-P concentrations exceeded the USEPA's recommended concentration criteria of 0.10 mg/L on two of 16 site visits (13% exceedance rate), with concentrations ranging from ND (MDL 0.030) to 0.370 mg/L.
- Chl-A concentrations exceeded the USEPA recommended concentration criteria of 1.08 ug/L on six of 16 site visits (38% exceedance rate), with concentrations ranging from 0.263 to 2.90 ug/L.

3.7.1.2.3. Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 72.

- Arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on nine of 16 site visits (56% exceedance rate), exceeded USEPA's secondary MCL for drinking water (50 ug/L) on 11 site visits (69% exceedance rate), exceeded DHS's secondary MCL for drinking water (200 ug/L) on four site visits (25% exceedance rate). Aluminum concentrations ranged from 14.30 to 640.00 ug/L, with the highest average concentrations observed at station EFRR01.

Table 72. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Upper Russian River HA – East Fork Russian River (ug/L).

	Basin Plan	Drinking Water Standards - Maximum Contaminant Levels (MCLs)			
	NCRWQCB	Ca DHS		U.S. EPA	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	0	0	4	-	11
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	9	-	0

[1] Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.
[2] Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.

3.7.1.2.4.____Pesticides, PCBs, and Phenols

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. There were no PCB or pesticide detections, but there were four nonylphenol detections, two detections at EFRR20 in a DNQ concentration (RL 2.0 ug/L) and a concentration of 2.85 ug/L, and two detections at EFRR01 in a DNQ concentration (RL 2.0 ug/L) and a concentration of 2.17 ug/L. Nonylphenol is often found as a breakdown product from surfactants and detergents. USEPA's continuous concentration criterion for freshwater aquatic life protection for nonylphenol is 6.6 ug/L, therefore, this concentration is in compliance.

3.7.1.3.____Mainstem Russian River

During the 29 site visits, the NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), PCBs (PCB), and phenolic compounds (PHEN). Table 73 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the applicable criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 lists the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 73. Summary of sample types, sample numbers, and objective exceedances in the Upper Russian River HA – Mainstem Russian River

		FP	CON	MET		PEST	PCB	PHEN
RRTAL1	# Sampling events	22	22	22	# Sampling events	19	20	10
	Total # Analytes	63	192	242	Total # Analytes	1682	1000	20
	Exceedances	-	-	-	Detections	5	4	5
	Potential Exceedances	-	37	22	Quantifiable Concentrations	-	-	2
RRART1	# Sampling events	3	3	3	# Sampling events	3	3	1
	Total # Analytes	9	27	33	Total # Analytes	275	150	2
	Exceedances	-	-	-	Detections	1	-	1
	Potential Exceedances	-	7	3	Quantifiable Concentrations	-	-	-
RRRRES	# Sampling events	2	2	2	# Sampling events	2	0	0
	Total # Analytes	6	18	22	Total # Analytes	14	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	6	2	Quantifiable Concentrations	-	-	-
RRHOP1	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	22	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	3	2	Quantifiable Concentrations	-	-	-

3.7.1.3.1. Field Parameters

Specific conductivity, DO, and pH conditions at the time of sampling were all in compliance with the Basin Plan.

3.7.1.3.2. Conventional Water Quality Parameters

Ammonia-N, chloride, hardness, TDS, and sulfate concentrations, at the time of sampling, were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criteria of 0.12 mg/L on 26 of 28 site visits (90% exceedance rate), with concentrations ranging from 0.031 to 0.862 mg/L.

- Total-P concentrations exceeded the USEPA's recommended concentration criterion of 0.10 mg/L on five of 24 site visits (20% exceedance rate), with concentrations ranging from ND (MDL 0.030) to 0.500 mg/L.
- O-PO4 concentrations exceeded the USEPA recommended concentration criteria of 0.05 mg/L on three of 29 site visits (10% exceedance rate), with concentrations ranging from DNQ values (RL 0.010 mg/L) to 0.051 mg/L.
- Chl-A concentrations exceeded the USEPA recommended concentration criterion of 1.08 ug/L on 19 of 28 site visits (68% exceedance rate), with concentrations ranging from DNQ (RL 2.0 ug/L) to 3.20 ug/L.

3.7.1.3.3. Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 74.

- Arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations exceeded USEPA's criterion for continuous concentration for freshwater aquatic life protection (87 ug/L) on 21 of 29 site visits (72% exceedance rate), exceeded USEPA's secondary MCL for drinking water (50 ug/L) on all 29 site visits (100% exceedance rate), and exceeded DHS's secondary MCL for drinking water (200 ug/L) on 13 site visits (45% exceedance rate), and exceeded USEPA's maximum instantaneous concentration for freshwater aquatic life protection (750 ug/L) on one site visit (3% exceedance rate). Aluminum concentrations ranged from 52.80 to 871.00 ug/L.

Table 74. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Upper Russian River HA – Mainstem Russian River (ug/L).

	Basin Plan	**Drinking Water Standards - Maximum Contaminant Levels (MCLs)**			
	NCRWQCB	**Ca DHS**		**U.S. EPA**	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	0	0	18	-	29
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	32	-	1

[1] *Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.*
[2] *Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.*

3.7.1.3.4. Pesticides, PCBs, and Phenols

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. There were five nonylphenol, one nonylphenolethoxylate, six pesticide and four PCB detections.

Three of the nonylphenol and the one nonylphenolethoxylate detections were in DNQ concentrations (RL 2.0 ug/L), and two nonylphenol detections were in concentrations of 2.12 and 2.92 ug/L. Nonylphenol is often found as a breakdown product from surfactants and detergents. USEPA's continuous concentration criterion for freshwater aquatic life protection for nonylphenol is 6.6 ug/L, therefore, this concentration is in compliance.

The PCBs were all detected at station RRTAL1. The detections were all DNQ values (RL 0.001 ug/L). PCBs are a banned substance. USEPA's continuous concentration criterion for freshwater aquatic life protection for PCB is 0.014 ug/L, therefore, the maximum additive concentration of less than 0.004 ug/L is in compliance.

There were six detections of five different pesticides. The detected pesticides were:

- Diazinon (RL 0.02 ug/L)
- Dichlofenthion (RL 0.05 ug/L)
- Disulfoton (RL 0.05 ug/L)
- Endosulfan-sulfate (RL 0.001 ug/L)
- delta-HCH (RL 0.002 ug/L)

All of the pesticides were detected in DNQ concentrations.

- Dichlofenthion and Disulfoton are organophosphate pesticides for which there is no objective.
- Diazinon is a nonsystemic organophosphate insecticide removed from residential use in 2004. USEPA's continuous concentration criterion for freshwater aquatic life protection for Diazinon is 0.05 ug/L, therefore, this concentration is in compliance.
- Endosulfan-sulfate is an organochlorine insecticide. USEPA's 24-hour average concentration criteria for freshwater aquatic life protection for Endosulfan-sulfate is 0.056 ug/L, therefore, this concentration is in compliance.
- HCH (alpha-, delta-, and gamma isomers) is an EPA Severely Restricted Pesticide (Lindane) and is listed by the United Nations as a persistent organic pollutant (POP). The Basin Plan objective for Lindane is 0.004 mg/L, therefore, these concentrations are in compliance with the objective.

3.7.2.______Middle Russian River HA

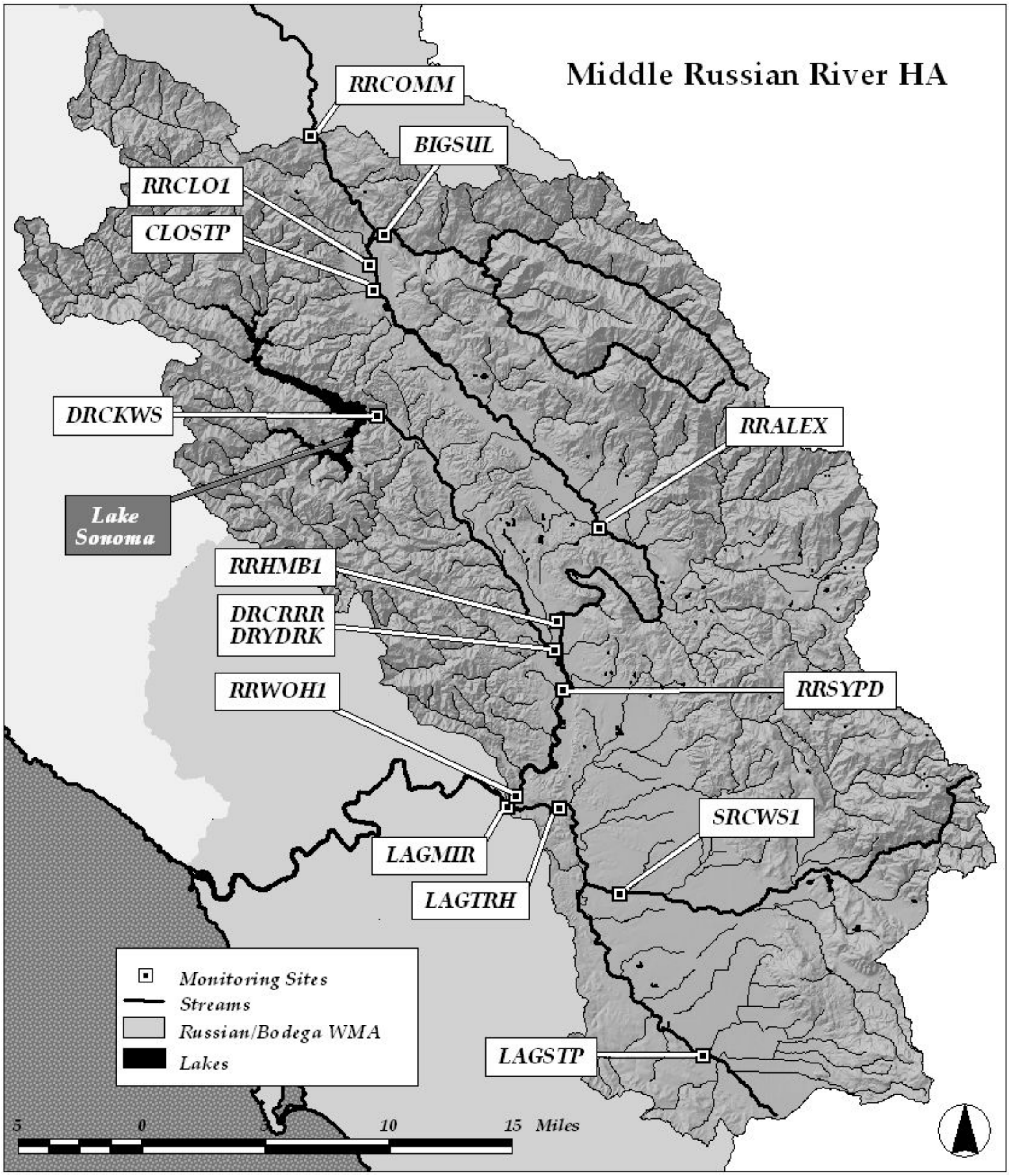

Figure 65. Sampling locations in the Middle Russian River HA

In the Middle Russian River HA, there were 14 sampling locations (see Figure 65). Table 68 lists the station names, descriptions, and locations. Included are eight Russian River mainstem stations, two of which are long-term trend monitoring sites that had 44 site visits during the fiscal years of 2000-06. Station CLOSTP is a rotating basin sampling location which had five site visits during the 2004-05 fiscal year. These site visits corresponded to Fall, Winter, Spring and Early Summer conditions.

The other five mainstem sampling locations are rotating basin sampling locations. There were a total of 10 site visits to these locations during the 2000-01 fiscal year with two site visits to each site in June 2001. Three tributary systems were sampled, Big Sulfur Creek, Dry Creek, and Laguna de Santa Rosa. This group included station LAGMIR which is a long-term trend monitoring site established in 2004, and had only 10 site visits during the fiscal years of 2004-06. The other tributary sampling locations are rotating basin sampling locations. There were a total of 24 site visits to these locations in June 2001 and during the 2004-05 fiscal year.

3.7.2.1. Mainstem Russian River

During 59 site visits, the NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), PCBs (PCB), and phenolic compounds (PHEN). Table 75 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the applicable criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 lists the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 75. Summary of sample types, sample numbers, and objective exceedances in the Middle Russian River HA – Mainstem Russian River

		FP	CON	MET		PEST	PCB	PHEN
RRCOMM	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	22	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	4	2	Quantifiable Concentrations	-	-	-
RRCLO1	# Sampling events	22	22	22	# Sampling events	19	19	10
	Total # Analytes	66	192	264	Total # Analytes	1682	950	20
	Exceedances	-	-	2	Detections	13	13	4
	Potential Exceedances	-	33	14	Quantifiable Concentrations	1	-	-
CLOSTP	# Sampling events	5	5	5	# Sampling events	5	5	3
	Total # Analytes	15	45	55	Total # Analytes	461	250	6
	Exceedances	-	-	-	Detections	-	-	1
	Potential Exceedances	-	8	2	Quantifiable Concentrations	-	-	1
RRGEYS	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	22	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	1	3	-	Quantifiable Concentrations	-	-	-
RRALEX	# Sampling events	2	2	2	# Sampling events	2	0	0
	Total # Analytes	6	18	22	Total # Analytes	14	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	1	4	-	Quantifiable Concentrations	-	-	-
RRHMB1	# Sampling events	22	22	22	# Sampling events	19	19	10
	Total # Analytes	66	193	242	Total # Analytes	1682	950	20
	Exceedances	1	-	3	Detections	15	9	4
	Potential Exceedances	5	33	9	Quantifiable Concentrations	1	-	1
RRSYPD	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	22	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	1	-	Quantifiable Concentrations	-	-	-
RRWOH1	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	22	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	3	1	Quantifiable Concentrations	-	-	-

3.7.2.1.1.____Field Parameters

DO conditions at the time of sampling were all in compliance with the Basin Plan.

Specific Conductivity met the Basin Plan objective at all stations except RRGEYS, RRALEX, and RRHMB1. The Basin Plan objective for specific conductivity in the Russian River mainstem is a two-part objective with a 50% upper limit of 250 mS/cm2 and a 90% upper limit of 320 mS/cm2. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 250 mS/cm2 and 90% or more of the monthly means within a calendar year must be less than or equal to 320 mS/cm2. The observed specific conductivity values ranged from 170 to 325 mS/cm2. The observed values met the 90% upper limit in all years but failed to meet the 50% upper limit at stations RRGEYS (2001), RRALEX (2001), and RRHMB1 (2001, 2002, 2004, 2005, and 2006). It is important to note that these results are based on two to five grab samples collected during each calendar year and are not a compilation of many samples used to calculate monthly means as the objective suggests. Therefore, a more detailed investigation is required to fully understand and document whether compliance or impairment of water quality objectives is occurring at this site.

pH values did not meet the Basin Plan objective on one of 22 site visits at station RRHMB1 (4% exceedance rate). The Basin Plan objective for pH is a two-part objective with a minimum value of 7.0 and a maximum value of 8.5. The observed pH values at RRHMB1 ranged from 7.69 to 8.65. The minimum pH objective was met on all occasions, but the maximum Basin Plan objective was exceeded on 11/14/2005 (8.65).

3.7.2.1.2. Conventional Water Quality Parameters

Ammonia-N, chloride, hardness, O-PO4, and sulfate concentrations, at the time of sampling, were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection.

TDS did meet the Basin Plan objective during all tributary site visits. TDS did not fully meet the Basin Plan objective during all Russian River mainstem site visits. The Basin Plan objective for TDS is a two-part objective with a 50% upper limit of 150 mg/L and a 90% upper limit of 170 mg/L. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 150 mg/L and 90% or more of the monthly means within a calendar year must be less than or equal to 170 mg/L. The observed TDS concentrations at the mainstem sites ranged from 107 to 200 mg/L. The observed values met the 90% upper limit each year, but failed to meet the 50% upper limit at stations RRALEX, RRGEYS, and RRWOH1 in 2001 and RRHMB1 in 2001, 2002 and 2005. It is important to note that these results are based on two to six grab samples collected at each location during the calendar year and are not a compilation of many samples used to calculate monthly means as the objective suggests.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criteria of 0.12 mg/L on 48 of 59 site visits (81% exceedance rate), with concentrations ranging from DNQ (RL 0.010 mg/L) to 1.075 mg/L.
- Total-P concentrations exceeded the USEPA's recommended concentration criteria of 0.10 mg/L on 14 of 49 site visits (29% exceedance rate), with concentrations ranging from ND (MDL 0.030) to 0.850 mg/L.
- Chl-A concentrations exceeded the USEPA recommended concentration criteria value of 1.08 ug/L on 21 of 58 site visits (36% exceedance rate), with concentrations ranging from 0.103 to 3.40 ug/L.

3.7.2.1.3. Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 76.

- Arsenic, cadmium, chromium, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on 25 of 59 site visits (42% exceedance rate), exceeded USEPA's secondary MCL for drinking water (50 ug/L) on 32 site visits (54% exceedance rate), exceeded DHS's secondary MCL for drinking water (200 ug/L) on 13 site visits (22% exceedance rate), exceeded USEPA's maximum instantaneous concentration for freshwater aquatic life protection (750 ug/L) on six site visits (10% exceedance rate), and the Basin Plan (1000 ug/L) on four site visits (7% exceedance rate). Aluminum concentrations ranged from 7.42 to 1787.00 ug/L.
- Mercury concentrations exceeded USEPA's continuous and maximum criteria for freshwater aquatic life protection (50.0 and 51.0 ng/L respectively) on one of 20 site visits (5% exceedance rate) to station RRCLO1. Mercury concentrations ranged from 1.31 to 70.90 ng/L.

Table 76. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Middle Russian River HA – Mainstem Russian River (mg/L except Mercury in ug/L).

	Basin Plan	Drinking Water Standards - Maximum Contaminant Levels (MCLs)			
	NCRWQCB	Ca DHS		U.S. EPA	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	4	4	13	-	32
Mercury Objective	2	-	-	-	-
Exceedances	0	-	-	-	-
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	25	-	6
Mercury Objective	0.05	0.051	0.77	-	1.4
Exceedances	1	1	0	-	0

[1] Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.
[2] Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.

3.7.2.1.4.____Pesticides, PCBs, and Phenols

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. There were five nonylphenol, four nonylphenolethoxylate, 28 pesticide and 22 PCB detections.

Three of the nonylphenol and the four nonylphenolethoxylate detections were in DNQ concentrations (RL 2.0 ug/L), and two nonylphenol detections were in concentrations of 4.23 (station CLOSTP) and 8.72 ug/L (station RRHMB1). Nonylphenol is often a breakdown product from surfactants and detergents. USEPA's continuous concentration criterion for freshwater aquatic life protection for nonylphenol is 6.6 ug/L, therefore, the observed concentration at RRHMB1 exceeds the objective (10% exceedance rate at station RRHMB1).

Thirteen PCB detections were at station RRCLO1 on one site visit, while RRHMB1 had nine detections on two site visits. The detections were all DNQ values (RL 0.001 ug/L). PCBs are a banned substance. USEPA's continuous concentration criterion for freshwater aquatic life protection for PCB is 0.014 ug/L, therefore, the maximum additive concentration of less than 0.013 ug/L is in compliance.

There were 28 detections of 15 different pesticides. The detected pesticides were:

- gamma-Chlordene (RL 0.002 ug/L)
- DDMU (RL 0.002 ug/L, MDL 0.001 ug/L)
- DDT (RL 0.005 ug/L, MDL 0.002 ug/L)
- Diazinon (RL 0.020 ug/L)
- Dichlofenthion (RL 0.050 ug/L)

- Dimethoate (RL 0.050 ug/L)
- Dioxathion (RL 0.050 ug/L)
- Disulfoton (RL 0.050 ug/L)
- Endosulfan-sulfate (RL 0.002 ug/L)
- Famphur (RL 0.050 ug/L)
- Fonofos (RL 0.050 ug/L)
- alpha-HCH (RL 0.002 ug/L)
- delta-HCH (RL 0.002 ug/L)
- gamma-HCH (RL 0.002 ug/L)
- Hexachlorobenzene (RL 0.001 ug/L)

All of the pesticides were detected in DNQ concentrations except gamma-Chlordene, which was detected in concentrations of 0.010 and 0.022 ug/L.

- Dichlofenthion, Dimethoate, Dioxathion, Disulfoton, Famphur, and Fonofos are organophosphate pesticides for which there is no objective.
- Diazinon is a nonsystemic organophosphate insecticide removed from residential use in 2004. USEPA's continuous concentration criteria for freshwater aquatic life protection for Diazinon is 0.05 ug/L, therefore, this concentration is in compliance.
- Endosulfan-sulfate is an organochlorine insecticide. USEPA's 24-hour average concentration criteria for freshwater aquatic life protection for Endosulfan-sulfate is 0.056 ug/L, therefore, this concentration is in compliance.
- HCH (alpha-, delta-, and gamma isomers) is an EPA Severely Restricted Pesticide (Lindane) and is listed by the United Nations as a persistent organic pollutant (POPs). The Basin Plan objective for Lindane is 0.004 mg/L, therefore, these concentrations are in compliance with the objective.
- Hexachlorobenzene, DDT and gamma-Chlordene (Chlordane) are banned pesticides. DDMU is a secondary breakdown component of DDT. USEPA's toxicity information for freshwater aquatic life protection for Hexachlorobenzene is 50 ug/L, therefore, this concentration is in compliance. USEPA's continuous concentration criterion for freshwater aquatic life protection for DDT is 0.001 ug/L, therefore, the additive concentrations are in exceedance of the objective (5% exceedance rate). The Basin Plan objective for Chlordane is 0.10 ug/L, therefore, these concentrations are in compliance.

3.7.2.2. Big Sulphur Creek

During the five site visits, the NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), PCBs (PCB), and phenolic compounds (PHEN). Table 77 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the applicable criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 list the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 77. Summary of sample types, sample numbers, and objective exceedances in the Middle Russian River HA – Big Sulphur Creek

		FP	CON	MET		PEST	PCB	PHEN
BIGSUL	# Sampling events	5	5	5	# Sampling events	5	5	3
	Total # Analytes	15	45	53	Total # Analytes	461	250	6
	Exceedances	4	-	-	Detections	-	-	1
	Potential Exceedances	-	6	3	Quantifiable Concentrations	-	-	1

3.7.2.2.1.____Field Parameters

Specific conductivity and DO conditions at the time of sampling were all in compliance with the Basin Plan.

pH values did not meet the Basin Plan objective on four of five site visits (80% exceedance rate). The Basin Plan objective for pH is a two-part objective with a minimum value of 7.0 and a maximum value of 8.5. The observed pH values ranged from 8.20 to 8.84. The observed values met the minimum pH objective on all occasions, but exceeded the maximum Basin Plan objective on four site visits.

3.7.2.2.2.____Conventional Water Quality Parameters

Ammonia-N, chloride, hardness, TDS, O-PO4, Total-P, and sulfate concentrations, at the time of sampling, were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criteria of 0.12 mg/L on all five site visits (100 % exceedance rate), with concentrations ranging from 0.153 to 0.579 mg/L.
- Chl-A concentrations exceeded the USEPA recommended concentration criteria value of 1.08 ug/L on one of five site visits (20% exceedance rate), the concentration values ranged from 0.222 to 36.70 ug/L.

3.7.2.2.3.____Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 78.

- Arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on two of five site visits (40% exceedance rate), exceeded USEPA's secondary MCL for drinking water (50 ug/L) on three site visits (60% exceedance rate), and exceeded DHS's secondary MCL for drinking water (200 ug/L) on one site visits (20% exceedance rate). Aluminum concentrations ranged from 7.13 to 547.00 ug/L.

Table 78. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Middle Russian River HA – Big Sulphur Creek (ug/L).

	Basin Plan	**Drinking Water Standards - Maximum Contaminant Levels (MCLs)**			
	NCRWQCB	**Ca DHS**		**U.S. EPA**	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	0	0	1	-	3
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	2	-	0

[1] *Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.*
[2] *Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.*

3.7.2.2.4.____Pesticides, PCBs, and Phenols

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. No PCBs or pesticides were detected, but there was one nonylphenol detection in a concentration of 6.84 ug/L.

Nonylphenol is often found as a breakdown product from surfactants and detergents. USEPA's continuous concentration criterion for freshwater aquatic life protection for nonylphenol is 6.6 ug/L, therefore, this concentration is in exceedance of the objective (33% exceedance rate).

3.7.2.3.____Dry Creek

During the 12 site visits, the NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), PCBs (PCB), and phenolic compounds (PHEN). Table 79 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to applicable criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 lists the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 79. Summary of sample types, sample numbers, and objective exceedances in the Middle Russian River HA – Dry Creek

		FP	CON	MET		PEST	PCB	PHEN
DRCKWS	# Sampling events	5	5	5	# Sampling events	5	5	3
	Total # Analytes	15	45	55	Total # Analytes	461	250	6
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	7	5	Quantifiable Concentrations	-	-	-
DRYCRK	# Sampling events	7	7	7	# Sampling events	5	6	3
DRCRRR	Total # Analytes	21	63	75	Total # Analytes	461	300	6
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	7	4	Quantifiable Concentrations	-	-	-

3.7.2.3.1.____Field Parameters

Specific conductivity, DO, and pH conditions at the time of sampling were all in compliance with the Basin Plan.

3.7.2.3.2.____Conventional Water Quality Parameters

Ammonia-N, chloride, hardness, TDS, O-PO4, and sulfate concentrations, at the time of sampling, were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criteria of 0.12 mg/L on ten of 12 site visits (83% exceedance4 rate), with concentrations ranging from 0.052 to 0.463 mg/L at station LAGMIR.
- Total-P concentrations exceeded the USEPA's recommended concentration criterion of 0.10 mg/L on one of 12 site visits (8% exceedance rate), with concentrations ranging from ND (MDL 0.030) to 0.170 mg/L.
- Chl-A concentrations exceeded the USEPA recommended concentration criterion value of 1.08 ug/L on three of 12 site visits (8% exceedance rate), with concentrations ranging from ND (MDL 0.045 ug/L) to 1.7 ug/L.

3.7.2.3.3.____Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 80.

- Arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on seven of 10 site visits (70% exceedance rate), and exceeded USEPA's secondary MCL for drinking water (50 ug/L) on nine site visits (90% exceedance rate). Aluminum concentrations ranged from 41.30 to 199.00 ug/L.

Table 80. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Middle Russian River HA – Dry Creek (ug/L).

	Basin Plan	Drinking Water Standards - Maximum Contaminant Levels (MCLs)			
	NCRWQCB	Ca DHS		U.S. EPA	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	0	0	0	-	9
	Freshwater Aquatic Life Protection				
	CTR		US EPA		
	CTS concentration [1]	*Maximum [2]*	*CTS concentration [1]*	*24 hr avg*	*Maximum [2]*
Aluminum objective	-	-	87	-	750
Exceedances	-	-	7	-	0

[1] Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.
[2] Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.

3.7.2.3.4.____Pesticides, PCBs, and Phenols

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. No PCBs, pesticides, or phenols were detected.

3.7.2.4.____Laguna de Santa Rosa

During the 17 site visits, the NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), PCBs (PCB), and phenolic compounds (PHEN). Table 81 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the applicable criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 list the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 81. Summary of sample types, sample numbers, and objective exceedances in the Middle Russian River HA – Laguna de Santa Rosa

		FP	CON	MET		PEST	PCB	PHEN
SRCWS1	# Sampling events	5	5	5	# Sampling events	5	5	3
	Total # Analytes	15	45	55	Total # Analytes	461	250	6
	Exceedances	2	-	-	Detections	5	-	2
	Potential Exceedances	-	10	4	Quantifiable Concentrations	3	-	1
LAGTRH	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	22	Total # Analytes	-	-	-
	Exceedances	1	-	1	Detections	-	-	-
	Potential Exceedances	-	4	1	Quantifiable Concentrations	-	-	-
LAGMIR	# Sampling events	10	10	10	# Sampling events	9	11	5
	Total # Analytes	30	90	105	Total # Analytes	803	550	10
	Exceedances	2	-	-	Detections	9	-	2
	Potential Exceedances	-	40	9	Quantifiable Concentrations	9	-	1

3.7.2.4.1.____Field Parameters

Specific conductivity conditions at the time of sampling were all in compliance with the Basin Plan.

DO values did not meet the Basin Plan objective on three of 12 site visits (25% exceedance rate). The Basin Plan objective for DO is a two-part objective, with an absolute minimum of 7.0 mg/L and a 50% lower limit of 10.0 mg/L. This means that 50% or more of the monthly means in a calendar year must be greater than or equal to 10.0 mg/L. The observed DO values ranged from 6.50 to 12.05 mg/L. The observed concentrations did not meet the absolute minimum criterion at station LAGMIR on 10/5/2004 and 2/24/2005 (6.75 mg/L and 6.93 mg/L) and at station LAGTRH on 6/25/2001 (6.50 mg/L). The observed concentrations at station SRCWS1 also failed to meet the absolute minimum criterion on one of five site visits (20% exceedance rate). The observed DO values ranged from 6.76 to 14.23 mg/L. The observed minimum concentration was observed on 10/7/2004 (6.76 mg/L).

pH values did not fully meet the objective on one of 17 site visits. The Basin Plan objective for pH is a two-part objective with a minimum value of 7.0 and a maximum value of 8.5. The observed pH values ranged from 7.79 to 8.57. The observed values met the minimum pH objective on all occasions, but exceeded the maximum Basin Plan objective at station SRCWS1 (20% exceedance rate) on 4/18/2005.

3.7.2.4.2. Conventional Water Quality Parameters

Ammonia-N, chloride, hardness, TDS, and sulfate concentrations, at the time of sampling, were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA’s recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA’s recommended concentration criterion of 0.12 mg/L on 15 of 17 site visits (88% exceedance rate), with concentrations ranging from ND concentrations (MDL 0.10 mg/L) to 2.025 mg/L.
- Total-P concentrations exceeded the USEPA’s recommended concentration criterion of 0.10 mg/L on 12 of 17 12 site visits (71% exceedance rate) to stations LAGMIR and LAGTRH site visits, but did not exceed the criterion at SRCWS1. Concentrations ranged from DNQ values (RL 0.050) to 0.890 mg/L.
- O-PO4 concentrations exceeded the USEPA recommended concentration criterion of 0.05 mg/L on 16 of 17 site visits (94% exceedance rate), with concentrations ranging from 0.045 to 0.662 mg/L.
- Chl-A concentrations exceeded the USEPA recommended concentration criterion value of 1.08 ug/L on one of five site visits to station SRCWS1 (20% exceedance rate), and exceeded the criterion on all 10 site visits (100% exceedance rate) to station LAGMIR, but did not exceed the criterion on two site visits to station LAGTRH. The concentration values at stations SRCWS1 and LAGMIR ranged from 0.481 to 17.40 ug/L, while concentrations were ND at station LAGTRH.

3.7.2.4.3.____Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 82.

- Arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on 13 of 17 site visits (76% exceedance rate), exceeded USEPA's secondary MCL for drinking water (50 ug/L) on 15 site visits (88% exceedance rate), exceeded DHS's secondary MCL for drinking water (200 ug/L) on 10 site visits (59% exceedance rate), exceeded USEPA's maximum instantaneous concentration for freshwater aquatic life protection (750 ug/L) on two site visits (12% exceedance rate), and the Basin Plan (1000 ug/L) on one site visit (6% exceedance rate). Aluminum concentrations ranged from 30.00 to 1900.00 ug/L.

Table 82. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Middle Russian River HA – Laguna de Santa Rosa (ug/L).

	Basin Plan	**Drinking Water Standards - Maximum Contaminant Levels (MCLs)**			
	NCRWQCB	**Ca DHS**		**U.S. EPA**	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	1	1	10	-	15
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	13	-	2

[1] *Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.*
[2] *Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.*

3.7.2.4.4.____Pesticides, PCBs, and Phenols

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. There were no PCB detections, but there were four nonylphenol and 28 pesticide detections. Two of the nonylphenol detections were in DNQ concentrations (RL 2.0 ug/L), and two nonylphenol detections were in concentrations of 4.30 and 5.17 ug/L.

Nonylphenol is often a breakdown product from surfactants and detergents. USEPA's continuous concentration criterion for freshwater aquatic life protection for nonylphenol is 6.6 ug/L, therefore, the concentrations were in compliance.

There were 28 detections of four different pesticides. The detected pesticides were:

- Diazinon (RL 0.020 ug/L)
- Dioxathion (RL 0.050 ug/L)
- Oxadiazon (RL 0.050 ug/L)
- Simazine (RL 0.002 ug/L)

Diazinon was detected in concentrations ranging from DNQ to 0.036 ug/L. Dioxathion was detected in one concentration of 0.084 ug/L. Oxadiazon was detected in concentrations ranging from 0.002 to 0.011 ug/L. Simazine was detected in concentrations ranging from DNQ to 0.159 ug/L.

- Dioxathion is an organophosphate insecticide, and Oxadiazon is an organochlorine herbicide, for which there is no objective.
- Diazinon is a nonsystemic organophosphate insecticide removed from residential use in 2004. USEPA's continuous concentration criteria for freshwater aquatic life protection for Diazinon is 0.05 ug/L, therefore, these concentrations are in compliance.
- Simazine is a selective triazine herbicide. USEPA's instantaneous maximum concentration criterion for freshwater aquatic life protection and the Basin Plan objective for Simazine is 10.0 ug/L, therefore, these concentrations were in compliance.

3.7.3.______Lower Russian River HA

Figure 66. Sampling locations in the Lower Russian River HA

In the Lower Russian River HA, there were five sampling locations (see Figure 66). Table 68 lists the station names, descriptions, and locations. Included are four Russian River mainstem stations, one of which is a long-term trend monitoring site that had 22 site visits during the fiscal years of 2000-06 (6/2001-6/2006). The other three mainstem sampling locations are rotating basin sampling locations. There were a total of six site visits, two site visits to each site in June 2001. One tributary station, Austin Creek, was sampled. Station AUSCRK is a rotating basin sampling location, and had four site visits during the 2004-05 fiscal year (11/2004-6/2005). The site visits corresponded to Fall, Winter, Spring and Early Summer conditions.

3.7.3.1.____Mainstem Russian River

During the 32 site visits, the NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), PCBs (PCB), and phenolic compounds (PHEN). Table 83 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the applicable criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 lists the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 83. Summary of sample types, sample numbers, and objective exceedances in the Lower Russian River HA – Mainstem Russian River

		FP	CON	MET		PEST	PCB	PHEN
RRODDF	# Sampling events	2	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	22	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	1	2	Quantifiable Concentrations	-	-	-
RRJB01	# Sampling events	22	22	22	# Sampling events	19	22	10
	Total # Analytes	66	193	235	Total # Analytes	1682	1100	20
	Exceedances	-	-	4	Detections	21	10	2
	Potential Exceedances	-	47	21	Quantifiable Concentrations	3	-	1
RRMRIO	# Sampling events	4	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	22	Total # Analytes	-	-	-
	Exceedances	2	-	-	Detections	-	-	-
	Potential Exceedances	-	3	-	Quantifiable Concentrations	-	-	-
RRVACB	# Sampling events	4	2	2	# Sampling events	0	0	0
	Total # Analytes	6	18	22	Total # Analytes	-	-	-
	Exceedances	-	-	-	Detections	-	-	-
	Potential Exceedances	-	2	2	Quantifiable Concentrations	-	-	-

3.7.3.1.1.____Field Parameters

Specific conductivity and pH conditions at the time of sampling were all in compliance with the Basin Plan.

DO conditions met the meet the Basin Plan objective at all locations except station RRMRIO. DO values did not meet the Basin Plan objective on both site visits (100% exceedance rate). The Basin Plan objective for DO is a two-part objective, with an absolute minimum of 7.0 mg/L and a 50% lower limit of 10.0 mg/L. This means that 50% or more of the monthly means in a calendar year must be greater than or equal to 10.0 mg/L. The observed DO values were 6.60 mg/L and 6.80 mg/L.

3.7.3.1.2.____Conventional Water Quality Parameters

Ammonia-N, chloride, TDS, hardness, and sulfate concentrations in the Russian River mainstem at the time of sampling, were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection.

TDS did not fully meet the Basin Plan objective during all site visits. The Basin Plan objective for TDS is a two-part objective with a 50% upper limit of 170 mg/L and a 90% upper limit of 200 mg/L. This means that 50% or more of the monthly means within a calendar year must be less than or equal to 170 mg/L and 90% or more of the monthly means within a calendar year must be less than or equal to 200 mg/L. The observed TDS concentrations at the mainstem sites ranged from 87 to 210 mg/L. The observed values met the 90% upper limit each year, but failed to meet the 50% upper limit in 2001. It is important to note that these results are based on two to six grab samples collected at each location during the calendar year and are not a compilation of many samples used to calculate monthly means as the objective suggests.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criterion of 0.12 mg/L on 18 of 28 site visits (64% exceedance rate), with concentrations ranging from ND (MDL 0.005 mg/L) to 0.834 mg/L.
- Total-P concentrations exceeded the USEPA's recommended concentration criterion of 0.10 mg/L on 11 of 23 site visits (48% exceedance rate), with concentrations ranging from ND (MDL 0.030) to 0.296 mg/L.

O-PO4 and Chl-A concentrations were analyzed only from station RRJB01.

- O-PO4 values exceeded the USEPA criterion of 0.05 mg/L on 10 of 22 site visits (45% exceedance rate), with concentrations ranging from 0.012 to 0.221 mg/L.
- Chl-A concentrations exceeded the USEPA recommended concentration criterion of 1.08 ug/L on 13 of 22 site visits (59% exceedance rate), with concentrations ranging from 0.226 to 11.00 ug/L.

3.7.3.1.3.____Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA

recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 84.

- Arsenic, cadmium, chromium, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on 20 of 28 site visits (71% exceedance rate), exceeded USEPA's secondary MCL for drinking water (50 ug/L) on 25 site visits (89% exceedance rate), exceeded DHS's secondary MCL for drinking water (200 ug/L) on 12 site visits (43% exceedance rate), exceeded USEPA's maximum instantaneous concentration for freshwater aquatic life protection (750 ug/L) on two site visits (7% exceedance rate), and exceeded the Basin Plan (1000 ug/L) on two site visits (7% exceedance rate). Aluminum concentrations ranged from 32.80 to 2547.00 ug/L.
- The California Toxics Rule (CTR) criterion to protect freshwater aquatic life for copper and lead is hardness dependent. Exceedance or compliance is determined through a calculation in which the total metals concentration and the hardness concentration are considered. Copper exceeded the CTR maximum concentration criteria on one of 20 site visits (5% exceedance rate) to station RRJB01. Lead potentially exceeded the CTR continuous concentration criterion on one of 20 site visits (5% exceedance rate) to station RRJB01.
- Mercury concentrations exceeded USEPA's continuous and maximum criteria for freshwater aquatic life protection (50.0 and 51.0 ng/L respectively) on two of 18 site visits (11% exceedance rate) to station RRJB01. Mercury concentrations ranged from 1.65 to 57.90 ng/L.

Table 84. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Lower Russian River HA – Mainstem Russian River (ug/L).

	Basin Plan	**Drinking Water Standards - Maximum Contaminant Levels (MCLs)**			
	NCRWQCB	**Ca DHS**		**U.S. EPA**	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	2	2	12	-	25
Copper Objective	-	1300	1000	1300	1000
Exceedances	-	0	0	0	0
Lead Objective	50	15	-	15	-
Exceedances	0	0	-	0	-
Mercury Objective	2	-	-	-	-
Exceedances	0	-	-	-	-
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	20 [2]	-	2
Copper Objective	Hardness dependent [1]	Hardness dependent [1]	-	-	-
Exceedances	1	0	-	-	-
Lead Objective	Hardness dependent [1]	Hardness dependent [1]	Hardness dependent [1]	-	Hardness dependent [1]
Exceedances	1	0	1	-	0
Mercury Objective	0.05	0.051	0.77	-	1.4
Exceedances	2	2	0	-	0

[1] Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.
[2] Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.
[1] See Appendix C for graphs of these metals based on concentrations, hardness, and EPA criterion.

3.7.3.1.4.____Pesticides, PCBs, and Phenols

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. There were two nonylphenol, 21 pesticide, and 10 PCB detections.

Two of the nonylphenol detections were in DNQ concentrations (RL 2.0 ug/L), and one detection was in a concentration of 2.97 ug/L. Nonylphenol is often found as a breakdown product from surfactants and detergents. USEPA’s continuous concentration criterion for freshwater aquatic life protection for nonylphenol is 6.6 ug/L, therefore, the observed concentrations are in compliance with the objective.

The 10 PCB detections were all on samples from the same site visit. The detections were all DNQ values (RL 0.001 ug/L). PCBs are a banned substance. USEPA’s continuous concentration criterion for freshwater aquatic life protection for PCB is 0.014 ug/L, therefore, the maximum additive concentration of less than 0.010 ug/L is in compliance.

There were 21 detections of 14 different pesticides. The detected pesticides were:

- gamma-Chlordene (RL 0.002 ug/L)
- DDMU (RL 0.002 ug/L, 0.001 ug/L)
- DDT (RL 0.005 ug/L, MDL 0.002 ug/L)
- Diazinon (RL 0.02 ug/L)
- Dichlofenthion (RL 0.05 ug/L)
- Dimethoate (RL 0.05 ug/L)
- Dioxathion (RL 0.05 ug/L)
- Disulfoton (RL 0.05 ug/L)
- Endosulfan-sulfate (RL 0.001 ug/L)
- Fonofos (RL 0.05 ug/L)
- alpha-HCH (RL 0.002 ug/L)
- delta-HCH (RL 0.002 ug/L)
- Hexachlorobenzene (RL 0.001 ug/L)
- Oxadiazon (RL 0.002 ug/L)

All of the pesticides were detected in DNQ concentrations with the exception of gamma-Chlordene which was detected in a concentration of 0.005 ug/L; one detection of Diazinon in a concentration of 0.024 ug/L; and one detection of Oxadiazon in a concentration of 0.002 ug/L.

- Oxadiazon is an organochlorine herbicide, commonly known as Ronstar, for which there is no objective. Dichlofenthion, Dimethoate, Dioxathion, Disulfoton, and Fonofos are organophosphate pesticides for which there is no objective.
- Diazinon is a nonsystemic organophosphate insecticide removed from residential use in 2004. USEPA's continuous concentration criterion for freshwater aquatic life protection for Diazinon is 0.05 ug/L, therefore, this concentration is in compliance.
- Endosulfan-sulfate is an organochlorine insecticide. USEPA's 24-hour average concentration criterion for freshwater aquatic life protection for Endosulfan-sulfate is 0.056 ug/L, therefore, this concentration is in compliance.
- HCH (alpha-, delta-, and gamma isomers) is an EPA Severely Restricted Pesticide (Lindane) and is listed by the United Nations as a persistent organic pollutant (POPs). The Basin Plan objective for Lindane is 0.004 mg/L, therefore, these concentrations are in compliance with the objective.
- Hexachlorobenzene, DDT and gamma-Chlordene (Chlordane) are banned pesticides. DDMU is a secondary breakdown component of DDT. USEPA's toxicity information for freshwater aquatic life protection for Hexachlorobenzene is 50 ug/L, therefore, this concentration is in compliance. USEPA's continuous concentration criterion for freshwater aquatic life protection for DDT is 0.001 ug/L, therefore, the additive concentrations are in exceedance of the objective (11% exceedance rate). The Basin Plan objective for Chlordane is 0.10 ug/L, therefore, these concentrations are in compliance.

3.7.3.2.____Austin Creek

During the four site visits, the NCR collected standard field parameters (FP) and grab samples for the analysis of conventional water quality constituents (CON), trace metals concentrations (MET), pesticides and pesticide residues (PEST), PCBs (PCB), and phenolic compounds (PHEN). Table 85 lists the number of sampling events by category, total number of analytes, and the number of exceedances and potential exceedances as compared to the applicable criteria, objectives, and standards (Basin Plan objectives, State of California DHS and USEPA drinking water standards, State of California CTR and USEPA recommended criteria for freshwater protection of aquatic life, and USEPA recommended nutrient criteria for rivers and streams). Tables 4 and 5 on pages 162 and 163 lists the numeric values for the various criteria, objectives, and standards utilized in this report.

Table 85. Summary of sample types, sample numbers, and objective exceedances in the Lower Russian River HA – Austin Creek

		FP	CON	MET		PEST	PCB	PHEN
AUSCRK	# Sampling events	4	4	4	# Sampling events	4	4	3
	Total # Analytes	12	36	40	Total # Analytes	370	200	6
	Exceedances	-	-	-	Detections	-	-	2
	Potential Exceedances	-	3	2	Quantifiable Concentrations	-	-	-

3.7.3.2.1.____Field Parameters

Specific conductivity, DO, and pH conditions at the time of sampling were all in compliance with the Basin Plan.

3.7.3.2.2.____Conventional Water Quality Parameters

Ammonia-N, chloride, TDS, O-PO4, Total-P, Chl-A, hardness, and sulfate concentrations in Austin Creek at the time of sampling, were all in compliance with the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection.

The NCR Basin Plan does not include numeric objectives for phosphorus and nitrogen species, except for nitrate concentrations. Data for these parameters is compared to USEPA's recommended nutrient criteria for rivers and streams in Western Forested Mountains portion of the US, also known as Ecoregion II.

The NCR collected and analyzed grab samples for TKN, nitrite-N, and nitrate-N. The values of all analytes were added together to determine the total-N concentration.

- Total-N concentrations exceeded the USEPA's recommended concentration criterion of 0.12 mg/L on 3 of 4 visits (75% exceedance rate), with concentrations ranging from DNQ (RL 0.020 mg/L) to 0.280 mg/L.

3.7.3.2.3.____Trace Metals

The NCR analyzed grab samples for the concentrations of dissolved metals. The results were compared with multiple criteria based on the Basin Plan, California and USEPA guidelines for drinking water, the California Toxics Rule (CTR), and the USEPA recommended criteria for freshwater aquatic life protection. The criteria, parameter, and number of exceedances or potential exceedances are outlined in Table 86.

- Arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc concentrations were all in compliance with every objective at the time of sampling.
- Aluminum concentrations potentially exceeded USEPA's continuous concentration for freshwater aquatic life protection (87 ug/L) on one of four site visits (25% exceedance rate), exceeded USEPA's secondary MCL for drinking water (50 ug/L) on two site visits (50% exceedance rate), and exceeded DHS's secondary MCL for drinking water (200 ug/L) on one site visits (25% exceedance rate). Aluminum concentrations ranged from a ND value (MDL 0.10 ug/L) to 450.00 ug/L.

Table 86. Trace metal exceedances of the NCR Basin Plan and Drinking Water standards in the Lower Russian River HA – Austin Creek (ug/L).

	Basin Plan	**Drinking Water Standards - Maximum Contaminant Levels (MCLs)**			
	NCRWQCB	**Ca DHS**		**U.S. EPA**	
	WQO	*Primary MCL*	*Secondary MCL*	*Primary MCL*	*Secondary MCL*
Aluminum objective	1000	1000	200	-	50
Exceedances	0	0	1	-	2
	Freshwater Aquatic Life Protection				
	CTR		**US EPA**		
	CTS concentration [1]	*Maximum* [2]	*CTS concentration* [1]	*24 hr avg*	*Maximum* [2]
Aluminum objective	-	-	87	-	750
Exceedances	-	-	1	-	0

[1] *Exceedance of Continuous (CTS) concentration criterion is determined if the 4-day average concentration exceeds the criteria more than once every three years on the average.*
[2] *Exceedance of Maximum concentration criterion is determined if the 1-hour average concentration exceeds the criteria more than once every three years on the average.*

3.7.3.2.4.____Pesticides, PCBs, and Phenols

The NCR analyzed grab samples for a) 100 pesticides, pesticide constituents, isomers, or metabolites, b) 50 PCB cogeners, and c) 6 phenolic compounds. There were no PCB detections, but there was one nonylphenol, one nonylphenolethoxylate and one pesticide (Diazinon) detection, all of which were DNQ concentrations.

Nonylphenol is often found as a breakdown product from surfactants and detergents. USEPA's continuous concentration criterion for freshwater aquatic life protection for nonylphenol is 6.6 ug/L, therefore, the observed concentrations all met the objective. Diazinon is a nonsystemic organophosphate insecticide removed from residential use in

2004. USEPA's continuous concentration criterion for freshwater aquatic life protection for Diazinon is 0.05 ug/L, therefore, this concentration was in compliance.

3.7.4.____Trend Monitoring – Russian River WMA

For this report, we are only looking at general trends across sampling years. The long-term monitoring sites were chosen from both impaired and unimpaired waterbodies within each of the WMAs. This component of the SWAMP monitoring plan is designed to monitor water quality trends through time, allowing for the ongoing evaluation of improvements or degradation to water quality. The long-term monitoring sites are located at the bottom of large drainage areas and reflect the impacts of management activities occurring within the respective basins. The long-term sampling locations have had between 10 and 22 site visits over the course of two to five years, dependent upon the timing of station establishment. Each sampling effort was designed so that site visits in the same watershed occurred within the same one to three day period.

In the Russian River WMA, there are five long-term trend monitoring sites, four on the mainstem Russian River and one on the Laguna de Santa Rosa. The mainstem Russian River sites were established in June 2001 and have had 22 site visits each. The Laguna de Santa Rosa site was established in October 2004, and has only had 10 site visits. There has not been a sufficient number of site visits at the Laguna de Santa Rosa site to draw any conclusions regarding trend determinations at this time.

3.7.4.1._____Field Parameters

Only Specific Conductivity and pH values were evaluated for the determination of trends. Specific Conductivity values at all stations varied by season, with the highest values recorded in the fall and the lowest values recorded in the winter. Specific Conductivity did not exhibit any apparent trend in concentrations, the values remained within the same range throughout the period of record. pH values did not exhibit a seasonal trend nor did the concentrations demonstrate any trend through the period of record.

3.7.4.2._____Conventional Water Quality Parameters

Hardness, chloride, sulfate, and TDS concentrations at all stations varied by season, with the highest values recorded during the fall. There was no apparent trend in concentrations, the values remained within the same range throughout the period of record. Chl-A, Total P, Ortho-P, and TKN results did not exhibit a seasonal trend nor did the concentrations demonstrate any trend through the period of record. Ortho-P did not exhibit a seasonal trend at the mainstem stations with the exception of station RRJB01, located below the confluence of the Russian River and the Laguna de Santa Rosa. This station exhibited seasonal highs during the spring. There was no apparent trend in concentrations, the values remained within the same range throughout the period of record at all stations.

3.7.4.3. Trace Metals

Aluminum, chromium, copper, lead, mercury, nickel, silver and zinc concentrations at all stations varied by season, with the highest values recorded during the winter and spring and the lowest values recorded in the summer and fall. Arsenic concentrations demonstrated an inverse relationship with the highest concentrations recorded during the summer and fall and the lowest concentrations recorded during the winter and spring. There was no apparent trend in the concentrations of any trace metals constituent, the values remained within the same range throughout the period of record.

4.0 References

Brown, L.R., P.B. Moyle, and R.M. Yoshiyama. 1994. "Historical decline and current status of coho salmon in California." North America Journal of Fisheries Management. Vol 4. No. 2: 237-261.

Brown, W.M., J.R. Ritter. 1971. "Sediment Transport and Turbidity in the Eel River Basin, California." U.S. Geological Survey Water-Supply Paper 1986

California Department of Fish and Game. 2002. Status Review of California Coho Salmon North of San Francisco.

California Department of Fish and Game. 2002. Russian River Basin Fisheries Restoration Plan - July 2002 Draft

California Department of Fish and Game, 2004. Stream Inventory Reports for Salmon Creek and Tributaries, Central Coast Region, CA.

California Regional Water Quality Control Board, Central Valley Region. 2003. A Compilation of Water Quality Goals. Prepared by J.B. Marshack, Central Valley Regional Water Quality Control Board, Sacramento, CA.

California Regional Water Quality Control Board, North Coast Region. 2000. Reference Document for the Garcia River Watershed Water Quality Attainment Action Plan for Sediment.

California Regional Water Quality Control Board, North Coast Region. 2000. Staff Report for Proposed Regional Water Board Actions in the North Fork Elk River, Bear Creek, Freshwater Creek, Jordan Creek and Stitz Creek Watersheds.

California Regional Water Quality Control Board, North Coast Region. 2001. Technical Support Document for the Gualala River Watershed Water Quality Attainment Action Plan for Sediment.

California Regional Water Quality Control Board, North Coast Region. 2005. Staff Report for the Action Plan for the Scott River Watershed Sediment and Temperature Total Maximum Daily Loads.

California Regional Water Quality Control Board, North Coast Region. 2005. Watershed Planning Chapter.

California Regional Water Quality Control Board, North Coast Region. 2006. Staff Report for the Action Plan for the Shasta River Watershed Temperature and Dissolved Oxygen Total Maximum Daily Loads.

California State Coastal Conservancy and Circuit Rider Productions Inc. 1987. Sonoma County Coastal Wetlands Enhancement Plan

Collison, A., W. Emmingham, F. Everest, W. Haneberg, R. Marston, D. Tarboton, and R. Twiss. 2003. Phase II report: Independent Scientific Review Panel on sediment impairment and effects on beneficial uses of the Elk River and Stitz, Bear, Jordan and Freshwater creeks. Authored by the Humboldt Watersheds Independent Scientific Review Panel under the auspices of the North Coast Regional Water Quality Control Board. Santa Rosa, CA

Crandell, D. R. 1989. Gigantic debris avalanche of Pleistocene age from ancestral Mount Shasta Volcano, California, and debris-avalanche hazard zonation. U.S. Geological Survey Bulletin 1861.

Eel River Salmon Restoration Project. Undated. Available at: <http://www.hits.org/salmon98/>. Website accessed December, 2006.

Entrix, Inc. 1998. Pacific Watershed Associates, Circuit Rider Productions, Inc., Navarro Watershed Community Advisory Group, and D.T. Sincular. 1998. “Navarro Watershed Restoration Plan”. Prepared for the Mendocino County Water Agency, The Coastal Conservancy, and The Anderson Valley Land Trust.

Entrix, Inc. 2002. Russian River Biological Assessment - Alternatives: Evaluation of management actions . Prepared for U.S. Army Corps of Engineers, San Francisco District and Sonoma County Water Agency. Walnut Creek, CA.

Federal Energy Regulatory Commission. 2002. Biological opinion for the proposed license amendment for the Potter Valley Project (Federal Energy Regulatory Commission Project Number 77-110).

Friends of the Eel River. Undated. Available at: <http://www.eelriver.org/>. Website accessed December, 2006.

Puckett, M. 2002. Quality Assurance Management Plan for the State of California's Surface Water Ambient Monitoring Program. California Department of Fish and Game. Monterey, CA.

Save the Redwoods League. Undated. The Smith River. Available at: <http://www.savetheredwoods.org/protecting/pdf/mp_b_smith.pdf>. Website accessed December, 2006.

Shasta Cascade Wonderland Association. Undated. Smith River. Available at: <http://www.shastacascade.org/forest/sixriver/smithr.htm >. Website accessed December, 2006.

Shasta-Scott Coho Salmon Recovery Team (SSRT). 2003. Shasta and Scott River Pilot Program for Coho Salmon Recovery: with recommendations relating to Agriculture and Agricultural Water Use. Prepared for The California Department of Fish & Game

Sullivan, C. 1989. Juvenile life history and age composition of mature fall Chinook salmon to the Klamath River, 1984-1986. Master's thesis . Humboldt State University . Arcata, CA .

U.S. Bureau of Land Management. 1995. Mainstem Trinity River watershed analysis. Redding, CA

U.S. Department of Agriculture, Forest Service. 1996. North Fork Eel River Watershed Analysis.

U.S. Department of Agriculture, Forest Service. 2003. Mainstem Trinity Watershed Analysis. Prepared by Natural Resources Management Corporation for USFS, Pacific Southwest Region, Six River National Forest, Lower Trinity Ranger District. Eureka, CA

U.S. Environmental Protection Agency. 1986. Quality Criteria for Water (The Gold Book). EPA 440/5-96-001. Office of Water, Regulations and Standards. Washington, D.C.

U.S. Environmental Protection Agency. 1998. South Fork Trinity River and Hayfork Creek Sediment Total Maximum Daily Loads. Region 9, Water Division. San Francisco, CA.

U.S. Environmental Protection Agency. 1998. Total Maximum Daily Load for Sediment Redwood Creek, California. Region 9, Water Division. San Francisco, CA.

U.S. Environmental Protection Agency. 1999. Noyo River Total Maximum Daily Load for Sediment. Region 9, Water Division. San Francisco, CA.

U.S. Environmental Protection Agency. 1999. South Fork Eel River Total Maximum Daily Loads for Sediment and Temperature. Region 9, Water Division. San Francisco, CA.

U.S. Environmental Protection Agency. 1999. Van Duzen River and Yager Creek Total Maximum Daily Load for Sediment. Region 9, Water Division. San Francisco, CA.

U.S. Environmental Protection Agency. 2000. Ambient water quality criteria recommendations. Information supporting the development of state and tribal nutrient criteria for rivers and streams in nutrient Ecoregion II. EPA 822-B-00-015. Office of Water, Office of Science and Technology. Washington, D.C.

U.S. Environmental Protection Agency. 2000. Navarro River Total Maximum Daily Loads for Temperature and Sediment.

U.S. Environmental Protection Agency. 2000. Ten Mile River Total Maximum Daily Load for Sediment. Region 9, Water Division. San Francisco, CA.

U.S. Environmental Protection Agency. 2001. Albion River Total Maximum Daily Load for Sediment. Region 9, Water Division. San Francisco, CA.

U.S. Environmental Protection Agency. 2001. Big River Total Maximum Daily Load for Sediment. Region 9, Water Division. San Francisco, CA.

U.S. Environmental Protection Agency. 2001. Gualala River Total Maximum Daily Load for Sediment. Region 9, Water Division. San Francisco, CA.

U.S. Environmental Protection Agency. 2001. Trinity River Total Maximum Daily Load for Sediment. Region 9, Water Division. San Francisco, CA.

U.S. Environmental Protection Agency. 2002. North Fork Eel River Total Maximum Daily Loads for Sediment and Temperature. Region 9, Water Division. San Francisco, CA.

U.S. Environmental Protection Agency. 2003. Mattole River Total Maximum Daily Loads for Sediment and Temperature. Region 9, Water Division. San Francisco, CA.

U.S. Environmental Protection Agency. 2003. Middle Fork Eel River Total Maximum Daily Loads for Temperature and Sediment. Region 9, Water Division. San Francisco, CA.

U.S. Environmental Protection Agency. 2004. Upper Main Eel River and Tributaries (including Tomki Creek, Outlet Creek and Lake Pillsbury) Total Maximum Daily Loads for Temperature and Sediment.

U.S. Environmental Protection Agency. Middle Main Eel River and Tributaries (from Dos Rios to the South Fork) Total Maximum Daily Loads for Temperature and Sediment.