2002 NWCCOG REGIONAL WATER QUALITY MANAGEMENT PLAN

VOLUME I - POLICY PLAN

NWCCOG 208 PLAN INTRODUCTION

2002

Pollution of the region's waters may constitute a menace to public health and welfare, may create public nuisances, may be harmful to wildlife and aquatic life, and may impair beneficial uses of these waters high quality waters are valued by the citizens of the region who recognize the necessity of protecting the existing uses for the benefit of residents, visitors, and future generations. The region consists of the area within Eagle, Grand, Jackson, Pitkin, and Summit Counties. Northwest Colorado Council of Governments (“NWCCOG”) is the designated regional water quality management agency responsible for water quality planning within this region.

This NWCCOG 208 Plan is adopted pursuant to Section 208 of the Federal Clean Water Act as implemented through Colorado Water Quality Control Act. The Colorado General Assembly adopted the Colorado Water Quality Control Act "[t]o protect, maintain, and improve where necessary and reasonable, water quality for public water supplies, for protection and propagation of wildlife and aquatic life, for domestic, agricultural, industrial, and recreational uses" (CRS 25-8-102). The purpose of Section 208 of the Federal Clean Water Act is to require plans for coordinated regional approaches to water quality management. This Regional Water Quality Management Plan, or 208 Plan, is a comprehensive revision of the NWCCOG 208 Plan that was last approved in 1998 by Governor Romer.

This 208 Plan consists of two volumes and appendices (including a glossary). Volume I consists of the Regional Policies and describes recommendations to protect and enhance the water quality within the NWCCOG region, consistent with the requirements of the Clean Water Act. Volume II consists of the Regional Water Quality Assessment which describes existing water quality, identifies the major regional water quality issues, and presents the individual Water Quality Management Plans for each of the five watersheds within the NWCCOG region (Figure 1).

Figure 1. Northwest Colorado Council of Governments' Regional and Watershed Boundaries

HOW TO USE THIS PLAN

Volume I, Policy Plan, consists of six policies. Policy 1 outlines changes NWCCOG is recommending to the State Water Quality Control Commission regarding water quality regulations. The next four policies recommend actions to minimize water quality impacts for political jurisdictions that have the authority to regulate land use and development. These jurisdictions are federal, state, and local governments. The last policy identifies entities or "Management Agencies" that are responsible for implementing the recommended actions.

Volume II, Water Quality Program Development, describes the water quality assessments that were used to develop the policies in Volume I. The Regional Water Quality Assessment is a summary of the major water quality issues identified in the region. This section is also provided to inform readers of water quality impacts from various activities and gives an overview of the existing systems which protect water quality.

The five individual watershed plans in Volume II form the foundation of this 208 Plan. Each watershed plan has the following sections:

- A summary of the watershed characteristics and how the plan was developed;
- An evaluation of existing water quality data;
- Identification of Point and Nonpoint Source issues and recommendations for specific water quality issues in the basin;
- A description of existing and potential water quality improvement projects (including education);
- A summary of local water quality related land use regulations;
- A summary of water quality monitoring efforts and needs;
- A discussion of watershed stream segment water quality designations, classifications, standards and recommended changes.

The flow chart below (Figure 2) illustrates the structure of this 208 Plan.

Figure 2. NWCCOG Regional Water Quality Management Plan Structure

Regional Water Quality Policies — Volume I

Regional Water Quality Assessment — Volume II

Blue River Plan	Eagle River Plan	North Platte River Plan	Roaring Fork River Plan	Upper Colorado River Plan

LEGAL AND REGULATORY FRAMEWORK

In 1972, Congress overrode a presidential veto to pass the Federal Water Pollution Control Act Amendments of 1972 (PL92-500), also known as the Clean Water Act. This

Act has been further amended with significant changes in 1977 (PL95-217) and 1987 (PL100-4). The Clean Water Act states that the ultimate objective of the Act is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters". In beginning the process to improve water quality, Section 208 of the Clean Water Act identified a number of planning programs to be initiated at various levels of government.

To maximize efficient use of resources and provide regional coordination, Section 208 of the Act established an areawide approach to planning for the abatement of pollution. Section 208 (titled "Areawide Waste Treatment Plans") provides criteria to design local plans, based on an integrated and comprehensive planning process. NWCCOG was designated as the areawide waste treatment management planning authority, under Section 208, in February 1976 by the governor of Colorado. NWCCOG develops and maintains the Areawide Water Quality Management Plan (208 Plan) for the NWCCOG.

The NWCCOG planning region (Region XII) includes the area within Eagle, Grand, Jackson, Pitkin, and Summit Counties and includes two river basins: the Colorado River Basin and the North Platte River Basin.

In Colorado, the Colorado Water Quality Control Commission and Division are responsible for regulating water quality through the establishment of water quality classifications, designations, standards, and control regulations to protect the beneficial uses of the streams and lakes; issuance of discharge permits; water quality certifications; and enforcement.

The Continuing Planning Process for Water Quality Management in Colorado, adopted by the Water Quality Control Commission in 1983, and revised and adopted in 1998 as Commission Policy 98-2 recommends regular updates of the Areawide Water Quality Management Plans prepared under Section 208 of the Clean Water Act. The purposes of this 208 Plan revision are to: update the plan to reflect the progress that has been made in plan implementation, reflect changes in the state of water quality and land uses in the region, reflect changes in regulatory programs**,** and address the region's shift in focus to a watershed perspective.

The Plan is structured to satisfy the applicable state guidelines and to satisfy local planning considerations that dictate a flexible and innovative approach to water quality planning to avoid future water quality problems.

Table 1 provides a summary of the elements of water quality planning recommended under the State Guidelines compared to the elements contained in this Plan. The Policy Plan (Volume I) together with the technical appendices contain all of the State elements.

Table 1. Water Quality Planning Elements

208 Plan Element	Plan Policy (V. I)						Vol.	Appendix														
	1	2	3	4	5	6	II	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Facility location						X	x			X	X								X			X
Facility needs							x			X												X
Facility capacity							x			X	X											X
Facility timing							x			X												X

Population projections							x		X													
Service area										X									x			X
Treatment level				X			x			X												X
Permit conditions							x			X												X
Wasteload allocations				X			x			X												X
NPS information							x										X	x				
Management agencies						X	x									x						X
WQ standards recommend	X						X					x	x	x								
Hydrologic modifications		X					x														X	
Stream setbacks			X				x										X	x				
Silviculture activity			X				x											X				
Construction activity			X				x										X	X				
Urban runoff	X		X				X										X	X				
Onsite wastewater systems				X		X	x											x				
Chemical management					X		x										X	X				
WQ assessment	X						x					X										
BMP recommendations		x	X	x	x	X	x										x	x				
Water efficiency		X	X				x										X					
Model ordinances			x		X		x										x	x				
Mine drainage management	X						x										x					
Agricultural management		x	X	x			x											X				

Table 2. Management Agency Structure.

Activity and Policy	Management Agency
Areawide Water Quality Planning	Northwest Colorado Council of Governments
Local Land Use Planning	Counties and municipalities
Policy 1. Protect and enhance water quality	
Recommend water quality standards revisions	NWCCOG, counties, municipalities, special districts, Water Quality Control Division
Policy 2. Water Use and Development	
Issue 1041 permits	Counties and municipalities
Issue Special Use Permits/Right of ways	USFS, BLM, Counties
Issue 404 permit	US Army Corps of Engineers
Issue 401 certifications	Colorado Water Quality Control Division
Policy 3. Land Use and disturbance	
Encroachment	Counties, municipalities, special districts, federal land management agencies
Public facilities	Counties, municipalities, special districts, federal land management agencies, Colorado Department of Transportation
Vegetative disturbance	Counties, municipalities, special districts, federal land management agencies
Soil Disturbance Issue 1041 Permits	Counties, municipalities, special districts, federal land management agencies, Natural Resource Conservation Service
Impervious Cover	Counties, municipalities
Stormwater	Counties, municipalities, Colorado Water Quality Control Division
Policy 4. Domestic, municipal, and industrial water and waste treatment facilities	
Issue Colorado Discharge Permit s	Colorado Water Quality Control Division
Approve site applications	Colorado Water Quality Control Division
Review site applications	NWCCOG, counties, municipalities, special districts

Issue 1041 permits	Counties, municipalities
Biosolids Applications	Counties, Water Quality Control Division, Hazardous Materials Division
Landfill site approvals	Counties, Hazardous Materials Division
Onsite wastewater system permits	Counties, Colorado Water Quality Control Division
Policy 5. Chemical Management	
Spill prevention and cleanup	Colorado Department of Public Health and Environment, CDOT, municipalities, special districts

Policy 1. Protect and Enhance Water Quality

The surface and ground waters of the region shall be protected to minimize degradation of existing water quality and maintain existing and designated uses of those waters; waters not currently supporting designated uses shall be restored as soon as is financially and technically feasible.

Implementation Recommendations

1.1 Meet Existing Water Quality Standards

The Water Quality Control Commission has divided the surface waters of this region into stream segments, assigned designations, classifications, and set water quality standards. The five watershed plans in Volume II identify the existing designations, classified uses, and water quality standards in each of the watersheds. These designations, classifications, and standards are incorporated by reference and should be met though actions of designated management agencies, as identified in Policy 6.

1.2 Recommend Revisions to Water Quality Standards and Classifications.

Existing designations, classifications, and standards are documented in Section 8.1 of each of the watershed water quality plans. These designations, classifications and standards should be met through all actions of designated management agencies.

NWCCOG, after consultation with designated management agencies, will recommend selected revisions to these standards at triennial reviews and rule making hearings scheduled by the Commission. Recommended revisions to water quality standards are an element of 208 Plans under State Guidelines for the Continuing Planning Process.

1.2.1 Streams Which should be Investigated for Outstanding Waters Designation in Region XII

The Northwest Colorado Council of Governments does not currently recommend any additional waterbodies to the list of “Outstanding Waters” designation. If new wilderness areas within the region are approved by Congress, NWCCOG recommends investigations of waterbodies within those areas for appropriate ness of “outstanding waters” designation.

1.2.2 Use-Protected Waters in Region XII

Stream segments currently designated "Use-Protected" (discharges in these segments are not subject to antidegradation review) are listed in the appropriate watershed plans.

NWCCOG recommends that Segment 2 of the Blue River (the Blue River from French Gulch to Swan River) be designated “Use-Protected” because of water quality impacts from historical mining activities in French Gulch, lack of seasonal stream flows, and habitat impacts from historic placer mining. Additional information on this can be found in Chapters 2 and 8 of the Blue River Water Quality Management Plan.

1.2.3 Changes to Temporary Modifications in Region XII

Existing stream segments with temporary modifications are identified in the appropriate watershed plans in Volume II.

NWCCOG supports the continuation of temporary standards in the Blue River watershed for segments 2(Blue River below French Gulch), 6 (Snake River source to Dillon Reservoir), 7 (Peru Creek), and 11 (French Gulch from Wellington-Oro to mouth). TMDLs are pending for these segments and appropriate underlying standards for these segment have not yet been determined. As mentioned in Chapters 2 and 4 of the Blue River Water Quality Management Plan, activities are occurring in each of these areas to assist in the development of TMDLs.

1.2.4 Designated Uses Recommendations in Region XII

Designated Uses include: domestic water supply; agriculture; recreation; and aquatic life. No changes in designated uses are recommended to the stream segments in Region XII.

NWCCOG is supportive of the State's antidegradation provision and protection of high quality waters. NWCCOG is concerned, however that currently classified Recreation Class 2 waters will be reclassified as Recreation Class 1a unless a Use Attainability Analysis (UAA) is completed. It is highly likely that Recreation Class 2 is the appropriate classification for most of these segments. UAAs are encouraged to be pursued, however it is unlikely that UAAs will be completed for all segments in the NWCCOG region, due to financial and time constraints. In the NWCCOG region these waters are:

Upper Colorado River watershed

- Seg. 6 All tributaries to the Colorado River from Lake Granby to the Blue River not on National Forest lands
- Seg. 6c Unnamed tributary to Willow Creek from Willow Creek Reservoir Rd to Willow Creek
- Seg. 7 All tributaries to the Colorado River from Blue to the Roaring Fork not on National Forest lands

Blue River Watershed

- Seg. 7 Peru Creek mainstem
- Seg. 8 Keystone Creek, Chihuahua Creek, N Fork Snake
- Seg. 11 Mainstem French Gulch Lincoln to confluence w/ Blue River
- Seg. 12 Mainstem Illinois Gulch
- Seg. 13 Mainstem Tenmile from Climax flume to W. Tenmile Creek

Eagle River Watershed

- Seg. 11 Mainstem Alkali Creek

Roaring Fork River Watershed

- Seg. 4 Mainstem Brush Creek
- Seg. 10 Mainstem N. Thompson Creek to confluence w/ Crystal

North Platte Watershed

- Seg. 2 Mainstem Encampment R to Wyoming border
- Seg. 5 Mainstem Michigan River from source to N. Platte River

Seg. 6 Mainstem Pinkham Creek from source to N Platte
Seg 7 Mainstem of Government Creek from boundary of Colorado State Forest to the confluence with the Canadian River. Mainstem of Spring Creek from the source to confluence with Illinois River.

1.2.6 Water Quality Limited - Not Supporting (303(d) List) Recommendations in Region XII

Water designated "Not Supporting" are waters where designated uses are measurably impaired because of water pollution. The use may be present, but at a significantly reduced level from full support in all or some portion of the waterbody.

The existing "Not Supporting" identified segments are listed in the appropriate watershed water quality plan in the Water Quality Standards section. These segments are reflected in the State's existing 303(d) list as impaired waters.

Blue River

- Segment 2 - Blue River from French Gulch to Swan River confluence – zinc and cadmium.
- Segment 6 - Snake River - source to Dillon Reservoir – zinc, cadmium, copper, lead.
- Segment 7 - Peru Creek – source to Snake River confluence – zinc, cadmium, copper , lead.
- Segment 11 - French Gulch from Wellington–Oro mine to Blue River confluence – zinc, cadmium, pH.
- Segment 18 - Straight Creek - source to Blue River confluence – sediment (TMDL approved in 2000).

Eagle River

- Segment 3, Eagle River – Black Gore Creek - sediment
- Segment 5 - Eagle River – Belden to Gore Creek confluence – cadmium, zinc, manganese.
- Segment 7 - Cross Creek – lower portion near mouth – zinc, manganese.
- Segment 9 - Eagle River – Gore Creek to Colorado River confluence – manganese.

Roaring Fork River

- Coal Creek – source to Crystal River confluence - iron

Upper Colorado River

- Segment 6c - Tributary to Willow Creek from Three Lakes WWTF discharge to Willow Creek – ammonia (TMDL approved in 2000).

1.2.7 Monitoring and Evaluation Recommendations in Region XII for 2002 303(d) List

The Northwest Colorado Council of Governments recommends that several segments in the region be added to the State of Colorado's 303(d) list for monitoring and evaluation

as follows:

Eagle River Watershed

- Milk, Ute and Alkali Creeks (Eagle River segment 10) - this segment is likely impaired due to highly erosive soils and past and possibly current land use practices. Water quality impacts are related to sediment and salinity loads. It is not known if this problem has a technical or cost-effective solution, or if the impacts from this segment on the Eagle River are significant.

Upper Colorado Watershed

- Fraser River (Upper Colorado River segment 10) – this segment is likely impaired due to Highway sanding and erosive conditions. Water quality impacts are related to sediment. Data collected in this segment to date is inconclusive.

Roaring Fork Watershed

- Four Mile Creek is likely impaired due to low stream flows, point and significant nonpoint source inputs of nutrients, and nonpoint source sediment loading.

The Northwest Colorado Council of Governments recommends that several segments in the region be removed from the State of Colorado's 303(d) list for monitoring and evaluation as follows:

North Platte Watershed

It is recommended that the North Platte, Grizzly Creek, Illinois River, Canadian River and Michigan River are removed from the Monitoring and Evaluation list. These segments were proposed for evaluation based on elevated iron and manganese values. In the July 2000 Rule Making Hearing, the Commission ruled that for segments with a water supply classification that have an actual water supply use, that the numerical standard would be the less restrictive of either a) the existing quality as of July 2000, or b) the water supply table value criteria. Based on the information collected by the Jackson County Water Conservancy District, it appears that the elevated concentrations of iron and manganese are naturally occurring, and that the existing quality is the appropriate standard.

The Jackson County Water Conservancy District has monitored Newcomb, Ninegar, Pinkham, and Snyder Creeks, for sediment impacts and recommends deletion of these segments from the monitoring and evaluation list.

1.3. Implement Local Governmental Land Use Controls to Address Nonpoint sources.

1.3.1 Counties and municipalities should continue to adopt and enforce land use regulations designed to address water quality impacts associated with land use activities

1.3.2 NWCCOG should assist counties and municipalities to implement the

NWCCOG Model Water Quality Regulations through their individual land use codes. The priority areas for implementation are Grand, Summit and Eagle Counties

1.3.3 Municipalities should adopt watershed protection regulations to protect the area located upstream of their intake point for municipal water supply pursuant to CRS 31-15-707(1)(b).

1.3.4 Entities providing domestic water supplies should work with the Water Quality Control Division's Source Water Assessment and Protection Program to ensure a safe water supply.

1.4 Implement Water Quality Improvement Projects

NWCCOG should facilitate activities of designated management agencies and other interested parties to implement voluntary water quality improvement projects.

The Regional Priorities for projects and project funding is based on the regional priorities listed in Volume II and listed below.

Nonpoint Source Pollutants From Development Areas
Acid Rock Drainage
Point Source Discharges From Developed Areas
Hydrologic Modifications From Water Projects
Large Area Soil Disturbance Activities
Roadways and Pavements

As identified in Chapter 2 of Volume II, the two most significant water quality priorities in the region are Nonpoint Source Pollutants From Development Areas and Acid Rock Drainage.

Nonpoint Source Pollutants From Development Areas

Areas of focus should include:

Urbanized areas in the Fraser River, Blue River, Gore and Eagle River, and Roaring Fork River

Pollutants of interest include:

Nutrients
Sediment

A subset of this area of focus is related to groundwater impacts in development areas and includes impacts from septic systems and urban activities.

Acid Rock Drainage

Areas of focus should include:

Snake River Watershed
French Gulch
Blue River below French Gulch
Eagle River in the Belden area

NWCCOG recommends that projects addressing these two issues receive the highest priority for grant funding and direction of personnel activity.

It should be noted that although Roadways and Pavement have been broken out separately, it is a subset of Nonpoint Source Pollutants from development areas, and should also receive high priority for activities and funding – especially in the following areas:

Fraser River
Straight Creek
Black Gore Creek

Chapter 4 in each of the watershed plans identifies watershed-specific projects that NWCCOG supports.

1.4.1 Nonpoint Source Improvement From Development Area Projects

Nonpoint pollution from development areas have the potential to significantly impact water quality in the region. Pollutants of highest concern are sediment, nutrients and dissolved solids (salt). The NWCCOG and local land use management agencies should actively work to develop nonpoint source water quality improvement projects directed in developed urban areas in the Fraser, Blue, Eagle, and Roaring Fork watersheds.

1.4.2 Inactive Mine Water Quality Improvement Projects

Historic mining activities in Region XII have left mine and mill tailings, spoil piles and inactive mine workings which cause water quality degradation through acid mine drainage. While these mines were operated according to standards accepted at the time, these inactive mines often contribute to water quality problems. Local governments and NWCCOG are working with the Colorado Water Quality Control Division and the Division of Minerals and Geology to improve water quality where impacts have been identified. Public and private sector cooperative efforts should be undertaken to reclaim these sites and to minimize long-term water quality impacts. Specific site projects are listed in the appropriate watershed plan in the Watershed Water Quality Improvement Projects section.

Policy 2. Water Use and Development

The project developer shall mitigate the impacts to water quality and the aquatic environment caused by water projects.

Implementation Recommendations

2.1 Municipalities and counties should require mitigation of impacts to water quality and the aquatic environment caused by water use and development activities subject to local government regulations.

2.2 Where a federal permit is required for a water project water quality impacts, including those caused by hydrologic modifications, should be analyzed and mitigated through the federal permit process; NWCCOG will review and comment on proposed federal permits to ensure that mitigation is required to the extent allowed by law.

2.3 NWCCOG should encourage the Colorado Water Conservation Board to establish instream flows and acquire the water rights necessary to protect those flows in cooperation with local water user groups and water quality management agencies so that all affected interests can be taken into consideration.

2.4 NWCCOG should work with local governments to identify Recreational In-Channel Diversion projects that protect and enhance water quality and the aquatic environment while developing water rights.

2.5 NWCCOG should continue its efforts, such as the Upper Colorado Basin Project in Grand and Summit Counties, to jointly develop water quality and quantity data with operators of trans-mountain diversion projects so that those projects can be operated to avoid increases in wastewater treatment costs and to minimize adverse impacts to waterbodies within the Region.

2.6 NWCCOG should develop and support efforts in the Front Range and the Region to improve water use efficiency such as conjunctive use agreements, water banking, water metering, potable and non-potable reuse, landscaping requirements and conservation.

2.7 NWCCOG should facilitate public/private cooperative efforts to implement stream restoration projects that address the adverse impacts of hydrologic modifications (specific recommendations are listed in the individual watershed water quality management plans in the Watershed Improvement Projects Section).

2.8 Whenever authorized pursuant to intergovernmental agreements, counties should require an applicant for a permit to construct a major water project to consider and mitigate impacts to water quality and the aquatic environment that might result in an adjacent jurisdiction.

POLICY 3. Land Use and Disturbance

Land uses and disturbances shall not result in significant degradation of water quality nor impair the natural protection and/or treatment processes provided by wetlands, floodplains, shorelines, and riparian areas.

Implementation Recommendations

3.1 Local governments should amend their land use codes to adopt the NWCCOG Water Quality Regulations (Appendix 10) or other regulations that require building setbacks from waterbodies, erosion control,-post-construction stormwater detention, snow storage and melt criteria, and related techniques to prevent degradation of water quality associated with building and development.

3.2 NWCCOG and counties should encourage the agricultural community to implement voluntary Best Management Practices (BMPs) for agricultural activities to minimize adverse impacts to water quality from these activities. Examples of BMPs can be found in Appendix 11.

3.3 Developers should protect critical stream environment zones, floodplains, wetlands, riparian areas, and reservoir shorelines for public uses through conservation easements, land exchanges, transfer of development rights, or similar resource protection techniques whenever possible.

3.4 Developers should maintain the hydrologic characteristics of the development site similar to pre-development conditions. Drainage plans, including calculation of storm runoff volumes and velocities (before and after development) using accepted hydrologic calculation procedures, should be designed and implemented..

3.5 Counties and municipalities should adopt building restrictions on slopes greater than 30% as a means of limiting the water quality impacts of soil disturbance.

3.6 Counties and municipalities should require that development proposals be designed to minimize impervious surfaces.. The greatest restrictions on impervious cover are recommended for groundwater recharge areas. The Colorado Water Quality Control Division's Wellhead Protection Program has information on these areas.

3.7 Stormwater discharges should not result in any significant increase in total pollutant loads and the direct discharge of stormwater to a waterbody or drainage way should be prohibited.

3.8 Design, construction, operation and maintenance of golf courses should follow “Guidance for Water Quality Enhancement at Golf courses through the Use of Best Management Practices” prepare for the Colorado Nonpoint Source Council, December, 1996 (Appendix 11).

3.9 Design and maintenance of mountain driveways should follow “Mountain Driveway Best Management Practices”, prepared for the Colorado Nonpoint Source Task Force, June 1999 (Appendix 11).

Policy 4. Domestic, Municipal, and Industrial Water and Wastewater Treatment Facilities

Decisions to locate water supplies, wastewater treatment systems, and other water and wastewater facilities shall be made in a manner which protects water quality and the aquatic environment. Where growth and development requires the need for additional facility capacity, existing facilities should be expanded in lieu of developing new facilities, unless expansion is not feasible because of technical, legal or political reasons.

Implementation Recommendations

4.1 NWCCOG will review site applications for wastewater treatment plants and industrial water projects and forward comments to the county or municipal government within which the project will be located, and to appropriate state and federal agencies.

4.2 NWCCOG will coordinate local watershed efforts with those off the State Water Quality Control Division to track waste load allocations.

4.3 NWCCOG and appropriate watershed management agencies will coordinate efforts to minimize nonpoint source pollution so that point source dischargers do not bear a disproportionate share of water quality protection costs.

4.4 NWCCOG should recommend to the Water Quality Control Commission that the effectiveness of pollutant trading schemes be evaluated. During facility planning and drafting of Colorado Discharge Permits (CDPS), the cost-effectiveness of controlling nonpoint sources of critical pollutants should be considered. Dischargers should be given credit towards CDPS limits for removal of critical point source pollutants from nonpoint sources.

4.5 Whenever possible, new development should be served by central wastewater treatment systems. Where central systems are not possible, onsite wastewater systems (individual sewage disposal systems or septic systems) should be required to meet appropriate performance criteria that are protective of surface and groundwater quality.

4.6 The proliferation of wastewater treatment plants and operating agencies should be discouraged by consolidating treatment plants and management agencies whenever possible. Counties and the Water Quality Control Division should require that wastewater treatment plants be operated by entities with the technical, financial and legal capability to ensure reliable treatment over the life of the facility.

4.7 Biosolids generated by municipal and industrial wastewater treatment plants should be disposed of and/or beneficially re-used according to a disposal plan approved by the Colorado Department of Public Health and Environment and the appropriate local government. Re-use of biosolids locally is strongly encouraged as an alternative to landfill disposal.

4.8 Counties should work with municipal and special district wastewater treatment facilities to consider the treatment of septic tank septage from onsite wastewater systems and recreational vehicles. Costs for construction, operation, and maintenance

of these facilities should be paid for by the generators of the septage.

4.9 Any new wastewater facility shall be consistent with this Plan. A site application for a wastewater treatment facility not identified in this plan is required to provide adequate information in an engineering report submitted with the site application to ensure consistency with this plan. A check list of the required information for facilities over 10,000 gallons per day is found in Appendix 15.

4.10 The use of Operating Agencies, i.e. homeowner associations or private wastewater operators, to own and manage wastewater treatment facilities should be avoided whenever possible because of the time, technical training, and consistency of effort needed to manage and operate wastewater facilities.

4.11 NWCCOG will facilitate watershed-based water and wastewater provider forums for discussion of TMDLs, wasteload allocation and management, and sharing of information. Existing examples include the Summit Water Quality Committee and the East Grand Water Quality Board.

Policy 5. Chemical Management

The uses of pesticides, fertilizers, algaecides, road deicing and friction materials, and other chemicals which would temporarily or permanently cause a significant degradation of water quality or impair the current or designated uses of these waters should be regulated to the extent allowed by law.

Implementation Recommendations

5.1 Decisions about limitations and management of agricultural, industrial, and domestic chemicals should be based upon preparation of carefully designed pest control and nutrient management plans reflecting integrated approaches to pest control and detailed soil testing and plant analyses. Appropriate Management Agencies will encourage education efforts in cooperation with the Natural Resources Conservation Service and State Extension Service to inform the public and other users of fertilizers and pesticides concerning the appropriate use and alternatives to the use of these materials in order to minimize water quality impacts.

5.2 Application of road deicing and friction materials should be conducted throughout the region in accordance with the following recommendations. NWCCOG and county governments should provide these recommendations to state or federal agencies involved with road maintenance efforts:

- Sanding materials and chemical application rates should be the minimum necessary to obtain safe and efficient operation of streets, roads, and highways.
- Salt and other chemicals should be applied only when removal of snow and ice cannot be accomplished by blading, plowing or sanding.
- Measures should be taken to minimize and mitigate the use of sand and chemicals in and adjacent to environmentally sensitive areas including: streams; lakes; ponds; wetlands; potential aquifers; and flood prone areas.
- Chemically treated or sanded snow and ice should not be dumped or stored where melt can flow directly into surface waters.
- Snow storage areas shall be located taking into consideration state requirements that direct discharges of snow storage areas to waterbodies require a Colorado Discharge Permit.

5.3 Local governments should enact regulations to require that storage**,** handling, and use of hazardous substances be conducted in accordance with the following general guidelines:

- All materials should be kept in appropriate containers and/or under cover, protected from precipitation and stormwater flows and in compliance with state and federal hazardous waste and management laws.
- All storage areas should be kept clean of spilled material.
- Handling and moving of materials should be limited as much as possible.
- Only "reasonable" quantities of toxic materials should be kept on hand.
- Hazardous substances should not be stored on potential aquifer recharge areas, unstable slopes, flood prone and other geologic hazard areas.

5.4 Storage, handling and transporting of large amounts of hazardous substances should be tracked and monitored throughout the region by the local fire departments or designated emergency response provider.

5.5 Water providers that depend on ground and surface waters for domestic water supplies should develop appropriate protection programs, such as a source water protection program pursuant to Section 1428 of the Safe Drinking Water Act or a watershed protection program pursuant to CRS 31-15-707(1)(b).

5.6 The communities and solid waste disposal facilities in the region should encourage responsible management of household hazardous wastes (oil, paint, acids, pesticides, etc.) through public education outreach. Development of a region-wide hazardous materials management program and waste minimization programs should be encouraged.

POLICY 6. Management System

The waters of the region shall be protected by a management agency structure within the existing governmental and regulatory framework that allows decisions to be made at the most appropriate level of control. For nonpoint source pollution control the recommended level of management is at the watershed level. Table 2 identifies the recommended management agency structure.

Background

The federal Clean Water Act requires the governor of each state to designate management agencies responsible for carrying out the provisions of approved water quality management programs. Once designated by the governor and approved by the Regional Administrator of EPA, functional responsibility for carrying out the provisions of the water quality management plan is legally assigned to that entity.

Further, the Federal Clean Water Act specifies that:

- Future construction grants for wastewater treatment facilities under Section 201 of the Act will be awarded only to entities who are designated as management agencies.
- No discharge permit will be issued which is in conflict with the recommendations of an approved 208 Plan as updated by the designated planning and management agencies.

The Designation Process

The designation of management agencies establishes part of the legal basis for delegation of authorities necessary to carry out the recommendations of Water Quality Management Plans. The management agency structure by NWCCOG is outlined in Table 3.

Implementation Recommendations

See Table 3 for the Recommended Management Agency Structure to implement the NWCCOG Regional Water Quality Management Plan.

6.1 Federal Lands: Federal land managers (USFS, BLM, NPS) are management agencies for lands which they manage in cooperation with counties where the land is located.

6.2 Local Governments: Municipal and county governments are designated as management agencies for local land use decisions within their jurisdictions.

6.3 Sanitation Districts: Sanitation Districts are designated as management agencies for the construction, operation, and maintenance of wastewater facilities within their service area. The following districts operate under an intergovernmental agreement:

Breckenridge, Frisco, and Kremmling

Sanitation districts should enter into agreements with their local general purpose governmental body which indicates their resolution to act as the management agency

responsible for controlling point source discharges consistent with the 208 Plan, and agree to abide by the local government's regulations with respect to nonpoint source control of water pollutants related to their activities.

6.4 Municipal and County Facilities: The following general purpose governments operate municipal wastewater treatment facilities and are designated as management agencies for wastewater treatment within their service areas: the Towns of Eagle, Gypsum, Hot Sulphur Springs, Red Cliff, Silverthorne/Dillon, and Summit County (Snake River).

6.5 Operating Agencies: Homeowner associations and private owners of wastewater treatment facilities are designated as operating agencies for their own facilities. Operating agencies are encouraged to have agreements in place with appropriate management agencies (local governments and special districts) regarding their service areas, scope of services, cooperative monitoring programs and responsibilities.

6.6 NWCCOG will facilitate the development of Memorandums of Understandings or Inter-Governmental Agreements between federal, state, local, and private entities to manage water quality issues.

6.7 The recommended role of NWCCOG is to:

- Develop, review and revise the Regional Water Quality Management Plan;
- Provide outreach and education to its member jurisdictions;
- Support watershed water quality planning processes;
- Encourage and assist local governments in developing regulations which address water quality issues as recommended in the 208 Policy Plan;
- Facilitate intergovernmental agreements which will further watershed water quality planning;
- Provide technical support in development of water quality improvement projects;
- Review, and comment when appropriate on, Site Applications, water quality standards, environmental impact statements and permits in the region, in accordance with the 208 Plan policies and implementation recommendations.
- Participate in State activities, such as Water Quality Control Commission hearings and State sponsored work groups, to promote the interest of members of NWCCOG, as identified in this 208 Plan.

Table 3. Management Agency Structure

Activity and Policy	Management Agency
Areawide Water Quality Planning	Northwest Colorado Council of Governments
Local Land Use Planning	Counties and municipalities
Policy 1. Protect and enhance water quality	
Recommend water quality standards revisions	NWCCOG, counties, municipalities, special districts, Water Quality Control Division
Policy 2. Water Use and Development	
Issue 1041 permits	Counties and municipalities
Issue Special Use Permits/Right of ways	USFS, BLM, Counties
Issue 404 permit	US Army Corps of Engineers
Issue 401 certifications	Colorado Water Quality Control Division
Policy 3. Land Use and disturbance	

Encroachment	Counties, municipalities, special districts, federal land management agencies
Public facilities	Counties, municipalities, special districts, federal land management agencies, Colorado Department of Transportation
Vegetative disturbance	Counties, municipalities, special districts, federal land management agencies
Soil Disturbance	Counties, municipalities, special districts, federal land management agencies, Natural Resource Conservation Service
Issue 1041 Permits	Counties, municipalities
Impervious Cover	Counties, municipalities, Colorado Water Quality Control Division
Stormwater	
Policy 4. Domestic, municipal, and industrial water and waste treatment facilities	
Issue Colorado Discharge Permit s	Colorado Water Quality Control Division
Approve site applications	Colorado Water Quality Control Division
Review site applications	NWCCOG, counties, municipalities, special districts
Issue 1041 permits	Counties, municipalities
Biosolids Applications	Counties, Water Quality Control Division, Hazardous Materials Division
Landfill site approvals	Counties, Hazardous Materials Division
Onsite wastewater systems	Counties, Colorado Water Quality Control Division
Policy 5. Chemical Management	
Spill prevention and cleanup	Colorado Department of Public Health and Environment, CDOT, municipalities, special districts

NWCCOG 208 Plan Policy Summary

Policy 1. Protect and Enhance Water Quality

The surface and ground waters of the region shall be protected to minimize degradation of existing water quality and maintain existing and designated uses of those waters; waters not currently supporting designated uses shall be restored as soon as is financially and technically feasible.

Policy 2. Water Use and Development

The project developer shall mitigate the impacts to water quality and the aquatic environment caused by water projects.

POLICY 3. Land Use and Disturbance

Land uses and disturbance shall not result in significant degradation of water quality nor impair the natural protection and/or treatment processes provided by wetlands, floodplains, shorelines, and riparian areas.

Policy 4. Domestic, Municipal, and Industrial Water and Wastewater Treatment Facilities

Decisions to locate water supplies, wastewater treatment systems, and other water and wastewater facilities shall be made in a manner that protects water quality and the aquatic environment. Where growth and development requires the need for additional facility capacity, existing facilities should be expanded in lieu of developing new facilities, unless expansion is not feasible because of technical, legal or political reasons.

Policy 5. Chemical Management

The uses of pesticides, fertilizers, algaecides, road deicing and friction materials, and other chemicals which would temporarily or permanently cause a significant degradation of water quality or impair the current or designated uses of these waters should be regulated to the extent allowed by law.

POLICY 6. Management System

The waters of the region shall be protected by a management agency structure within the existing governmental and regulatory framework that allows decisions to be made at the most appropriate level of control. For nonpoint source pollution control the recommended level of management is at the watershed level. Table 2 identifies the recommended management agency structure.

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2002 NWCCOG REGIONAL WATER QUALITY MANAGEMENT PLAN

VOLUME II - WATER QUALITY PROGRAM DEVELOPMENT

Appendices

Appendix 1. Glossary

Appendix 2. Towns and Counties within Region XII, and Population Projections

Appendix 3. Wastewater Treatment Plants within Region XII.

Appendix 4. Water Providers Within Region XII, Including: Population served and Source.

Appendix 5. Select Water Quality Data From Region XII.

Appendix 6. Stream Standards and Classifications for Waters Within Region XII and Impaired Uses Stream Segments (303(d) list).

Appendix 7. Dillon Reservoir/ Roberts Tunnel Planning Information

Appendix 8. CDPS Permit Holder List for Region XII (Including Stormwater Permits)

Appendix 9. Designated Management Agencies Agreements

Appendix 10. Sample Local Government Water Quality Regulations

Appendix 11. Example Best Management Practices

Appendix 12. Maps

Appendix 13. Comments Received on Draft 208 Plan

Appendix 14. Colorado Water Conservation Board Instream Flow Appropriations

Appendix 15. Site Application Engineering Report Outline and Checklist for New Wastewater Facilities Not Identified in the Current 208 Plan

EXECUTIVE SUMMARY

The Guidelines for Water Quality Planning in Colorado require annual updates of the Areawide Water Quality Management Plans under Section 208 of the Clean Water Act. The Purpose of the Northwest Colorado Council of Governments (NWCCOG) 2002 Regional Water Quality Management Plan is to satisfy the requirement for an update of the Plan to reflect the progress in plan implementation. A second purpose of the Plan is to address the current focus on water quality planning from a watershed perspective.

The NWCCOG Regional Water Quality Management Plan (208 Plan) 2002 revision is structured to satisfy the requirements established under the applicable State Guidelines and to satisfy local planning requirements, which dictate a flexible and innovative approach to water quality planning to avoid future water quality problems.

The 2002 208 Plan is composed of two volumes and a set of technical appendices. Volume I is presented in a policy plan format and describes the program recommendations to protect and enhance the level of water quality consistent with the requirements of the Federal Clean Water Act. Volume I is intended to provide the direction for water quality decisions resulting from activities which have the potential to generate both point and nonpoint sources of water quality degradation in the Region. Volume I of the plan is organized around six policies which will lead to maintaining and improving water quality in the region. Under each policy, Implementation Recommendations are presented for use by agencies who have and will continue to implement the plan. These management agencies are identified in Policy 6 of Volume I, and the rationale for their selection is discussed in Chapter 5 of Volume II - Management Systems.

Volume II describes the water quality program development in a format similar to the specific items contained in Colorado's planning guidelines. Volume II draws on material contained in previous 208 Plan submittals and from technical appendix information.

Volume II provides supporting information for the development and adoption of water quality management policies currently in practice in Region XII. The appendices provide supporting technical information regarding specific water quality issues addressed in the plan.

Table 4 provides a summary of the requirements for water quality planning established under the State Guidelines compared to the elements contained in the 2002 NWCCOG 208 Plan. While it is clear from this table that the Policy Plan (Volume I) together with the technical appendices contain all of the State required elements, a two-volume format was chosen to increase the utility of the 208 Plan.

Table 4 Water Quality Planning Elements

208 Plan Element	Plan Policy (V. I)						Vol.	Appendix													
	1	2	3	4	5	6	II	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Facility location						X	x			X	X								X			X
Facility needs							x			X												X
Facility capacity							x			X	X											X
Facility timing							x			X												X

Population projections							x		X													
Service area										X									x			X
Treatment level				X			x			X												X
Permit conditions							x			X												X
Wasteload allocations				X			x			X												X
NPS information							x										X	x				
Management agencies						X	x									x						X
WQ standards recommend	X						X					x	x	x								
Hydrologic modifications		X					x														X	
Stream setbacks			X				x										X	x				
Silviculture activity			X				x											X				
Construction activity			X				x										X	X				
Urban runoff	X		X				X										X	X				
Onsite wastewater systems				X		X	x											x				
Chemical management					X		x										X	X				
WQ assessment	X						x					X										
BMP recommendations		x	X	x	x	X	x										x	x				
Water efficiency		X	X				x										X					
Model ordinances			x		X		x										x	x				
Mine drainage management	X						x										x					
Agricultural management		x	X	x			x											X				

1.0 INTRODUCTION

In 1972 the US Congress overrode a presidential veto to pass the Federal Water Pollution Control Act Amendments of 1972 (PL92-500), also known as the Clean Water Act. This Act has been further amended with significant changes in 1977 (PL95-217) and 1987 (PL100-4). The Clean Water Act states that the ultimate objective of the Act is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters".

In beginning the process of water quality improvements, the Clean Water Act identified a number of planning programs to be initiated at various levels of government.

In Colorado, the Colorado Water Quality Control Commission (WQCC) is responsible for regulating water quality through the establishment of water quality classifications, designations, standards, and control regulations to protect the beneficial uses of the streams and lakes in the state.

To maximize efficient use of resources, Section 208 of the Act established an areawide approach to planning for the abatement of pollution. Section 208 provided criteria to design local plans, based on an integrated and comprehensive planning process. The state of Colorado has continued to use regional planning agencies as defined in the Act.

The Northwest Colorado Council of Governments (NWCCOG) was designated the areawide waste treatment management planning authority, under Section 208, in February 1976 by the governor of Colorado. NWCCOG develops and maintains the Areawide Water Quality Management Plan (208 Plan) as a means of preserving and enhancing state water quality standards and classifications for both surface and groundwater.

The Northwest Colorado Council of Governments' planning region includes Eagle, Grand, Jackson, Pitkin and Summit Counties. These counties include portions of two river basins: the Colorado River Basin and the North Platte River Basin.

The state is divided into seven geographic divisions for the administration and distribution of water in Colorado, under the Office of the State Engineer and the Division of Water Resources. These divisions do not neatly correspond to the planning regions with respect to the Water Quality Management Plans. The following information comes, in part, from "Colorado Water" produced by the League of Women Voters, 1992, and the USGS publication entitled "Hydrology of Area 58, Northern Great Plains and Rocky Mountain Coal Provinces, Colorado and Utah", (1987).

1.1 The Colorado River Basin

The Colorado River basin extends from Loveland and Berthod Passes on the east to the state line on the west, an east-west length of approximately 200 miles. The north-south boundaries are generally between 50 to 100 miles wide. The major tributaries include the Fraser, the Williams Fork, the Blue, the Eagle, and the Roaring Fork rivers. The basin, including the Gunnison basin, which is not part of this plan, encompasses 13,132 square miles (8,404,480 acres).

Agriculture is still the dominant water user, with diversions of 2,415,950 acre-feet per year for the irrigation of 359,800 acres. Industrial diversions total approximately 2,392,400 acre-feet. The greatest expansion in industrial use during recent years has been for snow making at ski areas and there has been increasing pressure for instream flows for other recreational uses such as fishing and rafting.

The 2000 ten-year average of trans-basin water diversions total 479,194 acre-feet per year from the Colorado River basin to Front Range cities and agriculture [Colorado Division of Water Resources Division 5 2000 Annual Report]. Currently the Colorado-Big Thompson and the Windy Gap projects supply approximately 200,000 to 250,000 acre-feet of water (Denver Water Department records show these projects supply 218,632 acre-feet) for agriculture and municipalities on the Front Range. The Roberts and Moffat tunnels supply approximately 110,000 to 150,000 acre-feet of water per year to the Denver metropolitan area (the 2001 ten-year average is 109,774, according to Denver Water records). The Boustead, Twin Lakes, Busk-Ivanhoe and Homestake tunnels and diversions supply approximately 75,000 to 122,000 acre-feet of western slope water to Colorado Springs, Aurora, and agriculture in the Arkansas River basin. Other Continental Divide diversion such as the Columbine, Ewing and Wurtz ditches increase the diversion of water to the Arkansas River to an ten-year average of 139,472 acre-feet.

Most of the annual stream flow in the perennial streams results from snowmelt during the months of May, June and July, when the high elevation deep snow pack melts. Stream flow characteristics have changed significantly from natural conditions due to reservoir storage. Stream flow is highly variable, both within any given year and between individual years. Low flows on perennial streams are sustained by flows from groundwater, gradual melting of perpetual snow fields and reservoir releases.

Surface water storage (including the Gunnison basin) exceeds 2.3 million acre-feet, with most of this storage in a few large reservoirs. This storage capacity is approximately 60 percent of the average annual stream flow in the basin. The storage capacity in Colorado basin portion of NWCCOG's region is 1,208,080 acre-feet.

The Northwest Colorado Council of Governments is responsible for producing the Water Quality Management Plan for the upper portion of the Colorado River basin. Essentially, the planning area includes all the major tributaries previously mentioned, but excludes the area downstream of Eagle County (this includes the confluence of the Roaring Fork and Colorado River at Glenwood Springs). The drainage area for this basin, the Upper Colorado River basin, is approximately 6,010 square miles (3,846,400 acres). Figure 3 illustrates the Upper Colorado River Basin.

Figure 3. Upper Colorado River Basin Map.

1.2 THE NORTH PLATTE RIVER BASIN

The headwaters of the North Platte River basin are located in Jackson County (Figure 5). Ranching, mining, and logging are the predominant economic activities in the County. The population of Jackson County in 1990 was 1,597 persons and 1,577 in 2000. A significant aspect of the North Platte River in Colorado is the Nebraska versus Wyoming Decrees (325 US 589 (1945), and 345 US 981 (1953)) which limits the State of Colorado from diverting more water than that needed to irrigate 145,000 acres of land in Jackson County, prohibits storing more than 17,000 acre feet of water in any year for irrigation purposes, and prohibits the export of more than 60,000 acre feet of water out of basin in any ten year period.

Figure 4. Upper North Platte River Basin Map.

2.0 REGIONAL WATER QUALITY ASSESSMENT SUMMARY

Most of the streams in Region XII are very high quality, supporting all desired uses (although not in every stream reach). This general assessment is supported by the "Reconnaissance Evaluation of Surface Water Quality in Eagle, Grand, Jackson, Pitkin, Routt and Summit Counties" prepared in 1979 by the USGS for NWCCOG and by the assessment of water quality of each watershed in Chapter 8 of this Volume. Additional water quality data and analyses over the past twenty years continues to show that, in general, waters of the region are of better quality than required by State standards. For examples, see USGS Water Resources Investigation Report 99-4181 "Characterization of selected biological, chemical, and physical conditions at fixed sites in the Upper Colorado River Basin, Colorado, 1995-1998" and USGS Circular 1214 "Water Quality in the Upper Colorado River Basin, Colorado 1996-1998".

The emphasis of water quality planning in Region XII is largely directed toward preserving this existing high quality. There are some areas, however, where improvement of water quality is necessary and reasonable to restore beneficial uses, particularly with regard to acid rock drainage from historic mining areas.

The water quality assessment includes specific sections on both point and nonpoint source water quality issues in each of the region's watersheds. The assessment provides the basis for ranking problems within the region. Considering water quality problems which need to be corrected to meet the objectives of the federal Clean Water Act throughout the region, the following are listed in order of priority (highest, or most serious, to lowest):

Nonpoint Source Pollutants From Development Areas

Acid Rock Drainage

Point Source Discharges From Developed Areas

Hydrologic Modifications From Water Projects

Large Area Soil Disturbance Activities

Roadways and Pavements

This qualitative ranking is based on the existing or potential seriousness of the impact, miles of stream affected or likely to be affected, and the degree of present or potential control of the problem.

Five of the six significant water quality issues in Region XII are nonpoint source issues. The State's 305(b) Report which discusses water quality threatened stream segments (individual segments are discussed in the individual watershed plans in Sections 2 and 8) are point source oriented because the system for identifying threatened segments is point source oriented. Point source controls will be applied to prevent damage to the threatened stream segments. The real challenge for water quality management lies in the area of nonpoint source control. Each problem category is briefly discussed below and is discussed in detail in Chapter 8 of Volume II under the status of watershed water quality assessments and nonpoint source control programs in the watersheds.

Nonpoint Source Pollutants from Development Areas

Nonpoint source pollution from development areas is a significant issue in Region XII, and more specifically in the Upper Colorado (Fraser River Valley), Blue, Eagle, and Roaring Fork watersheds. Water pollutants in nonpoint source runoff from urbanizing areas include nutrients (nitrogen and phosphorus), sediment, heavy metals, petroleum products, and organic pesticides. In Summit County, roughly one quarter of the phosphorus contributed to Dillon Reservoir is generated by nonpoint source runoff from human activities in the watershed. Preventing eutrophication in Dillon Reservoir requires tight controls on nonpoint sources. More detail on specific sources is provided in Appendix 5. Dillon Reservoir presents an example of the types of issues that are likely to increase in seriousness throughout the State in the future. As the rural West Slope grows, the areas contributing to construction-related erosion and urban runoff will also increase.

Acid Rock Drainage

Acid rock drainage impedes attainment of water quality standards for several streams in the Blue, Eagle, and Roaring Fork watersheds. These streams are described in the Colorado Inactive Mine Reclamation Plan produced by the Colorado Division of Minerals and Geology and in the water quality assessments contained in Chapter 8 of Volume II of this plan. Of particular concern are: Cross Creek and the Eagle River near Minturn; and French Gulch, Peru Creek, and the Snake River in Summit County.

Point Source Discharges from Developed Areas

Point source discharges in Region XII are typically well managed. Advanced wastewater treatment is often required for ammonia removal to protect fisheries and advanced phosphorus removal is required in the Dillon and Green Mountain Reservoirs' watersheds. Continued attention to point sources is needed to ensure that the region's high quality water streams are protected.

Hydrologic modifications From Water Projects

Hydrologic modifications are changes in stream channels, stream flows or the timing of those flows, generally resulting from water projects. Water quality impacts accompany major water use and development projects. The amount of water available to dilute natural and human induced pollutants is reduced, costs for wastewater treatment are increased due to lower stream flows (lower dilution flows), fish are stressed more often when low flows are combined with factors such as higher water temperatures and poor food supplies, water supply uses are eliminated when water is not present in a stream, stream channel morphology is impacted as the stream volume is reduced in relation to the stream cross-section which results in higher water temperatures and lower stream capacity to move sediment [Effects of Flow Diversion on Downstream Channel Form in Mountain Streams, Sandra Ryan and Neil Caine, Completion Report 176, December 1993, Colorado Water Resources Research Institute; Applied Fluvial Geomorphology,

Dave Rosgen, 1995]. Some recreational uses are also dependent on stream flows, such as rafting and boating in lakes. Water use and development projects are listed as a significant water quality issue in the region in terms of potential to degrade existing high levels of water quality because of the number of uses affected and the extent of impact. All basins in the region are potentially affected by hydrologic modifications. Hydrologic modifications resulting from existing and projected water use and development projects in Region XII are also discussed in more detail in Section 4.2.2 of this Volume.

As a basis for comparison with other types of water quality degradation, a few numbers may be useful. According to State Engineer Office Division V records, Region XII trans-basin diversions to the eastern slope totaled 606,817 acre-feet in 1993. At the USGS Colorado River gage below Glenwood Springs, total flows for water year 1993 equaled 2,874,000 acre-feet [USGS Water Resources Data Colorado Water Year 1993, Volume 2. Colorado River Basin]. Based on rough estimates for water consumption for various uses (as estimated by the Division V Engineer, in-basin consumption in 1993 was about 318,000 acre-feet. Thus, the total consumption in the basin was approximately ¼ of the total stream flow, and the trans-basin diversions amounted to approximately two-thirds of this consumption.

For the water year 2000, trans-basin diversions from State Water Resources Division 5 totaled 555,273 acre-feet. In 2000 the ten-year average was 480,766 acre-feet. At the USGS Colorado River gage below Glenwood Springs, total flows for water year 2000 equaled 2,110,000 acre-feet, and the average for water years 1967-2000 is 2,522,000 acre-feet. [USGS Water Resources Data Colorado Water Year 2000, Volume 2. Colorado River Basin].

In-basin water use can also raise water quality concerns. Included in these concerns are: conversion of agricultural water to municipal use (loss of groundwater recharge); change in timing of return flows (specifically related to snow making); and "de-watering" stream segments between water diversion and wastewater return flows; and the "consumptive use" of various beneficial water uses. In-basin consumption can be calculated using general figures of 10% consumption for municipal use, 20~~-25~~% consumption for snow making, and approximately 1.8 acre-feet per acre irrigated for agriculture (Water Division V estimates).

Large area soil disturbances

Large area soil disturbance activities such as mining, grazing, timber harvesting, and ski area expansion present the potential for large water quality impacts. The US Forest Service has identified areas where excessive soil loss from existing timber harvest operations require remedial actions to protect water quality. In addition, large area surface mining operations can contribute excessive soil loss. At present, these operations are well managed under permits from the Colorado Division of Minerals and Geology and the US Forest Service. All watersheds in Region XII are potentially vulnerable to water quality impacts resulting from large area soil disturbances.

Roadways And Pavement

Water quality problems associated with roadways and pavements include sediment and

associated nutrients resulting from road cuts and fills, continuing erosion of unstable slopes adjacent to roads, erosion of unpaved road and parking surfaces, and road sanding operations. To a lesser degree, heavy metals, petroleum products, and hazardous materials spills along roadways near waterbodies also have been documented to impact water quality. The Colorado Department of Transportation has a program underway to address these concerns while also considering public driving safety and existing funds and needs. All watersheds in Region XII are potentially vulnerable to water quality impacts from this type of activity, although the major areas of concern are in those areas where development has or is occurring.

3.0 CLASSIFICATIONS AND STANDARDS SYSTEM

3.1 Overview of Colorado's Classifications and Standards System

The system for assigning surface and groundwater classifications and standards is administered by the Water Quality Control Commission and Division and is based on adopting use classifications that identify those uses to be protected on a stream segment and then adopting numerical standards for specific pollutants to protect those uses.

Use classifications and numeric water quality standards have been adopted for streams, lakes, and reservoirs throughout each of the State's river basins. Within each basin, waters are divided into individual stream segments for classification and standard setting purposes. Water quality standards are applied in a regulatory context principally through Colorado Discharge Permit System (CDPS) where point source dischargers are regulated to ensure that water quality standards are met.

Site-specific water quality classifications are intended to protect all existing uses of state waters, and any additional uses for which waters are suitable or are intended to become suitable. The current use classification categories are: recreation (class 1a, 1b, or 2); agriculture; aquatic life (cold or warm water, class 1 or 2); water supply; and wetlands.

For each classified stream segment, numeric water quality standards are adopted that are intended to maintain water quality at a level sufficient to protect the classified uses. There are three potential approaches to the adoption of site-specific numeric standards. First, table value standards (TVS) are based on criteria set forth in three tables contained in the Commission's Basic Standards and Methodologies for Surface Waters 31 5CCR 1002-31). These are levels of pollutants determined to be generally protective of the corresponding use classifications, and are applied in most circumstances, unless site-specific information indicates that one of the following approaches is more appropriate. Second, ambient quality-based standards - i.e. standards based on the existing instream quality, may be adopted where natural or irreversible pollutant levels are higher than would be allowed by table value standards, but are determined adequate to protect classified uses. The third option is to adopt site-specific standards where a bioassay or other site-specific analysis indicates that alternative numeric standards are appropriate for protection of classified uses.

In addition to water quality classifications and standards, either of two water quality based designations may be adopted in appropriate circumstances. An "Outstanding Waters" designation may be applied to certain high quality waters that constitute an

outstanding natural resource. No degradation of outstanding waters by regulated activities is allowed. A "Use-Protected" designation may be applied to waters with existing quality that is not better than necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water. The quality of these waters may be altered so long as applicable water quality classifications and standards are met. Waters that are not given one of these designations are subject to the State's Antidegradation Review requirements before any new or increased permitted water quality impacts are allowed.

3.2 Existing Water Quality Standards

The surface waters of the region have been divided into stream segments and classified by the Water Quality Control Commission. Certain stream segments in the region with known water quality problems have been identified, and are classified as either Water Quality Limited, Partially Supporting, or Not Supporting Designated Uses, as presented in each of the watershed plans.

3.2.1 Table Value Water Quality Standards

Most of the stream segments in our region meet or exceed table value standards. These standards are based on levels of pollutants determined to be generally protective of the corresponding use classifications. Additional information on the specific stream segments can be found in each of the watershed plans. The Basic Standards and Classifications which are applicable to the Region, including the basis and purpose for the standards and classifications can be found in Appendix 6

3.2.2 Outstanding Waters in the Region

Outstanding Waters designation is applied to certain high quality waters that constitute an outstanding natural resource. No degradation of these waters is allowed. The following stream segments in our region are currently designated "Outstanding Waters".

Headwaters of the Colorado River in Rocky Mountain National Park (Upper Colorado River Segment 1)

All tributaries to the Colorado and Fraser Rivers within the Never Summer, Indian Peaks, Ptarmigan, and Flat Tops Wilderness areas (Upper Colorado River segment 9)

All tributaries to the Blue River within the Eagle Nest and Ptarmigan Peak Wilderness areas (Blue River segment 16)

All tributaries to the Eagle River system within the Gore Range-Eagles Nest and Holy Cross Wilderness areas (Eagle River segment 1)

Headwaters of the Roaring Fork River in the Snowmass/Maroon Bells Holy Cross, Raggeds, Collegiate Peaks and Hunter/Frying Pan Wilderness Areas (Roaring Fork River Segment 1)

Tributaries to the Encampment, North Platte, in the Mount Zirkel and Never Summer Wilderness Areas (North Platte River Segment 1)

3.2.3 Use-Protected Waters in the Region

Use-Protected designation is applied to waters of the state that the Water Quality Control Commission has determined do not warrant the protection provided by "Outstanding Waters" designation or the antidegradation review process. The quality of these waters may be altered so long as applicable water quality classifications and standards are met. The following are the stream segments in our region which are designated "Use Protected".

Willow Creek - mainstem of unnamed tributary (Church Creek) to Willow Creek from the headwaters to confluence of Willow Creek (Upper Colorado River Segments 6b and 6c).

Snake River - from the source to Dillon Reservoir, excluding Deer and Keystone Creek (Blue River Segments 6 and 7).

French Gulch - from 1.5 miles below Lincoln (site) to confluence with Blue River (Blue River Segment 11).

Illinois and Fredonia Gulches - from their source to their confluence with the Blue River (Blue River Segment 12).

Mainstem of Tenmile Creek from Climax to West Tenmile Creek (segment 13).

All tributaries to the Blue River below Green Mountain Reservoir except Elliot and Spruce Creeks (Blue River Segment 19).

Alkali and Milk Creek, from their source to the confluence with the Eagle River (Eagle River Segment 11).

Red Canyon from the source to the confluence with Roaring Fork, except for Landis Creek (Roaring Fork segment 3a).

Brush Creek from its source to the confluence with the Roaring Fork River (Roaring Fork River Segment 4).

Government Creek mainstem from Colorado State Forest to the confluence with the North Platte River (North Platte River Segment 7).

Spring Creek from its source to the confluence with the Illinois River North Platte River Segment (North Platte River Segment 7).

Waters that are not given the designation of "Outstanding Waters" or "Use Protected" are subject to the State's Antidegradation Review requirements before any new or increased permitted water quality impacts are allowed. More information on stream standards can be found in each of the watershed plans under Water Quality Standards and Classifications.

4.0 REGIONAL WATER QUALITY ISSUES

4.1 Point Source Impacts

Point sources discharges can be defined as discharge of water from a discernible, confined, and discrete conveyance, such as a pipe, ditch, channel or conduit, from which pollutants are, or may be discharged. Point sources do not include irrigation return flows. The point source impacts within our region come from three types of sources that are permitted by the Colorado Department of Public Health and Environment's Water Quality Control Division under the Colorado Discharge Permit System (CDPS). These sources are: Municipal Dischargers; Industrial Dischargers; and Construction Activities.

4.1.1 Municipal Dischargers

Municipal wastewater dischargers include both public and private dischargers which treat domestic and commercial wastewater. The general pollutants of concern from these facilities are: toxins such as metals and ammonia which are harmful to aquatic life; suspended material, mostly organic wastes, which use up oxygen in the water to decompose; nutrients, such as nitrogen and phosphorus compounds, which cause algae growth; and pathogens (organisms which cause disease). The Water Quality Control Division has authority to permit facilities which discharge over 2,000 gallons per day. Most individual septic systems discharge less than this amount and are permitted under County regulations that are required by the State to meet certain minimum state-wide standards. Specific municipal dischargers are discussed in Chapter 3 of each of the watershed plans under Point Source Water Quality Issues and in Appendix 3. Domestic wastewater facility discharge permits are written by the state with EPA oversight.

The state defines major municipal wastewater treatment plants as those discharging greater than 1 million gallons per day (MGD). In the area covered by this plan there are 14 major municipal wastewater treatment plants: five in the Blue; three in the Upper Colorado; three in the Eagle; and three in the Roaring Fork.

4.1.2 Industrial Dischargers

There are a limited number of major industrial dischargers in Region XII. They all hold valid discharge permits and they are all operated under the terms of their permits. For the most part, industrial dischargers within our region are mining operations. Discharges from these facilities are also permitted by the Water Quality Control Division. Potential pollutants from industrial facilities in our region generally include: sediment, which is a source of nutrients and also can "smother " the bottom of streams; heavy metals, and hazardous materials spills and leaks. Specific "major" industrial dischargers are discussed in the appropriate watershed plan under Point Source Issues - Industrial Activities. Industrial dischargers in the region are listed in Appendix 8.

Industrial discharges are permitted by effluent and industry type. There are three major industrial permits within Region XII: the Eagle Mine; and Phelps-Dodge which operates the Henderson and Climax facilities. Industrial discharge permits are written by the state

with EPA oversight.

There are a number of specific point sources within the region which do not have permits. These are inactive or abandoned mines which have a discharge from the mine. These sites have been identified by the Department of Minerals and Geology, and some are known to impact the classified uses of specific stream segments. The significant sites are discussed in the appropriate watershed plans.

4.1.3 Construction Activities

Construction activities which disturb more than one acre of land are considered to be an industrial activity under the Clean Water Act and require a stormwater discharge permit. As the activity is required to be permitted, it is considered a point source discharge, although the requirements of the permit are generally "Best Management Practices" directed towards controlling nonpoint source pollutants and hazardous materials spill prevention. The Water Quality Control Division issues these permits. The potential pollutants of concern are similar to the other industrial pollutants - sediment, and hazardous material spills. These permits are listed in Appendix 8.

Point sources from construction dewatering activities are also controlled through the Water Quality Control Division's permitting process.

Most local governments in the region have regulations to provide additional water quality protection during construction activities. Most of the regulations focus on erosion and sediment control requirements, although many also include stream and wetland setbacks, and other measures which reduce water quality impacts from construction sites. Each watershed water quality management plan in Chapters 4 and 5 contains watershed specific information on this subject.

4.2 Nonpoint Source Impacts

Nonpoint sources of pollution can be defined as those sources resulting from diffuse sheet flow of stormwater or snowmelt runoff or reduced stream flows. Nonpoint sources include: runoff from mine tailing piles, roads, residential, and commercial land uses; irrigation return water, and clear-cut areas; failing or inadequate septic systems; and hydrologic modifications. Hydrologic modifications are changes in water quality resultant from reservoirs, releases from reservoirs, or water diversions. The impacts of this type of nonpoint source pollution has been previously discussed (Volume I, Policy 2, and earlier in this volume). The State has a Nonpoint Source Management Program which was approved by the EPA in May of 1989 which is designed to address the problems identified in the State's "Nonpoint Assessment Report" (November 1989).

4.2.1 Land Use and Disturbance

Development of land for residential, commercial, agricultural, and industrial use can have significant water quality impacts, especially when viewed cumulatively. Some of the nonpoint source issues related to land development include stormwater runoff,

impacts of septic systems, habitat disturbance and loss, and recreational impacts. There are numerous pollutants which come from general land use activities. Runoff pollutants include: sediment; nutrients; heavy metals such as zinc, lead, copper, cadmium and nickel; salt; PCBs; pesticides; petroleum products; and asbestos.

4.2.2 Inactive Mines

The impacts of mining have been previously discussed in the point source section, however, nonpoint source water quality impacts have also been identified in our region. These impacts are a result of runoff which comes in contact with mine tailing, waste rock, and roaster fines piles. These "left overs" of mining activities contain heavy metals, and sulfide products which form sulfuric acid when exposed to water. Heavy metals are toxic to aquatic life at low concentrations and also act as "stressors" at sub-lethal concentrations. Acidity can also cause aquatic life mortality and act as a stressor to aquatic life.

A number of inactive mine sites have been identified in the watershed plans as impacting water quality in the region. The stream segments are:

Blue River Watershed
- Peru Creek
- French Creek
- Upper Blue River (Segment 2)
- Upper Snake River
- Upper Ten Mile

Eagle River Watershed
- Cross Creek
- Upper Eagle River (Segment 5)
- Eagle River (Segment 5)

Roaring Fork Watershed
- Thompson Creek
- Coal Creek

Policy 1, Water Quality, recommends actions to reclaim these sites and minimize the associated water quality impacts.

4.2.3 Development

Land development practices can impact water quality through increased pollutant loads, increased runoff (both in quantity and velocity), and wetland and riparian habitat losses, as described below. A nonpoint source water quality management plan produced by the Northwest Colorado Council of Governments for the Town of Vail in 1995 indicated that the runoff water pollutants of most concern include: sediment, dissolved solids (salt); petroleum compounds, nutrients, and heavy metals.

Population estimates in the NWCCOG region only partially show the extent of

development and growth in the region. Two additional variables also need to be considered regarding development and growth (and infrastructure needs) in the region. One variable is the "transient" visitor to the region who relies on infrastructure (e.g. hotels, motels, etc.) which are not part of the population estimate. The other variable is the second homeowner, who maintains a secondary residence in the region, but does not add to the population estimate.

These two variables are extremely important considerations in growth and development in the region, and again, are not reflected in the population estimates and population growth projections in the watershed plans. For example, in 2001, second homes are estimated to represent 85% of the housing stock in Winter Park, 73% in Vail, 70% in Grand Lake, and 60% in Summit County.

4.2.3.1 Stormwater

Stormwater runoff concerns are not only limited to pollutants (such as nutrients, sediments, metals, and organic contaminants), but also to timing and quantity of water. Increases in impervious surfaces such as roads, houses, etc. increase the amount of runoff and increase the rate at which the runoff occurs. This can lead to increased flooding which impacts water quality by increasing erosion and therefore sediment and nutrient inputs.

4.2.3.2 Onsite Wastewater Systems

Another land use concern is an increase in density and design of onsite wastewater systems (septic systems) - especially those constructed on marginal sites (poor soils, fractured bedrock, and high groundwater tables) which can lead to high inputs of nutrients (phosphorus and nitrate), and potentially harm human health through transmission of water-borne pathogens.

In November 1998 the Denver Regional Council of Governments published "Individual Sewage Disposal Systems: Colorado Issues Review and Task Force Recommendations", which was prepared for the Individual Sewage Disposal Systems Task Force. Representation on the Task Force included representatives from 20 County Health Departments (including Eagle, Grand, Jackson, Pitkin, and Summit counties), and the Northwest Colorado Council of Governments. This report states "Onsite wastewater treatment is a proven treatment and disposal option. Properly designed and constructed onsite systems are cost-effective, efficient and nonpolluting." However, the report also states "Septic system 'failures' have been documented in Colorado by a variety of local governments and other agencies. Numerous studies and water testing programs in Colorado have documented groundwater contamination attributed to on-site systems". Constituents of concern include pathogenic bacteria and virus contamination of groundwater, the movement of nitrate into groundwater, the movement of phosphorus through valley alluvium or thin mountain soils, and varieties of household chemicals and hazardous waste disposal. The Report provides Task Force Recommendations. This 208 Plan supports the Task Force's Recommendations, especially those related to licensing, registration, and permits.

In 2000 the Colorado Department of Public Health and Environment established a

Individual Sewage Disposal System Steering Committee. The committee has produced a "Summary Characterization of Onsite Wastewater System Impacts". The summary states, "[t]he potential risk posed by onsite wastewater systems varies greatly depending on an number of factors. Onsite wastewater systems pose relatively greater water quality risks when: a) They are present in high numbers and high density; b) They are present in areas served by private drinking water wells that are shallow or poorly constructed; c) They are improperly sited, particularly in sensitive environments; d) They were installed prior to 1973 when uniform design and siting standards were first established; and/or; e) When they were not properly designed, installed, operated and/or maintained."

The Committee has developed recommendations, currently in a Public Review Draft dated November 26, 2001 which is included in Appendix 11 of this Plan. NWCCOG is generally supportive of the recommendations in the Report, which include the development of a performance-based management system, additional State funding to support local government oversight of septic systems, development of performance criteria, ability of local governments to develop renewable permits, and development of a strategy to manage septage.

The Committee is continuing to meet with the intent of providing the Water Quality Control Commission and Board of Health with additional recommendations regarding permitting of onsite wastewater systems.

4.2.3.3 Wetland and Riparian Area Losses

Habitat disturbance and loss is another significant issue associated with land development which has secondary impacts to water quality. The habitats referred to are: wetlands, riparian areas, floodplains, and shorelines which provide natural filtering of pollutants, flood water buffering, and provide shading which reduces water temperature and algae growth.

Scientific evidence shows that these areas are environmentally sensitive and that disturbance of these areas can negatively impact water quality. "Chase et al. (1995) after reviewing available literature, determined that 100 ft was the most reasonable width if a standard fixed-width riparian buffer was to be chosen to protect New Hampshire's streams and river for all functions and values." This paper also states " it is important to note that effective buffer widths will change from region to region and as a function of buffer conditions, management objectives, and in-stream characteristics". " Smaller headwater streams are typically more vulnerable to water quality and quantity impacts as they are less able to dilute or buffer impacts such as sedimentation, solar heating, nutrient loading, or base flow alterations (e.g. water withdrawal)." These authors, working under the direction of the State of Maine Planning Office, advocate for a two-zone, variable outer buffer width, as they can be designed to take into account site-specific conditions and desired buffer functions. [Journal of the American Water Resources Association, vol. 6, number 36, December 2000, Method to Identify Effective Riparian buffer widths for Atlantic Salmon habitat protection, A.E. Haberstock et.al.]

A final report by SAIC prepared for Summit County Community Development Division, entitled "Summit County Wetland Functional Assessment" (April 7, 2000), provided

management recommendations for wetlands protection, including wetland buffers. "Based on the information presented in this report and review of other studies and similar setback regulations, we believe that a minimum 100-foot buffer should be instituted for all Summit County wetlands that meet one or more of the following criteria: 1. Over one acre in size individually or cumulatively; 2. Habitat for State or federally listed threatened or endangered species; 3. Habitat for focal listed species with established setback/impact zones; 4. Part of a beaver complex, 5. Adjacent to a water body (e.g. stream, river, pond, lake, reservoir).

The Northwest Colorado Council to Governments endorses the use of a variable outer-buffer beyond a 25-foot minimum inner buffer adjacent to waterbodies. In numerous studies [Wetland Buffers: An Annotated Bibliography, State of Washington Shorelines and Coastal Zone Management Program, Washington State Department of Ecology, 1992, Stream Stewardship, Department of Fisheries and Oceans, Province of British Columbia, Canada, 1986, and others], it has shown that 25 feet is the minimum setback necessary to achieve any water quality protection. NWCCOG's recommendation of an outer buffer, of up to 100 additional feet, should take into consideration wetland or riparian functions and values, proposed land use and mitigation activities.

4.2.4 Agriculture & Silviculture

Agriculture and silviculture (logging) activities can cause increased sediment, nutrients, and dissolved solids from associated land disturbance and fertilizer applications. In addition, crop and forage production is responsible for large water withdrawals for irrigation, and riparian and wetland disturbance and loss which has secondary impacts on water quality.

Policy 3, Land Use and Disturbance, deals with the impact of land use and development throughout the region. The policy recommendations are being implemented at the local government level and at the federal level for those land use agencies which have the appropriate authority. With respect to agricultural and silvicultural impacts, the policy recommendations are voluntary implementation of Best Management Practices.

It should be noted that agricultural Best Management Practices, especially those related to livestock grazing, ranch management practices, and logging are being widely implemented throughout Region XII. The ranchers, the Natural Resources Conservation Service, the Bureau of Land Management, and the US Forest Service are actively involved in implementing the recommendations outline in Appendix 11.

4.2.5 Recreation Impacts

Another set of issues related to land development is recreation impacts to waterbodies, such as stream bank erosion and lack of proper sanitation facilities. Increased population density generally results in greater demand for recreational opportunities, which are often centered around water, especially in mountain communities. Water quality impacts associated with recreation are usually related to habitat disturbance, which as previously stated, has secondary impacts. Water diversion for recreational uses, such as irrigation of golf courses and snow making also impact water quality, as a result of runoff and consumptive water use at critical times.

In the June 2001 Journal of the American Water Resources Association, King et al. demonstrated increased nitrate/nitrite and orthophosphate loading from a municipal golf course managed at a “moderately intensive” level. The study indicated “the potential for nutrients applied to golf courses to exit the course in stream flow, which may contribute to water quality degradation (such as algal blooms and low dissolved oxygen) . . ..” The results also support the need for turf system managers to carefully manage nutrient inputs.

Policy 3, Land Use and Disturbance, deals with the impact of land use and development throughout the region. The policy recommendations are being implemented at the local government level and at the federal level for those land use agencies which have the appropriate authority.

Policy 4, Domestic, Municipal, and Industrial Wastes, includes recommendations regarding siting of facilities to reduce nonpoint source impacts.

Policy 5, Chemical Management, includes recommendations for storage, handling, transportation, disposal, and application of materials, in such ways to minimize nonpoint source water quality impacts.

4.2.6 Water Use and Development

The State's Nonpoint Source Management Program includes a "Hydrologic Modification Nonpoint Source Management Program" which is intended to identify and develop programs for minimizing adverse nonpoint source water quality impacts associated with hydrologic modifications. Hydrologic modifications are defined in the program as: reservoirs; releases from reservoirs; diversions; and other spatial and temporal changes of the movement and circulation of flow of water.

The USGS did a study titled "Estimated Water Use in Colorado, 1985" [Water Resources Investigations Report 88-4101, 1989] documenting water use by county. According to that report irrigation, followed by hydropower generation, domestic, livestock watering, commercial, and thermal power generation, are the principal uses of water in Region XII.

Water use and development can result in water quality impacts caused by reductions in stream flows. This document identifies water quality impacts from water diversions for out of basin needs and in basin needs separately. Generally, water used for domestic or agricultural purposes is not fully consumed; some portion of the diverted water remains as "wastewater" or "return flow" which is directed back to a stream. For domestic use, the consumptive use is generally 10% of the diverted volume. For snow making, the consumptive use is generally considered to be about 20% of the diverted volume and water is usually applied at 1 acre-foot per acre of terrain [Colorado Ski Country USA]. Agricultural return flows are quite variable, but can range from 15 to 60% in consumptive use. For water that is taken out of the watershed, there is no return flow to the basin, while water which is used in-basin is returned to the stream at some point, generally not too far downstream. Thus in-basin use is not 100% consumptive, while trans-basin usage is 100% with respect to the basin of origin.

The principal consumptive uses in the region are: agricultural (irrigation and stock watering; trans-basin diversions; domestic and municipal; snow making; and reservoir evaporation.

4.2.6.1 Hydrologic Modifications

The term hydrologic modification refers to changes in hydrologic conditions (changes in stream channels, stream flows or the timing of those flows) due to man's actions on the natural environment. Changes to the natural hydrology of a watershed occur from the construction of reservoirs, diversions, and infiltration galleries. Water quality impacts can include nutrient concentrations increases, dissolved oxygen decreases, temperature increases, changes in chemistry and turbidity, and detrimental deposition of sediment.

The Colorado Nonpoint Source Council's Hydrologic Modifications Subcommittee defines hydrologic modifications as "reservoirs, releases from reservoirs, diversions, and other spatial and temporal changes in the movement and/or the circulation of water." [Colorado's Nonpoint Source Management Program, January 2000, Colorado Water Quality Control Division].

A project that is being lead by the Northwest Colorado Council of Governments' Quality Quantity Committee called the "Upper Colorado River Project" was initiated in 1998 and seeks to quantify both the in-basin and trans-basin water quantity needs, expected to arise in the next twenty-five years. Considerations include: municipal demands, minimum and optimum flows for fish; reservoir levels; kayaking and rafting flows; wastewater treatment facility discharge permit 1E3 and 30E30 flows; existing and conditional water rights; and population projections. This study is intended to assist in identifying future water quality and quantity concerns, and potential opportunities for minimizing impacts of future water development activities in the Blue and Upper Colorado River (to the confluence with the Blue River) watersheds.

Hydrologic modifications have also resulted from in-stream mining impacts. For example, the Blue River between the Swan River confluence and Breckenridge was mined using mechanical dredge boats. As a result of the dredge mining, a natural stream channel no longer exists. In portions of this stream segment, water is absent from the surface during late summer, fall and winter, and flows through the sorted dredge spoils as subsurface flow. The negative impacts from this type of hydrologic modification which includes loss of instream flow, loss of instream and riparian habitat, bank stability, and loss of a functioning aquatic ecosystem. While these impacts are not directly related to water quality, they should be addressed through future permits for mining, and the development of projects to restore the effects of historical practices.

4.2.6.1.1 Trans-basin Diversions

Region XII is impacted by trans-basin diversions, which as previously noted, are 100% consumptive for the basin from which the water is taken. Water quality impacts arise from the loss of high quality water from the basin and changes in the stream's hydro-morphology which reduces natural scouring and affects habitat.

It should be noted that, generally speaking, during the two critical low flow periods (late

summer and early winter) trans-basin diversions are not in priority.

The 2000 Annual Report for Division 5 Water Resources lists the ten-year average acre-feet of water diverted out of the NWCCOG portion of Division 5 (which includes Grand, Summit, Eagle, and Pitkin counties) as 479,194 acre-feet. For water year 2000, the trans-basin diversions amounted to 553,713 acre-feet. The USGS Water Resource Data Report for the Colorado River mainstem gage below Glenwood Springs lists the annual runoff for 2000 as 2,110,000 acre-feet. The trans-basin diversions in 2000 amounted to approximately 20% of the total stream flows in the Upper Colorado River watershed.

4.2.6.1.2 In-Basin Diversions

Water usage in the basin includes irrigation, hydropower, domestic, commercial, and industrial uses. Generally speaking, in-basin diversions consume 10-50% of the water diverted or used.

According to State Engineer's Office of Water Resources, Division 5 2000 Annual Report, irrigation diversions represent about 90% of in-basin water diversions in the Upper Colorado River basin including the Roaring Fork watershed. Table 5 below is based on the above referenced report, removing the uses in Water Districts 39, 45, 70, and 72 which are below the confluence of the Roaring Fork.

Table 5. Estimated In-basin Water Diversions, 2000 – Division 5 Water Resources

Use	Water Year 2000 Water diversions acre-feet
Irrigation	778,668
Municipal Public Supply	33,148
Fishery	18,572
Augmentation	12,670
Livestock	6,422
Domestic and Household	3,943
Industrial and Mining	3,235
Snowmaking	1,530
Commercial	1,096
TOTAL	859,284

4.2.6.2.1 In-Basin Changes in Water Usage

Historically (and currently), the most significant water use in the region has been for irrigation purposes. The 1988 USGS report "Estimated Use of Water in Colorado, 1985" [USGS, 1989] estimated that 952.82 million gallons per day (MGD), or 2,924 acre-feet per day were used in our region for irrigation. The next highest usage was hydropower generation at 497.72 MGD. Domestic and commercial usage was estimated to be 11.6 and 4.68 MGD, respectively. As the region becomes more developed, changes in land uses will result in changes in water usage in the basin.

4.2.6.2.2 Municipal and Domestic Usage

As illustrated in the previous table, municipal and domestic diversions of water are less than one-twentieth of the irrigation diversion in the basin. Additionally, Municipal water consumption is much less than that of agriculture, in other words, less of the water diverted is actually "used up" during its use and thus a larger percentage of the water diverted is returned to the stream.

According the Colorado Department of Public Health and Environment's Water Quality Control Division public water supply records, the NWCCOG region includes 90 community systems, 86 transient non-community systems, and 10 private systems (186 systems total). 151 of those systems are reliant upon ground water (including 8 under the influence of surface water), and 35 systems are reliant upon surface water sources. The population (resident, non-transient and transient population) served by these systems is estimated to be 265,690 people. The total number of taps for these systems is 56,865. Additional information on domestic usage is available in the watershed management plans and Appendix 4.

4.2.6.2.2 Industrial Usage

Industrial use of water means the use of water for purposes of producing or processing non-agricultural products or services for sale, such as manufacturing, mining, milling, land reclamation, golf course irrigation, snowmaking, and non-hydroelectric power generation. The water quality concerns associated with snowmaking are generally the removal of water from streams during critical low flow periods. Snowmaking studies have indicated that the spring peak runoff is extended in time as a result of snowmaking activities, but that runoff rates are not increased.

Although golf courses are much more efficient at using water than traditional agriculture, one of the concerns is that historical irrigation allowed groundwater recharge which provided late season groundwater returns to surface waters. With the more efficient application of water to golf courses, late season return flows to surface waters from groundwater are diminished.

In Region XII, most of the stream flow results from snowmelt, which is greatest during May, June, and July. There are two critical periods of low stream flows - late summer, and early to mid winter. The late summer period coincides with significant agricultural usage and higher stream temperatures, which can stress cold-water fish. The winter period - especially December can coincide with snow making water demands.

4.2.6.3 Hydrologic Modifications Summary

Policy 2, Water Use and Development, recommends actions to reduce the water quality impacts associated with water use and development.

Critical areas with respect to stream flows and water use and development in the region have been identified in the watershed plans. These areas include:

Blue River Watershed

Entire watershed

Colorado River Watershed
Fraser River

Eagle River Watershed
Upper Eagle River (above Gore Creek)
Gore Creek
Lower Eagle River (Gore Creek to the Colorado River confluence)

Roaring Fork River Watershed
Upper Roaring Fork (above the Crystal River)

4.2.3 Roadways and Pavement

Highways and roads contribute sediment, salts, heavy metals, and petroleum pollutants to the waters in the region. The Colorado Department of Transportation and local municipalities and counties have responsibility for managing the roads in our region. On-going activities related to this issue have focused on erosion and sediment control practices, both for new projects as well as on-going maintenance.

A study by Dr. William Lewis titled "Magnesium Chloride: A Literature Review With Emphasis on the State of Colorado" prepared in November 1997 concluded "The magnesium and chloride ions, which are in terms of mass, the main ingredients in magnesium chloride deicer, are unlikely to produce environmental effects except under unusual circumstances… Rust inhibitors are environmentally unknown for the most part. The most likely effects include metal toxicity associated with metallic inhibitors and eutrophication associated with the addition of phosphate inhibitors… Contaminants are possibly of much greater environmental interest than the main ingredients of magnesium chloride deicer."

A five-year assessment, released in August 2000 by the Canadian Government Agency Environment Canada found that the five million tons of road salts applied across the Country every winter contaminate ground water, surface water, poison wildlife and harm vegetation. Road salts included sodium chloride, calcium chloride, potassium chloride, magnesium chloride, and ferrocyanide salts. The principle salt used in Canada is sodium chloride.

A study of the impacts of use of magnesium chloride as a road de-icing compound has been initiated by the Colorado Association of Ski Towns, Colorado Department of Transportation, and the USGS. The study, to assess the possible water quality and human health impacts of the use magnesium chloride and determine whether better alternatives may exist, should be completed in the spring of 2002. The report will provide a review and analysis of other relevant studies and data, and detailed descriptions of magnesium chloride and alternative de-icing compounds, including known impacts on human health, aquatic flora and fauna, and terrestrial vegetation. A secondary un-intended effect of the increased use of magnesium chloride as a roadway de-icer is the potential increase in water consumption related to increased vehicle washing to remove the accumulated material.

Additional information regarding the potential negative and positive impacts of the use of magnesium chloride for road surface stabilization should be developed.

4.3 Colorado River Basin Salinity

Total dissolved solids (TDS) or salinity is of increased concern in arid and semi-arid areas when water is consumptively used. Application of irrigation water to saline soils leaches increased concentrations of TDS back to streams. Transpiration by plants and evaporation from open water further concentrates the salts.

TDS concentrations range from less than 50 mg/L in the headwaters of the Region XII watersheds, to 100,000 mg/L in saline springs in the Colorado River basins. Water with a TDS of less than 500 mg/L is preferable for water supplies. Agricultural crops exhibit a wide tolerance to TDS, with more sensitive species such as fruit trees, potentially affected at concentrations greater than 500 mg/L [USGS Open File Report 85-479, 1987]. Average concentrations for streams upstream of Glenwood Springs are all less than 500 mg/L. Downstream from Glenwood Springs, all USGS stations on the Colorado River mainstem have average TDS concentrations between 500 and 1,000 mg/L [USGS, 1987].

The Colorado River Basin Salinity Control Program is designed to reduce salt loadings to the Colorado River Basin in order to maintain standards established in 1972. Both the US Department of Agriculture and Department of the Interior are involved in programs designed to control nonpoint sources of salt loading. The Natural Resources Conservation Service, the Bureau of Land Management, and the Bureau of Reclamation are all actively involved in salinity reduction measures from a variety of sources. Farm reduction measures are handled by the Natural Resources Conservation Service. State participation in the salinity control program is coordinated through the water quality management planning process for nonpoint sources and the CDPS permit program for point sources. The Colorado River Basin Salinity Control Forum provides a forum for the states of the basin to coordinate their activities, and provide guidance to the federal agencies.

The program does not address potential salinity concerns of the Grand Valley water users - especially those of fruit growers, whose crops are less salt tolerant than other agricultural producers. A USGS report [Open File Report 87-568] states "the reach of the Colorado River between the towns of Dotsero and Glenwood Springs, Colo., represents the largest single source of dissolved solids in the Upper Colorado River basin . . . which represents 17 percent of the dissolved-sodium and 38 percent of the dissolved-chloride loads leaving the Upper Colorado River Basin... Most of this dissolved -solids load is contributed by very saline, thermal springs between the towns Dotsero and Glenwood Springs." Another USGS report [Open File Report 84-4198] shows that the dissolved solids concentrations in the mainstem of the Colorado River jumps from 230 mg/L to 370 mg/L at the confluence of the Eagle River. This information suggests two geographical areas, one of which (the Eagle River) is within Region XII, which could be investigated for reducing salinity impacts to downstream water users.

It is important to note that a USGS study [Characteristics and Trends of Streamflow and Dissolved Solids in the Upper Colorado River Basin, Arizona, Colorado, New Mexico, Utah, and Wyoming, open File Report 87-568] found that municipal wastewater

treatment plant discharges to the Colorado River and its tributaries contribute less than 5% of the total salinity at the Imperial Dam. A "significant" annual decrease in annual stream flow on the Colorado River near Glenwood Springs from 1942-49 to 1950-83 occurred concurrent with an increase in dissolved solids concentrations. These stream flow decreases and dissolved solids increases were "significant" and "highly significant" simultaneously during the months of May, June and July, which suggests that loss of stream flow is responsible for increases in dissolved solids concentrations (see Appendix 5 for USGS excerpts).

A recent USGS report [D. Butler, USGS, Trend Analysis of Selected Water-Quality Data Associated with Salinity-Control Projects in the Grand Valley, in the Lower Gunnison River Basin, and at Meeker Dome, Western Colorado, Water Resources Investigation Report 95-4274, 1996] found that monthly flow-adjusted salinity loads at the USGS Colorado River station near Cameo have had "highly significant" decreases for three time periods of investigation: 1970-1993; 1980-1993; and 1986-1993. The report attributes the significant decreases in salinity loads to "natural or man-induced effects in the Upper Colorado River Basin . . .."

Policy 2, Water Use and Development, recommends actions which reduce existing salt loads from areas which contribute significant salinity to the basin. NWCCOG encourages local governments and land use agencies to minimize increases in salinity of the Colorado River through the use of best management practices for nonpoint sources as recommended in Policy 2, 3 and 5.

4.4 Ground Water Issues

In our region, ground water has not received the attention that surface waters receive, although there are 151 (including 8 under the influence of surface water) community ground water supply systems serving 125,624 people [Water Quality Control Division, Colorado Open Records Act Information Request, Public Drinking Water Systems in NWCCOG's area, December 10, 2001].

Data is collected by water providers relying on groundwater as part of the Safe Drinking Water Act; however, there are no known documents that summarize the collected data.

Additional information on both the quality and the quantity of ground water within Region XII is needed for proper planning.

Groundwater contamination from leaking underground storage tanks has occurred and been documented (e.g. Town of Frisco's abandonment of city well). Nonpoint source pollutants have also been detected in shallow alluvial aquifers in urban settings [USGS, Water Quality in alluvial Aquifers of the Southern Rocky Mountains Physiographic Province, Upper Colorado River Basin, Colorado 1997, WRIR 99-4222]. The summary states "Overall, the water quality in the Southern Rocky Mountains physiographic province is suitable for most uses, but natural and human factors affect the water quality."

Summit County Environmental Health Department's well sampling program has also documented elevated nitrate and bacterial levels in drinking water wells in small areas of the County [Summit County Environment Health, 2001].

All of the Policies in Volume I are applicable to groundwater issues.

4.5 Regional Nonpoint Source Project Needs and Prioritization

As identified in Chapter 2 of this Volume, the two most significant water quality priorities in the region are:

- Nonpoint Source Pollutants From Development Areas
  - Areas of focus should include:
    - Urbanized areas in the Fraser River, Blue River, Gore and Eagle River, and Roaring Fork River
  - Pollutants of interest include:
    - Nutrients
    - Sediment

A subset of this area of focus is related to groundwater impacts in development areas and includes impacts from septic systems and urban activities.

- Acid Rock Drainage
  - Areas of focus should include:
    - Snake River Watershed
    - French Gulch
    - Eagle River in the Belden area

NWCCOG recommends that projects addressing these two issues receive the highest priority for grant funding and direction of personnel activity.

It should be noted that although Roadways and Pavement have been broken out separately, it is a subset of Nonpoint Source Pollutants from Development Areas, and should also receive high priority for activities and funding – especially in the following areas:

- Fraser River
- Straight Creek
- Black Gore Creek

4.6 Related Programs and Issues

4.6.1 Weeds

Non-native invasive plant species can negatively impact water quality and displace native plant species that provide habitat, stream shading, stream bank stabilization and organic material that serves as the basis of the food chain in aquatic systems. Salt cedar (also known as tamarix or tamarisk) and Russian Olive are two plant species presently replacing the native cottonwood/willow riparian habitats in the lower elevations of our region.

Certain terrestrial noxious weeds also negatively impact water quality through increased soil erosion (this was shown in a Montana study which demonstrated increased soil loss in an infestation of spotted knapweed over a native bunchgrass community).

NWCCOG supports efforts to control non-native invasive plant species through early detection/monitoring and removal.

4.6.2 Endangered Species

A number of aquatic and terrestrial plants and animals dependent on the aquatic environment are species that are federally listed as Endangered, Threatened, or Candidate species under the Federal Endangered Species Act. Additionally, the Federal Land Management Agencies (US Forest Service and Bureau of Land Management) and State Division of Wildlife maintain lists of sensitive species and species of special concern. Species either in our region, or outside of our region but potentially impacted by water resource related activities within our region, include the following:

Fish

- Bonytail chub (Federal and State endangered species);
- Razorback sucker (Federal and State endangered species);
- Colorado pikeminnow (Federal endangered species, State threatened species);
- Humpback chub (Federal endangered species, State threatened species);
- Colorado river cutthroat trout (State sensitive species and species of special concern);
- Bluehead sucker (State species of special concern);
- Flannelmouth sucker (State species of special concern);
- Colorado roundtail chub (State species of special concern);
- Mountain sucker State species of special concern);

Amphibians

- Boreal toad (Federal candidate species and State endangered species);
- Northern leopard frog (State species of special concern);
- Great Basin spadefoot (State species of special concern);

Birds

- Bald Eagle (Federal and State threatened species);
- Greater sandhill crane (State species of special concern);

Mammals

- River otter (State endangered species);

Plants

- Penland alpine fen mustard (Federal threatened species).

The Northwest Colorado Council of Governments supports appropriate stewardship efforts to restore these species to a condition which would reduce their populations' fragile status.

4.6.3 Source Water Assessment and Protection Plan

Under the Federal Safe Drinking Water Act, the State is required to complete a Source Water Assessment and Protection Program. The Plan includes the delineation of source

water areas for all public water systems, a contaminant inventory, and a susceptibility analysis. The Assessment Phase is required to be completed by 2003. The State has determined that regional planning agencies do not have a role in this program. All water providers are encouraged to thoroughly review all draft information produced by the State to ensure the information is correct, adequate, and appropriate.

4.6.4 Wildfire Control Efforts

Wildfires have been shown to cause significant negative water quality impacts. These impacts include increases in sediment mobilization, and subsequent impacts to riparian and in-stream habitat, and increases in nutrient concentrations. The NWCCOG supports appropriate wildfire control and suppression efforts as a mechanism to protect water quality from the negative impacts of sediment deposition and nutrient eutrophication.

5.0 MANAGEMENT SYSTEMS

The following is a brief discussion of the existing water quality management framework under which our region operates. For further information, the 1994 Working Paper produced by the Colorado Water Quality Forum titled "Colorado Watershed Protection Approach" provides a more detailed explanation of the federal and state programs which are related to water quality protection and restoration.

5.1 Clean Water Act

The federal Clean Water Act (33 U.S.C. 1251, et. seq.) forms the federal environment under which the state operates. Other related federal environmental legislation includes:

Safe Drinking Water Act
National Environmental Policy Act
Endangered Species Act
Wild and Scenic River Act
Resource Conservation and Recovery Act
Comprehensive Environmental Response, Compensation and Liability Act
Clean Air Act

5.2 Water Quality Control Commission

The state has primacy (i.e. responsibility) for carrying out the state programs developed in the Clean Water Act. Existing state water quality laws and regulations include the following:

Establishment of regional water quality management plans;
Classification of state waters
Establishment of water quality standards designations and regulations
water permits.

The state permits domestic wastewater discharges based on stream segment water quality standards and stream flow to establish discharge pollutant concentrations that

will protect the designated uses. Specific information on the domestic wastewater treatment. plants in our region is found in each of the watershed plans and also in Appendix 3 and 8. There are approximately 14 domestic wastewater treatment plants in the region that treat wastewater beyond the secondary level (85% removal of Biochemical Oxygen Demand).

The Water Quality Control Division is developing a Source Water Assessment and Protection Program to meet and satisfy the federal requirement of the Safe Drinking Water Act. This program is aimed at protecting public water supplies from contaminants. The State's Implementation Plan was approved by EPA in February, 2000.

5.3 Point Sources

5.3.1 Industrial Dischargers

There are three major industrial dischargers in Region XII. Major industrial discharge permits are issued by the Water Quality Control Division under EPA oversight. The three are all mines: the Eagle Mine above Minturn in Eagle County; Climax Molybdenum Company which operates the Climax Mine in Summit County and Henderson milling facility in Grand County. They all hold valid discharge permits and are operated under the terms of their permits. Besides the major industrial dischargers there are numerous other industrial permit holders in the region. These include: sand and gravel operation permits; mining permits; construction dewatering permits; and stormwater discharge permits. Industrial permits within our region are listed in Appendix 8.

5.3.2 Wasteload Allocations

"Wasteload allocation" means the portion of a receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. Wasteload allocations are a means to ensure that pollutants of concern from various sources do not exceed the applicable water quality standard. Allocations are developed in those areas where a number of permitted sources are discharging to the same stream segment and the possibility exists for the stream to exceed the water quality standard for that pollutant. In this region, the pollutant which as been allocated to the greatest degree is ammonia. The wasteload allocations are developed to ensure that all permitted discharges are treated fairly with respect to setting standards for their discharges.

5.4 Nonpoint Sources

The State's approach to control of nonpoint sources is documented in "Colorado Nonpoint Source Management Program, which was adopted by the State in January 2000. It describes federal control programs (such as the Agricultural Conservation Program, Conservation Reserve Program, Watershed Protection and Flood Prevention Act, and Resource Conservation and Development), state programs (such as the State Revolving Loan Fund, the Water Quality Control Commission, and the Nonpoint Source Taskforce), and local programs (such as state enabling legislation, e.g. CRS 24-65.1-101 - HB1041 - protection of local resources; and CRS 29-20-101 - HB1034 - land use controls).

Local governments in the region are sensitive to impacts of growth and development on water resources. Local governments have been involved in numerous activities to protect water quality from nonpoint sources. Both land use regulations and projects are listed in each of the individual watershed water quality management plans in Chapters 4 and 5.

5.5 Colorado River Basin Salinity Control Forum

The Colorado River Basin Salinity Control Forum is composed of members from the seven states in the Colorado River Basin (Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming). The Forum was established for the purpose of interstate cooperation and to provide states with the information necessary to comply with EPA regulation 40CFR, Part 120, entitled "Water Quality Standards, Colorado River System, Salinity Control Policy and Standards Procedures", and Section 303(a) and (b) of the Clean Water Act. More information on this Forum can be obtained through the Colorado Water Conservation Board, or the Colorado Water Quality Control Division. In 2002 the Forum is revising the “Water quality Standards for Salinity”. The Forum’s web site address is http://www.uc.usbr.gov/progact/salinity/index.html.

5.6 Colorado River Headwaters Forum

The Colorado River Headwaters Forum was initiated by the Northwest Colorado Council of Governments Quality/Quantity Committee in November, 1991 to facilitate the informal, non-adversarial discussion of water issues associated with the Colorado River headwaters. The Forum, open to "interested stakeholders", meets three times a year. Important outcomes of the Forum included the development of proposed methods for developing water projects allowing for public comment prior to formal submission of a 1041 permit application and revision of the 208 Plan.

5.7 Regional Management Agencies

Policy 6, Management Systems, defines the recommended regional management agency structure, with regard to both point and nonpoint source controls.

6.0 ENVIRONMENTAL, SOCIAL, AND ECONOMIC IMPACTS OF THIS PLAN

Continued implementation of the recommended Plan will necessarily have environmental impacts as well as social and economic costs and benefits. In assessing the impacts of the Plan, the majority of its policy recommendations (the implementation recommendations) have been in effect in their substantially present form at a local level since 1979 with the Plan's initial adoption. For point sources, wasteload allocations and treatment system recommendations have existed in substantially their present form since the adoption of the 303(e) basin plans in 1974.

There has been an extensive period of time during which the Plan's recommendations

have acted as policy guidance for water quality decisions within the region. As a result of these decisions, many of the recommendations of the Plan have been implemented.

This includes implementation of the point source discharge treatment levels (except the Fraser River wasteload allocation plan) and consolidation of municipal facilities through the recommended management agencies. It also includes implementation of nonpoint source controls for new sources of urban storm runoff, construction activities, silvicultural activities, stream encroachment, and water use and development activities.

Implementation items recommended by the Plan are the continuation of these point and nonpoint source control measures. Additional implementation recommendations include of controls for abandoned mine drainage, remedial controls for erosion due to past silvicultural activities on National Forest lands as recommended in forest management plans. Additional controls on other existing and potential nonpoint sources could be determined to be necessary by the towns or counties.

The analysis of environmental and social and economic impacts of the Plan was split between those implementation items of the Plan that have been substantially implemented and those that remain to be implemented as described.

6.1 Environmental Impacts

6.1.1 Overview

The Federal Clean Water Act has as its policy the restoration and maintenance of the chemical, physical, and biological integrity of the Nation's waters. The Plan is intended to accomplish these goals throughout the region based on the current understanding of important cause-effect factors leading to either existing or projected water quality problems. As the body of knowledge with regard to these factors continues to grow, adjustments have been made in the Plan to accomplish these broad objectives. Environmental impacts may occur as a result of implementing the Plan either as a result of adoption of the recommended controls on new potential sources of water quality degradation (preventative strategies) or as a result of recommended cleanup actions (remedial strategies).

The overall intent of the Plan is to maintain the existing high quality of the Region's streams and lakes while accommodating growth and development. A second intent is to improve water quality in degraded stream segments that are unable to support the full range of potential uses. Each of the Plan's recommendations is aimed towards one of these objectives. Maintaining and improving the Region's water quality has and will continue to have a positive effect on aquatic life and fisheries, on the provision of adequate quality and quantity of water supplies for domestic, agricultural, commercial, and industrial use, and on the ability to support high quality recreational experiences. The implementation of the Plan will indirectly benefit the wetland and wildlife resources by maintaining such areas; will result in positive impacts on aesthetic resources of the State; and will conserve soil resources. The implementation of the Plan has and will continue to require energy and capital resources necessary to provide wastewater treatment to meet water quality standards.

6.1.2 Previously Implemented Plan Recommendations

Previously implemented Plan items are described in each of the watershed plans. A major remedial element of the Plan is the implementation of point source controls. The establishment of effluent limitations, wasteload allocations, treatment service areas, and recommended areas of wastewater treatment consolidation have had a positive and negative impact upon the environment. Generally, the identified treatment needs have been satisfied through grants from the Environmental Protection Agency (EPA) and the State Construction Grant and loans from the State Revolving Loan fund, along with local financing. Expansion and upgrading of collection and treatment systems were therefore subject to the National Environmental Policy Act (NEPA), and environmental impacts resulting from such impacts were addressed in either an Environmental Impact Statement (EIS) or Environmental Assessment (EA).

A summary of the types of negative environmental impacts associated with meeting previous Plan wastewater treatment requirements include: increased energy consumption where advanced wastewater treatment has been recommended for phosphorus and ammonia removal; land use impacts where additional land area is required to satisfy higher treatment levels; temporary local construction impacts on noise, dust, soil disturbance, and traffic; and impacts caused by the transportation and disposal of waste by-products resulting from higher sludge generation requirements of advanced waste treatment. Positive impacts include: improvement and maintenance of water quality in streams and lakes throughout the region; protection and enhancement of aquatic life and fishery resources; and protection and enhancement of recreational opportunities. Alternative configurations for service areas and treatment methods for wastewater facilities necessary to meet the higher recommended treatment standards and/or recommendations for consolidation were described in the EIS or EA for upgrading the individual treatment plant. These documents provide a thorough discussion of the impacts associated with providing wastewater treatment and consolidation of facilities.

In addition to point source controls, prevention strategies will continue to be implemented in order to meet the objectives of the Clean Water Act. These include: controls on nonpoint sources of water quality degradation from water use and development activities; urban runoff; construction activities, agricultural activities; use of chemicals; and encroachment on wetlands, riparian areas, and waterbodies. Implementing these controls has and will continue to have a positive impact upon:

- wetland and riparian areas;
- protection of aquatic life and fisheries;
- protection of important wildlife habitat areas;
- stream channel stability;
- reduction of the potential damage to private property due to flooding and stream bank loss;
- maintenance and improvement of recreational opportunities;
- reduction of eutrophication of lakes and streams;
- provision of safe domestic water supplies;
- maintenance of water quality at existing high levels.

There are no identified negative environmental impacts associated with the implementation of these preventative water quality strategies.

6.1.3 Future Plan Recommendations

Remaining implementation items recommended by the Plan will be accomplished through the continued use of point and nonpoint source control measures. These measures include the implementation of controls for abandoned mine drainage, remedial controls for erosion, and additional controls on existing septic systems and other existing and future nonpoint sources.

Continued implementation of the point source controls recommended in this Plan will have continuing positive and negative impacts as described previously in this section under Point Source Control Impacts. In addition, newly recommended waste load allocations for ammonia for the Fraser River, and treatment plant expansions as identified in the watershed plans, will have environmental effects upon energy requirements and temporary local construction impacts to provide the necessary future wastewater treatment.

Continued implementation of the preventative control strategies for nonpoint sources of water quality degradation will continue to have the environmental benefits described previously.

Implementation of the recommendations for controls on existing identified mine drainage problems will have positive impacts upon the improvement of water quality and aquatic life. It would also have positive impacts on public water supplies adversely affected by mine drainage. Depending upon the type of treatment technologies selected for control of mine drainage or stormwater runoff, there may be adverse impacts to: energy requirements for treatment of the mine wastes; construction impacts necessary to remove or restore material from tailing, roaster and waste rock piles; and potential impacts to wetlands and wildlife if passive systems utilizing wetland treatment are selected for treatment of mine wastes.

Remedial water quality controls recommended by the US Forest Service for past silvicultural activities have been assessed in three separate EIS documents covering their proposed actions in their land management plans. The closure of roads, revegetation and other measures recommended to reduce sediment loads form previously logged areas will have a positive impact on water quality, vegetation and water yields, and will protection soil resources. Road closures are consistent with recommendations for recreational and other uses of forestlands recommended in forest plans.

6.2 Social and Economic Impacts

6.2.1 Overview

This Plan is intended to serve the population and economic growth projected by local governments within the region. The majority of the projected growth and development is associated with the growth of the tourism industry in the development of winter sports recreation areas and other year round outdoor recreational activities.

The existing demographic character of the region is influenced by rapid seasonal

fluctuations in population and in the demand for public and private services. In most of the Region, the peak seasonal population occurs during the ski season. Local planning efforts have recognized the desirability of utilizing existing facilities, both public and private, over a longer time frame to diversify economic activities and provide a more stable base for residents of the region. The emphasis for diversification has included the maintenance of traditional industries in the Region, including agriculture, silvilculture, and mining, but the real emphasis has been upon development of a year around economy based upon expanded summer tourism.

Protection and enhancement of the environment is a key element to the potential for economic diversification and the provision of a stable economic community for residents of the region. Many examples of the potential for economic diversification relate to the protection and enhancement of water quality, such as tourism and recreation. Positive impacts of implementing this Plan include the protection and enhancement of water quality, which leads to protecting the potential recreational resources for summer tourism activities. Negative impacts of this plan's implementation include increased levels of regulation and development costs associated with protecting water quality. These are described in more detail below.

6.2.2 Previously Implemented Plan Recommendations

The provision of advanced wastewater treatment for selected communities has had an impact associated with the construction and operation of these systems. Higher costs for construction and operation of these systems have been passed on to system users in the form of higher tap fees and service charges. Construction costs have been supported, in part, by federal grant programs, the state revolving loan fund and energy impact assistance programs.

The cost of these systems has been in part offset by water quality benefits that are attributable to a broader population base than system users. This includes benefits to recreation and tourism opportunities in the region as a result of protection of fish and wildlife, and improved aesthetic qualities of streams and reservoirs. Recreational studies have demonstrated a strong correlation between the opportunity for water-based activities and the selection of a recreational destination. To the extent that improved water quality maintains the opportunity for recreation, there should be a continuing benefit to summer tourism with a social and economic benefit to the region in accordance with objectives for economic diversification.

Controls on nonpoint sources of water quality degradation have also had social and economic costs and benefits. Controls for construction and grading activities have increased the cost of new construction for housing and commercial development. The cost increase on a per unit basis is dependent on the type of development and may range from a few dollars to several hundred dollars.

Controls implemented on water use and development activities to protect water quality and maintain the chemical, physical, and biological integrity of the Region's lakes and streams has increased the cost to water developers of providing new major water supplies utilizing water from the region. Windy Gap and Wolford Mountain Projects in Grand County are examples of how such additional costs are factored into the project costs for extension of major water supply systems in the Region under the Plan's recommendations. Additional development costs associated with provision of minimum

stream flows, wastewater treatment and water supply are examples of costs added to such projects as a result of local program requirements. Because the majority of the projects are designed to serve water users outside of the Region, the costs of mitigating such impacts has been borne largely by Eastern Slope water users while the benefits of requiring mitigation for water quality impacts have accrued to both residents and visitors to the Region.

Locally adopted regulations to protect the Region's water quality have had a social impact in terms of increased levels of government involvement in water quality concerns. Implementation of the regulations for nonpoint source controls only where necessary to meet a specific water quality goal has limited this involvement. Adoption of local regulations (as opposed to state regulation) integrated into local development review has placed responsibility closest to those impacted by the increased level of regulation.

6.2.3 Future Plan Recommendations

The continued implementation of this Plan will continue to have both positive and negative social and economic impacts as previously described.

Impacts due to recommended point source controls would be reduced to only those impacts associated with continued operation and maintenance of advanced wastewater treatment systems. This will reduce the continuing economic effect of higher user charges over time for those communities that have already made significant capital expenditures to provide for higher treatment levels. If expansion is necessary to accommodate growth, then both capital and operation expenses will be necessary to maintain the higher levels of treatment recommended in this Plan.

For communities in the Fraser Valley not now subject to advanced treatment levels, accepting this Plan's recommended wasteload allocations will have similar future economic impacts (both positive and negative) as described for communities which have already implemented advanced wastewater treatment for ammonia removal. These impacts are expected to occur in the next few years, as growth in the Fraser Valley will require more advanced treatment to limit the potential of ammonia toxicity to the Fraser River fishery.

New major expansions of water development projects will be subject to financial impacts for impact mitigation similar to those described for the Windy Gap and Wolford Mountain Projects. The specifics of required mitigation under locally implemented regulations will be dependent upon the review of the impacts of water quality resulting from the construction and operation of the project. It is therefore not possible to estimate the future costs to project proponents without a detailed review of the proposed project.

7.0 PLAN IMPLEMENTATION

The Critical Implementation Strategy is a four-pronged approach that consists of the following:

- Public education;
- Local implementation of the policy recommendations;
- Consistent enforcement of local regulations;

- Initiation of recommended watershed improvement projects.

In order for the implementation of this plan to be effective and efficient, communication between the various management agencies needs to be facilitated. There are a number of efforts that NWCCOG is involved with that are moving in this direction. These include the Colorado River Headwater Forum, the formation of watershed water quality groups, and the NWCCOG Quality/Quantity Committee. These are further discussed below.

The Colorado River Headwaters Forum is a group that was originally formed by the NWCCOG, but is now managed independent of the NWCCOG. This Forum is designed to facilitate discussion regarding water issues revolving around the Colorado River headwaters.

The Forum meets three times annually, and is composed of federal, state and local entities, including both western and eastern slope interests. One important outcome of the Forum has been the formulation of a model process for new water development projects. The process allows public input to projects prior to formal submission of 1041 and other permit applications.

The NWCCOG is continuing to assist in the formation, facilitation and technical assistance to local watershed water quality groups. Three groups have been formally established: the Summit Water Quality Committee (which has been established for 18 years); the East Grand Water Quality Board, and the Eagle River Watershed Council.

The NWCCOG Quality/Quantity Committee, which used to be composed mainly of NWCCOG governmental entities, in 1995 formally requested participation by all the water and sanitation districts. In 1995, 22 water and sanitation districts became members of the Committee. In 1996, three additional special districts have become members. In 2001 the Quality/Quantity Committee had 21 water and/or sanitation district members. The addition of water and sanitation districts represents a significant move forward in improving communication and participation in water quality planning and management. In this forum, management agencies responsible for both point source and nonpoint source water quality management can share concerns, ideas and direction for water quality protection and improvement.

Inherent in all of these efforts is the acknowledgement that there is a need to increase the awareness of individuals on water quality issues. This educational outreach needs to include the identification of issues, potential solutions, costs associated with solutions, and costs of inaction. Some of this information is currently available; some still needs to be developed. Through the management agencies and watershed groups, local needs and solutions will be further refined.

Through the efforts outlined above, it is expected that the four-pronged approach will result in successful implementation of this Regional Water Quality Management Plan.

BLUE RIVER WATER QUALITY MANAGEMENT PLAN 2002

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1.0 WATERSHED OVERVIEW

Geography and Hydrology

The Blue River drains an area of 680 square miles in the central Rocky Mountains, west of the continental divide in Colorado. The watershed drains northward, from elevations reaching 14,270 feet along the southeastern perimeter, to where it flows into the Colorado River south of Kremmling at an elevation of 7,400 feet. A map of the watershed is provided as Figure 6.

Figure. Blue River Watershed Map.

Three major tributaries in the Blue River watershed come together at Dillon Reservoir forming the Upper Blue River watershed: the Snake River, a westerly flowing tributary with its source originating at Webster Pass on the continental divide; the Blue River, a northerly flowing tributary with its headwater at the continental divide at Hoosier Pass; and Tenmile Creek a northeasterly flowing stream with its source at the continental divide at Fremont Pass. Each contributes approximately 1/3 of the flow to Dillon Reservoir. The lower Blue River watershed is approximately the same size as the upper Blue River watershed, and contributes approximately the same virgin yields (averaging approximately 160,000 acre feet per year).

Most of the annual stream flow results from snow melt during the spring and early summer (May through July). Major snowfall typically occurs January through April. Thunderstorm activity produces significant, although short-lived rainfall events in July and August. Stream flows above major water storage facilities have marked seasonal variability, with highest flows occurring during the snow melt, and low flows, sustained by groundwater, occurring October through April. Discharge from groundwater systems contribute about a quarter of the total surface water flow (Summit County Small Reservoir Feasibility Study, 1989).

Two significant water storage facilities are located in the watershed: Dillon Reservoir, with a capacity of 254,000 acre feet and a surface area of 3,220 acres; and Green Mountain Reservoir, with a storage capacity of 154,645 acre-feet and a surface area of 2,100 acres. Dillon Reservoir was constructed and is operated by the Denver Water Department as a municipal water supply. Green Mountain Reservoir was built and is operated by the United States Bureau of Reclamation. Its primary purpose is to provide compensatory water storage for the western slope (2/3's of its storage capacity) and augmentation water for the Colorado-Big Thompson project (1/3). It also provides hydroelectric power.

Average Blue River virgin flows are approximately 310,000 acre-feet (Summit County Small Reservoir Study, WBLA, Inc. 1989). In 2000, the ten-year annual average of water exports from the watershed was 75,109 acre-feet through the Straight Creek, Roberts, Hoosier Pass and Vidler tunnels and Boreas Pass ditch. The actual quantity of water diverted in 2000 was 104,739 acre-feet. Water exports result from water diversions by the Cities of Colorado Springs, Denver, other Front Range cities and agricultural users.

1.2 Land Uses and Population Characteristics

The Blue River watershed includes all of Summit County which encompasses approximately 619 square miles (383,260 acres). An additional 80 square miles lie within Grand County and the very head of the Tenmile basin lies within Lake County. Federal lands (Forest Service and Bureau of Land Management) account for approximately 79% (436 square miles or 279,145 acres) of the total area in Summit County. Private lands comprise 110,890 acres (approximately 21% of the County) and are concentrated along the major stream corridors in the valleys [Summit County Wetland Grant RFP, November 29, 2001]. Public lands in the Blue River watershed within Grand County account for approximately 18 square miles (11,520 acres of Forest Service and BLM property). The major population centers within the Blue River watershed are the towns and unincorporated areas of Blue River, Breckenridge, Copper

Mountain, Frisco, Keystone, Dillon, and Silverthorne. The permanent resident population of Summit County in 2000 was 20,946 and the peak seasonal population was 121,496 [Summit County Planning Department, 2000 Table A13]. The resident population growth in Summit County over the last nine years has averaged 7% per year. Skier visits to Front Range resorts (which includes Summit, Grand and Eagle County resorts) during the 2000-2001 season were approximately 7.2 million. Peak ski season population is approximately 122,000 [Summit County Wetland Grant RFP, November 29, 2001].

Economic and land use activities in Summit County include: recreation; mining; agriculture (including silviculture); and urban development. Recreation serves as the dominant economic base in Summit County, with four major ski areas in the county (Arapaho Basin, Breckenridge, Copper Mountain, and Keystone). The major historical mining areas in the county are at the headwaters of the watershed in the Tenmile, Blue and Snake Rivers. Agricultural products consist mainly of livestock, hay, and timber, with most of the irrigated acreage located in the Blue River valley downstream from Dillon Reservoir. Urban development in the county is primarily residential along the major tributaries in the vicinity of the ski areas, although development pressure and land prices have pushed development increasingly into unincorporated areas.

The lower portion of the Blue River watershed is situated within Summit and Grand Counties. This area is rural in nature and the predominant private land use is pasture and hay production (approximately 9,000 acres of irrigated land according to the State Engineer's Office, Division of Water Resources).

In the Blue River watershed there are 44 community, transient non-community, and private drinking water systems, serving a combined total population of 81,941 persons [Colorado Department of Public Health and Environment, Water Quality Control Division Colorado Open Records Act request, NWCCOG December 10, 2001]. Thirty-four of the systems are reliant upon ground water and ten systems are reliant upon surface water. This information does not include systems serving less than 25 people.

1.3 Watershed Water Quality Management

In the Blue River watershed, the Summit Water Quality Committee (SWQC) has been involved in water quality issues since 1984. The Committee's membership consists of the local municipalities, Summit County, and the Sanitation Districts in Summit County. The Committee's mission statement is "To protect and enhance water quality in Lake Dillon, Green Mountain Reservoir, and their tributaries." This watershed water quality management plant was developed using the SWQC to identify the water quality issues in each of the tributary watersheds.

2.0 WATERSHED WATER QUALITY ASSESSMENT

Generally, water quality in the Blue River watershed is of high quality. A portion of the Blue River below Dillon Reservoir has been designated as a gold medal fishery by the Division of Wildlife. Four segments in the watershed are on the State's 303(d) list of impaired waters, due to impacts associated with historical hard rock mining. Other

general water quality issues include concerns regarding sediment (a TMDL has been completed by the State and approved by EPA in 2000 for Straight Creek along I-70), and nutrients, both nitrogen and phosphorus. Municipal wastewater treatment facilities in the Blue River watershed all have tertiary treatment for phosphorus removal. The facilities also remove ammonia to meet the State stream standards and antidegradation provisions. Certain small areas in the watershed have demonstrated fairly high nitrate levels (greater than 5 mg per liter) in ground water, most likely as a result of septic system influence.

Most of the stream segments in the Blue River watershed are designated Aquatic life cold water class 1, recreation class 1, water supply, and agriculture. In general, the water in the Blue River watershed meets the water quality standards associated with these designated uses.

2.1 Straight Creek (part of Blue River Stream Segment 18)

Straight Creek has been heavily impacted by sediment related to the Interstate 70 corridor. In 1992, an EPA grant was awarded to the Summit Water Quality Committee to assess the sediment impacts on the aquatic community and develop metrics for assessing changes in sediment load. Macroinvertebrate densities, number of species, and species diversity have been negatively impacted by sediment accumulation. Fish populations were documented to be affected due to loss of pool habitat (pools were filled by sediment) [Straight Creek Sedimentation Investigation, December 1993. The Colorado Department of Transportation voluntarily began significant efforts in 1992 to address sediment inputs from road sanding operations as well as erosion from cut and fill slopes along the I-70 corridor. Monitoring is also taking place to assess the decrease in sediment loads as a result of these efforts.

Federal grants and state funds have been made available to the Colorado Department of Transportation to construct sediment retention ponds, stormwater rundowns, sediment retention barriers, and stabilize slopes, in order to reduce sediment loading to Straight Creek. Water quality data collected in Straight Creek in 1993 by Western Environmental Associates (2 sites, 18 dates) indicates that Straight Creek water is generally higher in nutrients and sediment than other inflows to the Blue River.

An EPA approved TMDL was developed for sediment in Straight Creek. Entities involved in the development of the TMDL included: the Forest Service; the Colorado Department of Transportation; the Division of Wildlife; the Town of Dillon; the Dillon Valley Metropolitan District; Northwest Colorado Council of governments; the Summit Water Quality Committee and the Water Quality Control Division. The Summit Water Quality Committee has coordinated the monitoring activities associated with the TMDL.

The established water quality targets of the TMDL are: 1) a minimum substrate D50 of 60 mm; 2) Maximum pool V* of 0.15; 3) Stable stream morphology; and 4) Five age classes of brook trout.

Straight Creek has no Colorado Water Conservation Board minimum instream flow filings below Laskey Gulch and has the potential for being completely diverted, de-watering the stream from Laskey Gulch to the confluence with the Blue River (approximately 2 1/2 miles). The Denver Water Board has conditional water rights (7

cfs) on Straight Creek, and the Town of Dillon and Dillon Valley Water District divert 7 cfs at Laskey Gulch (return flows are at the Silverthorne/Dillon Joint Waste Water Treatment Plant on the Blue River, approximately 3 miles down stream of the confluence).

2.2 Snake River and Peru Creek (Blue River segments 6, 7, 8, & 9)

The town of Montezuma was established as a mining community in the headwaters of the Snake River in the late 1860s. The community (approximate population: 70, 2000 US census data) does not provide water or sewage facilities, although the town owns senior water rights in the basin.

The Montezuma mining area of the Snake River basin is impacted by heavy metals and low pH (most heavily in Peru Creek). This part of the watershed contains large amounts of zinc veins in the Tertiary Montezuma stock. The ore deposits are thin veins along joints, faults, and contact surfaces. Bog-iron ore deposits are also known to exist in the upper Snake River basin and are believed to be a major contributor of acid to the streams [USGS, Reconnaissance Evaluation of Surface Water Quality in Eagle, Grand, Jackson, Pitkin, Routt, and Summit County, 1979].

Most of the ore deposits and abandoned mines are oriented north to south in the upper reaches of Peru Creek and the Snake River. Trace element concentrations in the Snake River and Peru Creek upstream of the major ore deposits indicate that some of the trace element contamination is from natural origins.

Water quality has been documented as being impacted in the upper sections of the Snake River by bog-iron ore deposits and historical mining activities upstream of the confluence of Deer Creek [USGS, 1979]. In a 1994 survey, DOW staff found no aquatic life in the first half mile of the Snake River above the confluence with Deer Creek. Aluminum, lead, copper, cadmium, and zinc are above the aquatic life standard above the Deer Creek confluence. DOW staff in 1994 found a healthy trout population in Deer Creek above the confluence with the Snake (Blue River Stream Segment 9). The acid production from the area above the confluence with Deer Creek results in low pH's for the upper section of the Snake River [McKnight and Feder, Hydrobiologia 119, 1984]. Another paper by McKnight et al. (Environmental Science and Technology, July1992) states "The Upper Snake River is acidic and has high concentrations of dissolved Al and Fe. Although some veins containing lead, zinc, and silver minerals have been mined sporadically, no effects on water chemistry in Deer Creek are evident." The Snake River downstream from Peru Creek showed a relatively neutral pH, indicating a recovery from possible acidity upstream.

A 1979 study done by Dave Holm, Timothy Sullivan and Bruce Stenulson, “The Restoration of Peru Creek”, indicated that the most significant source of metals in Peru Creek is the Pennsylvania Mine Complex. Only dissolved manganese exceeded water supply standards. Downstream from the majority of the mines on Peru Creek, all trace-element concentrations increase, with dissolved manganese exceeding water supply standards while concentrations of total cadmium, copper, lead and zinc exceeded standards for aquatic life [USGS, 1979]. Seasonal variation in trace element concentrations appears as a dilution effect, with lower concentrations as a result of spring runoff. No aquatic insects have been observed at sites downstream of the

abandoned mine activity on Peru Creek. Water quality impacts resulting from metals concentrations are documented in the 1989 Addendum of the 1988 Nonpoint Source Assessment Report [Water Quality Control Division in association with the Colorado Nonpoint Source Taskforce] which reports that Peru Creek is devoid of aquatic life (Blue River Stream Segment 7). A Division of Wildlife (DOW) survey in October of 1994 found no aquatic invertebrates or fish 400 feet upstream of the Pennsylvania mine site. All the other Snake River tributaries, as well as the Snake River, support only minimal aquatic life due to both acute and chronic metals problems.

As a result of discharge from Peru Creek, dissolved manganese concentrations still exceed water supply standards, at the Water Quality Control Division (WQCD) sampling site below Keystone. Dissolved zinc concentrations exceed applicable water quality standards for aquatic life at this station based on EPA STORET data collected by the WQCD between 1988 and 1994.

The Water Quality Control Division conducted sampling in 1996 and 1997 in the Snake River watershed. This sampling found that the Peru Creek drainage contributes 9 percent of the copper loading in the Snake River watershed, 18 percent of the cadmium, 21 percent of the manganese, 35 percent of the zinc, and 42 percent of the iron [rebuttal statement of the Water Quality Control Division, Upper Colorado River Basin Standards hearing, July 28, 1999].

The Water Quality Control Division has monitored several sites in the upper basin since fall of 2000. Sites monitored monthly, or as weather has allowed, include Snake River at Montezuma, Peru Creek at the mouth, North Fork of the Snake above Keystone Resort, and the Snake River at the stream gage at Keystone. Zinc, copper, and cadmium generally continue to exceed standards to protect aquatic life. Some exceedances of lead and iron also continue.

1988 Summit Water Quality Committee monitoring results indicated nonpoint source phosphorus levels which deviated significantly from background sources in the Keystone area. A study directed by the Summit Water Quality Committee identifying probable sources was completed in 1990. Potential phosphorus sources were identified: the two unpaved parking lots (East and West lots) located between Keystone Road and the Snake River, on the south side of the river near the Snake River Clinic and Lancaster Lodge; the area above Key Condos; Keystone Lake; and a culvert pond below the development. Other water quality concerns associated with the Keystone area include golf course runoff (currently one, and a second proposed), and minimum instream flow depletions in Keystone Gulch due to snow making activities.

The WQCD water quality monitoring data for the Snake River below Keystone during the period 1979-1994 were analyzed by the NWCCOG Water Quality Program. The 1988 208 Plan reported exceedances in numeric standards for copper, lead, zinc, and cadmium were observed. and that when compared with the data for the "most recent three years of this period" (1984-1987), average concentrations of copper and lead were reduced (though still had occasional exceedances of standards), while average concentrations for zinc and cadmium increased.

Data collected by the WQCD at the same site between 1988 and 1994 shows continued exceedances of water quality standards.

The mean of 40 dissolved zinc samples collected by the WQCD during this time period was 0.216 mg/L. The chronic water quality standard for Cadmium and copper also continue to occasionally exceed stream standards. Lead, however, was not detected in 40 samples collected during that same period. Total phosphorus concentrations are high in this reach with respect to measured background concentrations in other parts of the Blue River watershed. Special studies conducted through the Summit Water Quality Committee indicate that the areas around Keystone and Soda Creek (Blue River Stream Segment 5) are the largest contributors of phosphorus to Dillon Reservoir in the Snake River watershed.

Water quality data was collected by the Keystone Science School as part of the Division of Wildlife's River Watch Program at three stations in the Snake River drainage between 1991 and 1997: one on Keystone Gulch; one at the Keystone Science School bridge over the Snake River; and one on the Snake just above the confluence with Dillon Reservoir. Keystone Gulch pH's range from 5.7 to 8.5, and there are very occasional detections of dissolved iron, manganese, and zinc. The Snake River at Keystone Science School bridge has pH's of 5.2 – 8.1, consistent detections of dissolved cadmium, copper, manganese and zinc. The average dissolved concentrations of zinc at this station 32 samples between 1991 and 1997) was 258 ug/L. The Snake River confluence station has pH's similar to Keystone Gulch (5.7 - 8.2), and consistent detections of cadmium, copper, manganese, and zinc. Average dissolved zinc concentrations 32 samples between 1991 and 1996) were 307 ug/L. The chronic table value standard for dissolved zinc for the protection of aquatic life at a hardness of 50 is 65.5 ug/L.

A “Biological Investigation of the Aquatic Communities of the Snake and North Fork of the Snake Rivers” prepared for Keystone Resort by Chadwick Ecological Consultants was completed in September 1996. Macroinvertebrates were found at all five sites on the North Fork and Shannon-Weaver diversity indices ranged from 2.23 to 3.40. “This index generally has values ranging from 0-4, with values from 2.5 to 4.0 indicative of a healthy invertebrate community. Diversity index values less than 1.0 indicate a stream community under severe stress.” The same study sampled five sites on the mainstem of the Snake River from below Peru Creek to above Dillon Reservoir. Sites A and B (both above the North Fork of the Snake River) had 11 and 16 macroinvertebrate taxa and Shannon-Weaver diversity indices of 1.62 and 1.52. Sites C, D, and E on the mainstem of the Snake River below the North Fork confluence had diversity indices of 2.68 to 2.99.

The same Chadwick study found brook trout in the North Fork of the Snake River at 20 to 60 kg per hectare over five sites. No fish were collected from sites A and B (mainstem of the Snake between the north Fork and Peru Creek), while brook, brown, and rainbow trout were collected from sites C (brook and rainbow only), D, and E. Trout biomass at these three sites ranged from 20.4 to 26 kg per hectare. A table in the report summarizes fish biomass in similar streams in the Colorado Rocky Mountains. The mean trout biomass was 37.2 and the median trout biomass was 27.2 kg per hectare. The range of the 20 “reference” sites fish biomass was 10.6–114 kg per hectare.

In June 2001, the Forest Service released a study titled “Keystone Ski Area Water Quality Study” examining the impacts of artificial snowmaking in water quality at the Keystone ski area. Metals concentrations in pit and core snow samples from impacted locations (areas with artificial snow made with Snake River water) were generally substantially higher than those from reference locations (non snowmaking areas). Zinc

concentrations were substantially higher in creeks receiving direct runoff from slopes with artificial snow than reference condition streams, but were below aquatic life stream standards. Macroinvertebrate sampling indicated an impact from metals in mayfly numbers and sensitive invertebrate species diversity in streams receiving artificial snow melt runoff.

A group called the Snake River Watershed Task Force formed in the late 1990s to address metals problems in the Snake River watershed. The group's stated mission is "to improve water quality in the Snake River watershed. The Task Force will focus particularly on identifying, evaluating, and implementing opportunities to reduce heavy metal concentrations of concern." The objectives of the group are to: obtain better information on the watershed; identify opportunities for improvement; develop criteria to prioritize projects; assist project implementation for projects that meet the Task Force's criteria; and help establish and obtain reasonable standards.

In 1999 the Water Quality Control Commission established temporary modifications to segments 6 (mainstem of the Snake) and 7 (Peru Creek). The temporary modifications for cadmium, copper, iron, manganese, and zinc were set at ambient levels.

2.3 Upper Blue River and French Gulch (Blue River Stream Segments 1, 2, 10, 11, & 12)

The private lands in the upper Blue River (extending south of the inlet to Dillon Reservoir) have the potential for significant future development. Due to poor soils and shallow ground water, Individual Sewage Disposal System (ISDS) could negatively impact ground and surface water in this area. A limited number of small wastewater treatment plants currently exist in the area. Breckenridge Sanitation District has taken over the operation of four facilities in the upper basin above Goose Pasture Tarn. All the facilities provide secondary treatment with subsurface discharge in order to protect the major water supply, Goose Pasture Tarn.

Water quality in Goose Pasture Tarn has been characterized as "good", by the Town of Breckenridge, with no recent algal blooms. Goose Pasture Tarn serves as the water storage facility for the Town of Breckenridge's water supply.

The upper portion of French Gulch (above the Wellington/Oro Mine) supports a healthy fishery of native Colorado River cutthroat trout, according to the DOW.

The 1989 Addendum to the 1988 Nonpoint Source Assessment Report prepared by the WQCD noted that zinc, cadmium, lead, and copper concentrations are above the aquatic life standard on the Blue River from French Gulch to Dillon Reservoir.

French Creek from the Wellington–Oro Mine complex to the Blue River exceed**s** the water supply standard for dissolved manganese, and the aquatic life standard for cadmium, copper, lead, mercury and zinc.

The benthic organism community diversity is extremely low and is almost entirely composed of chironomids (midges, tolerant of poorer water quality).

An investigation of the chemical-biological integrity of French Creek and the Blue River

was conducted in May and September of 1989 by the WQCD. The major source of metals loading is the Wellington-Oro Mine complex. The primary components of metal toxicity are zinc and cadmium, of which zinc exhibits the most serious and persistent downstream effects. Seasonally, the greatest loading, potential toxicity, and furthest downstream effects occur during the spring snowmelt period. Water quality and habitat degradation has eliminated trout from the lower 2-3 miles of French Creek. Metals contamination of the Blue River below its confluence with French Creek appears to have seriously reduced trout populations for an undetermined distance downstream.

Summit County High School monitored water quality on French Gulch as part of the Division of Wildlife's River Watch Program, but no dissolved metals data was collected between 1992 and 1998 (most recent available data). The pH for the station ranged from 6.5-8.0 and dissolved oxygen concentrations range between 8 and 11 mg/L - excellent for aquatic life. Hardness ranges from 13 - 164, with an average of 40 mg/L.

WQCD water quality data collected at their routine monitoring site on the Blue River, approximately 3 miles downstream of French Creek, between 1988 and 1994 indicated one exceedance of the chronic silver standard out of 26 samples collected and occasional exceedances of the chronic cadmium standard. There were no exceedances of copper, manganese, or zinc (44 samples each).

WQCD data collected in November 1993 in the Blue River below the confluence with French Creek indicated that zinc significantly exceeded the temporary modification standard for the segment (the Blue River from the French Creek confluence to the confluence with the Swan River): 2.946 mg/L vs. the temporary standard of 1.7 mg/L.

A 1994 DOW visual survey of the Blue River in the vicinity of French Creek (Jake Bennett) found no fish within 500 feet downstream of the confluence downstream of French Gulch. According to the Breckenridge Town Engineer, approximately 1/2 mile downstream of the French Creek confluence (Valley Brook Road area) a year around population of trout exists.

As part of the French Gulch Remediation Opportunities Group (FROG) activities, the Summit Water Quality Committee and the Northwest Colorado Council of Governments coordinated a water quality monitoring effort on the Blue River above and below French Gulch from April 1997- September 1998 (23 sampling events). That monitoring effort documented that metals values in the Blue River above French Gulch meet table value standards, while below French Gulch, zinc and cadmium exceed acute and chronic table value standards.

The USGS has monitored fish and invertebrates in the Blue river in the vicinity of French Gulch. The USGS fact sheet “Effects of Water Quality and Habitat on Composition of Fish Communities in the Upper Colorado River Basin” by Jeffery Deacon and Scott Mize (October 1997) documents the fishery findings. In French Gulch no fish were found, however, 36 brook trout and 2 brown trout were found downstream of the confluence in the Blue River.

A draft “Wellington-Oro Mine Pool Engineering Evaluation/Cost Analysis” prepared by Adrian Brown for B&B Mines December 13, 2000, documents existing water quality in French Gulch and the Blue River. Potential contaminants of concern in French Creek include cadmium, iron, lead, manganese, and zinc. Potential contaminants of concern in

the Blue River include cadmium, lead manganese, and zinc.

Another report by Adrian Brown ("Tiger and Jessie Mines surface Water and Soil Characterization" for B&B Mines, August 4, 2000) documents limited water quality sampling on Gold Run and the Swan River. Discharging adits exist at both mines. The Tiger mine adit discharges cadmium and zinc at levels above Table Value Standards. The Jessie Mine adit discharges manganese and zinc at levels above Table Value Standards. One sample on the Swan River (June 2000) at the confluence with the Blue suggests that at that location table Value Standards are met.

Two "Analytical Results" reports produced by the Colorado Department of Public Health and Environment's Hazardous Materials and Waste Management Division in May of 2001 found portions of the Swan and Gold Run to be above Table Value Standards for cadmium and zinc. The elevated metals were found to be attributable to the Royal Tiger Mine and mill site about ¼ mile east of Muggins Gulch, and the Jessie Mine and mill site along Gold Run Gulch

A report prepared by the Division of Wildlife in June of 2001 titled "Aquatic Habitat Analysis: French Gulch and Blue River, Summit County Colorado" for the Hazardous Materials and Waste Management Division of the Colorado Department of Public Health and Environment documents the impacts to both French Gulch and the Blue River. The report states, "[t]he physical habitat of both the Blue River and French Gulch was highly modified by human actions in the last 100 years through a variety of activities including mining, road building, and urbanization of mountain terrain. As a consequence of these modifications, the amount of habitat available to support adult trout may have become compromised to the point where large numbers of fish will not be present." Blue River site 1 (just upstream to the confluence with French Gulch) and Blue River site 2 (just below the confluence) had 14 and 16 percent stream substrate with useable habitat for resting adult brown trout, respectively, compared to three other "reference" sites which had between 21 and 24 percent useable habitat. The report also states, "[e]ven if metals loading from French Gulch were to be reduced the physical habitat of the stream would need to be altered for trout numbers to increase substantially."

Additionally, stream flow in Blue River stream segment 2 (French Gulch to Swan River) is highly controlled due to the Town of Breckenridge's water supply from Goose Pasture Tarn and the ski area's snow making water rights. This occurs in an area that was historically dredged for gold and destroyed the stream channel and its associated riparian habitat (Blue River Restoration Master Plan, February 14, 2000 by Tetra Tech, Inc. for the Blue River Restoration Steering Committee and Northwest Colorado Council of Governments). Under the existing water rights situation it is possible for the surface flows in this segment to be non-existent during late summer and winter conditions (Scott Hummer, Colorado State Engineer Division 5 Blue River Water Commissioner, personal communication).

A population of Colorado River cutthroat trout exists in the North Fork of the Swan River. A culvert and a series of beaver ponds, barriers to fish passage have been responsible for maintaining this fairly "pure" population, but brown trout have been reportedly seen in these beaver ponds. This is a concern to the Division of Wildlife which is attempting to maintain "pure" cutthroat trout populations. The migration of brown trout upstream of the beaver dams could impact the genetic purity of the cutthroat population.

2.4 Tenmile Creek (Blue River Stream Segments 13, 14, & 15)

Tenmile Creek discharges to Dillon Reservoir in the Town of Frisco, approximately 18 miles northeast of the Climax Mine, which forms the headwaters of Tenmile Creek. The Climax mine and mill operations lie within a contiguous 14,300 acre land block on the upper reaches of the Arkansas, Eagle and Tenmile drainages atop the Continental Divide.

The Climax Mine site contains the richest molybdenum deposit discovered in the world to date (1980), Activity of State Interest, Summit County Permit Application, Climax Molybdenum Company, August 1992].

The Tenmile Creek watershed is highly mineralized and was a primary target of prospectors and mine development dating to the late 1860s. The upper stream segment (Segment 13) has continuing water quality problems due to extensive and intensive metal mining activities that occurred throughout the upper Tenmile Creek drainage. The historic lode operations mined and milled pyritic poly-metal ores. Many of these sites continue to discharge acidic waters. In the 1970's Climax constructed the West and East Interceptor ditch systems above its operations to divert stormwater and snowmelt around its facilities. As part of the interceptor system project, Climax consolidated into its water treatment system mine drainage and stormwater and snowmelt contact water from several of the worst pollutant sources in Searle and Kokomo Gulches. Numerous other historical mine sites located on federal lands contribute mine drainage and contaminated runoff to the interceptor system which discharges directly to Tenmile Creek.

The lower segment (from West Tenmile Creek to Dillon Reservoir) receives dilution flows from West Tenmile Creek, which is of high quality. A report titled “Water Quality Monitoring for Copper Mountain Resort Results for 1999 and 2000” prepared by William Lewis and James Saunders [December 15, 2000, available from the Summit Water Quality Committee] provides information on phosphorus concentrations and yields in West Ten Mile Creek. This study occurred during a time of significant base area development at Copper Mountain Resort. Between 44 and 91 kilograms of phosphorus were attributed to Interstate 70 (above the Lake Dillon model background estimate for the watershed), and between 9 and 91 kilograms of phosphorus were attributed to runoff from the ski area and base development.

The fishery on Tenmile Creek was completely eradicated by the impacts of acidic mine water drainage, smelter effluent and waste from the mining settlements in the late 1880s

Since that time, there have been substantial improvements to the physical characteristics of the stream associated with DOW guidance efforts related to the construction of Interstate 70 through West Tenmile Canyon. Tenmile Creek was restored as a fishery, although not to a pre-disturbance condition, by 1971. Tenmile Creek and Clinton Reservoir are viable fisheries that support game fish species including brook, brown, cutthroat, and rainbow trout (Clinton supports only cutthroat trout). Production data for all these surface water bodies have not been compiled (DOW, 1993), although fisheries production data has been compiled for CMC annually since 1970 [Climax Mines, Bryce Romig, personal communication, 1995].

During a wetland delineation along Tenmile Creek done as part of a Analytical Results Report Screening Site Inspection done for the EPA by URS Consultants September 29, 1994 [URS, 1995], a powder white coating was visible on rocks in the stream channel on the upper reaches of Tenmile Creek. Numerous persons have noted this condition. Climax Mine has identified this as un-reacted lime, an artifact of the water treatment process [Bryce Romig, personal communication, 1995].

The 1979 USGS study (previously cited) documented levels of heavy metals, which exceeded standards for water supply and aquatic life. The Dillon Clean Lakes Study documented high concentrations of phosphorus in Tenmile Creek [Lewis, Saunders, and Brendecke, Clean Lakes Study of Dillon Reservoir in Summit County, 1983]. It should be noted that significant reclamation activity and improvement in the water treatment system at the Climax Mine has occurred since the 1980s.

Historically, Tenmile Creek from its confluence with Kokomo Gulch to West Tenmile Creek (Segment 13 of the Blue River) contained zinc, copper, cadmium, and lead above the basic standards for aquatic life; water supply standards were also exceeded for cadmium, lead, and manganese [1988 208 Plan]. Below the West Tenmile Creek confluence (Blue River Stream Segment 14), concentrations of these metals were reduced due to dilution; however, cadmium, copper, and zinc still exceeded table value standards for aquatic life [1988 208 Plan].

Currently there is no sulfate standard for Segment 13, however 1993 and 1994 CMC water quality data collected on Tenmile Creek below Humbug Creek shows that sulfate concentrations usually exceed the 250 mg/L Table Value Standard for domestic water supplies (the 1993 average was 632 mg/l and the 1994 January through October average was 691 mg/L). The same data showed no exceedances of the copper, one exceedance of zinc at 0.26 mg/L (June, 1993), and one exceedance of manganese at 1.43 mg/L in July of 1993. This water includes non-Climax Mine historic mining pollutant sources. The point of including historical data is to show that significant progress has been made in improving water quality in Tenmile Creek.

Climax Mine is currently on a "care and maintenance" status and is not in production. There are no present plans to reinitiate production from the mine and mill (Bryce Romig, Climax Mine, personal communication, 1995]. Based on sampling conducted by the SWQC in the 1980s, it is expected that in production mode (based on historical data), the Climax Mine will increase phosphorus and nitrate concentrations in Tenmile Creek. Climax Mine is exempt from a phosphorus wasteload allocation under their existing and draft permits.

Historically, cyanide, copper, and zinc have been the primary contaminants discharged from the Climax Mine site that have exceeded WQCD discharge permit limits. There have been no exceedances of cyanide, copper, or zinc stream standards since 1986. Elevated concentrations of arsenic, cadmium, copper, silver and zinc were present in sediment samples from Tenmile Creek, and elevated concentrations of aluminum, cadmium, and zinc were present in surface water samples. Cyanide was not found in sediment or surface water samples. Observed elevated levels of copper, silver and zinc were detected in sediment samples 3.1 miles downstream from Climax Mine, and elevated levels of aluminum and zinc were detected in surface water samples at the same site [URS, 1995]. These metals were not elevated at the Climax Mine property boundary, suggesting sources other than Climax Mine. It should be noted that water

discharged by Climax Mine under its discharge permit (CDPS Permit No. CO-0000248) is in compliance with all conditions of this permit. This permit is currently under renewal.

Climax Mine also contracts for annual biological studies. In 1993, brown, brook, and rainbow trout were collected at study sites on Tenmile Creek. At the TM3 site (upper Tenmile) only two brown and one brook trout were collected (all <15 cm). The number of fish at this site has been low in the last three years, compared to 1989 and 1990, when 25 and 20 fish were collected, respectively. Young of the year have not been collected at this site since 1989. Climax has noted that the physical habitat at this site has been changing noticeably over the last five years from a deep pool towards a riffle as a result of natural processes, limiting the fishery habitat. Also, a weir at the lower end of this site becomes a barrier to movement of smaller fish during low water periods [Bryce Romig, personal communication, 1995].

At downstream sites density and biomass are relatively similar to previous years, and natural reproduction occurs annually at the collection site near Wheeler Flats. The macroinvertebrate community is showing some improvement over time at the upper site. Although total density remains low, number of taxa and species diversity has increased. Chironomids, highly tolerate organisms which previously accounted for 80 to 90% of all the organisms collected accounted for 37% of the organisms collected in 1993.

The macroinvertebrate community at the Climax Mine sampling site upstream of Frisco did not appear to be stressed in the 1993 study, and all major taxonomic groups were found.

Since the 1998 Climax Mine permit renewal, because of improvement in infrastructure which allows all seep water to be returned to treatment ensures that all water sees full treatment prior to release. Additionally, there have been numerous wastewater treatment improvements – a new and efficient lime delivery system, 2-stage pH adjustment system which is more effective in removing metals.

There has been more involved management of Clinton Reservoir by the owner (Clinton Reservoir and Ditch Company) since 1999. Much of this is related to the installation of the water diversion for Copper Mountain just above Wheeler Flats on the mainstem of Tenmile Creek. It is likely that the diversion may be doing two things- 1) providing increased instream flow of Clinton Reservoir water during low flow periods, and 2) pulling flows from the main stem from winter low flow – thus allowing West Fork of Tenmile chemistry to dominate during some period of the year. Good data on the volumes or timing of these diversions, may not be available but empirically, this management may be of some overall benefit to Tenmile Creek.

Climax has monitored macroinvertebrates and fish from 1990–1998. Sites include: (TM3), Wheeler flats (TM5) and Frisco Bridge (TM6). Data has been parsed into 1990-1994 and 1995-1998. The data is summarized below in Table 6. TM3 has been identified as a problematic site, due to habitat issues, and work is done to identify a more representative site for biological sampling.

Table 6. Biotic indices in Ten Mile Creek

Parameter	TM3		TM5		TM6	
	1990-1994	1995-1998	1990-1994	1995-1998	1990-1994	1995-1998
Mayfly species			2.0	7.5	3.5	8.5

Stonefly species			3.5	10.5	5.0	11.5
Caddisfly species			1.5	3.5	2.8	4.5
Fish per acre				780 ('98)		530 ('98)

Climax Mine's involvement in the July 2000 basic standards hearing resulted in a application of EC10 for most state waters for manganese with some allowance for higher hardness waters such as those found in segment 13. The current manganese standard, which is hardness based, is limited to maximum hardness of 400. Climax is interested in obtaining a manganese standard, which accounts for hardness values above 400 mg/L, as found in the upper Ten Mine Creek. The manganese effluent concentration currently in place, based on 400 hardness is 3100 ug/l.

The five municipal wastewater dischargers in the Blue River basin (Breckenridge, Copper Mountain, Frisco, Silverthorne/Dillon, and Snake River have entered into or are developing a cooperative agreement with Climax Mine for the disposal of their biosolids which will be used to reclaim the mine site.

The Division of Wildlife reports that a cyclical fish population that reflects changing metal concentrations is found in the lower stretch of Tenmile Creek [1988 208 Plan].

The Colorado Water Quality Control Division's water quality monitoring data for Tenmile Creek at Frisco during the period 1979 –1987 were analyzed by NWCCOG for the 1988 208 Plan. Occasional high levels of total inorganics, suspended solids and total phosphorus were reported to exist. Exceedances of numeric standards for sulfate, copper, lead, zinc, and cadmium occur infrequently. A comparison of the analysis from the most recent three years of that period (1984-1987) indicated an improvement for all parameters except suspended solids and sulfate. Occasional exceedances of the standard for lead still occurred during this period. Between 1988 and 1994, 55 dissolved lead samples were collected with no detections present, indicating that lead is no longer a concern. Sulfate is still a problem, with an average value of 215 mg/L for samples collected between 1979 and 1994, while averages for the other three WQCD stations in the Blue River watershed range from 27 – 34 mg/L. The average suspended solids concentration at this station for the same time period (1979-1994), >12.1 mg/L, is in line with the other WQCD average values for the watershed (averages range from 10.6 to 19.3 mg/L).

Summit County High School no longer monitors water quality at the Tenmile Creek confluence with Dillon Reservoir. The data available (three samples between 1993 and 1994) show a pH of 7.6 and saturating dissolved oxygen conditions – which indicates those parameters are good for aquatic life. Hardness (ranging from 360 to 518) is significantly different than most of the streams in the watershed which are significantly lower in hardness than Tenmile Creek. This indicates that there is a greater dissolved ion concentration in this stream than most in the watershed (such as calcium carbonate or sodium sulfate). Hardness does buffer (offset) the impact that dissolved metals have on aquatic life. No metals data is available for this station.

2.5 Dillon Reservoir (Blue River Stream Segment 3)

Dillon Reservoir was the subject of a Clean Lakes Study, which was conducted in 1982 [Lewis, Saunders, and Brendecke, Clean Lakes Study of Dillon Reservoir in Summit

County, 1983], with water quality data collection continuing through the present. Nutrient enrichment due to phosphorus loading from nonpoint sources is currently the principle concern in Dillon Reservoir. The study concluded that Dillon Reservoir is mesotrophic (moderate amount of nutrients), whereas a previous EPA study had found the reservoir to be oligotrophic (few nutrients). Nutrient enrichment studies in 1982, 1984, and 1987-1988 concluded and continue to indicate that the growth of phytoplankton and bacterioplankton is phosphorus-limited during the majority of the year (Clean Lakes Studies, and masters thesis and doctoral dissertation by Donald Morris, University of Colorado, Boulder).

Approximately 45% of the phosphorus loading is attributable to background runoff, 13% to precipitation, 16% to major point sources, 8% to septic systems, and 18% to all other sources. These percentages have been refined and revised through annual monitoring. For 1991 (adjusted to 1982 hydrologic conditions), approximately 50% of the phosphorus loading is attributable to background runoff, 18% to precipitation, 3% to major point sources, 15% to septic systems, and 14% to all other sources [SWQC Phosphorus Accounting System, 1995].

Conclusions from continued monitoring indicate sustained reduction in total phosphorus loading as compared with the levels observed in 1981 and 1982. Improved land use practices and performance of wastewater treatment plants are the apparent reasons for the reduced loads.

In 1984 the Water Quality Control Commission passed a control regulation, setting a phosphorus standard of 7.4 ug/L during the growing season, and establishing point source phosphorus load allocation for Dillon Reservoir. As previously noted, phosphorus was identified as the nutrient limiting algae growth in the reservoir.

This standard was set to protect the lake from algal blooms by establishing a “cap” at 1982 seasonal average chlorophyll levels. Wasteload allocations for the major dischargers were based on projected “build out” flows and a discharge treatment level of 0.2 mg/L total phosphorus. Wasteload allocations for the minor dischargers were based on the percentage of phosphorus available to the minor domestics without exceeding the total allowable load and allocated to the individual sources based on professional judgment.

The 2000 Annual Report on Dillon Reservoir, produced by Western Environmental Analysts for the SWQC documented that the total phosphorus concentration in 2000 averaged 6.3 ug/L, just above the median value of 6.2 for the years 1981 through 1999. The mean growing season chlorophyll a concentration was 2.9 ug/L, well below the median for the years 1981-1999 (4.9 ug/L). In 2000 the average Secchi disk depth was 4.0 meters, the fourth highest value (a good thing) since regular sampling was initiated in 1981. The median Secchi disk depth value for years 1981 through 2000 is 3.5 meters as an annual average.

The Climax Molybdenum Mine was identified in the Clean Lakes Study as a significant uncontrolled source of phosphorus (approximately 5% of the total phosphorus load in 1982) which behaved like a point source (coming from one identified source). This phosphorus impact was assumed to be associated with the workforce not the mining, per se. During the Clean Lakes Study the workforce numbered over 3,000. Since the time of the initial study the mine has reduced operations and a corresponding drop in the

loading from the mine has resulted (during the last five years the work force has not exceeded 150). Phosphorus concentrations in Tenmile Creek may increase as a result of future operations, and may increase the phosphorus load to Dillon reservoir.

Construction activities and septic systems were also identified as a significant source of nutrients in the Clean Lakes Study. In 1982, the contribution of phosphorus from septic systems to the reservoir was 8% of the total phosphorus load. In 1991, the Dillon Reservoir model predicted that 15% of the phosphorus load is attributable to septic systems. Considering the projected growth anticipated to occur in areas not currently served by advanced waste water treatment plants, nutrient contributions due to areas served by septic systems are anticipated to be a significant nonpoint source problem in the future, based on Dillon Reservoir model projections. Studies to characterize these non point sources are discussed further in the Nonpoint Source section.

The reservoir operational impacts on both the water quality and fishery in the reservoir are a continuing water quality "unknown".

In 1997,a special study entitled “Effects of Reservoir Management on Phosphorus and Chlorophyll Concentrations on Lake Dillon” was sponsored by the Summit Water Quality Committee. Reservoir management operation information was provided by Denver Water Department. Modeling was based on three sets of conditions intended to span full range of alternatives that might be realized for future years. 1) status quo- or existing conditions, 2) greater water demand (approximately the year 2015), and 3) maximum demand (year 2045). Three factors potentially affect phosphorus concentrations in the reservoir: land use, hydrology, and reservoir operations. Of these three, land use has by far the strongest effect, in other words, changes that are anticipated in land use between the present conditions and full build out (in the watershed above the reservoir) will have a much stronger effect on the total phosphorus concentrations than any variation in hydrology from year to year. Hydrology has the second strongest effect, and reservoir management has a small adverse effect on phosphorus concentrations in dry years at full build out.

In 1999 Western Environmental Analysts produced a report titled “A Quantitative Evaluation of Factors Controlling Transparency in Lake Dillon Colorado” [William Lewis and James Saunders, July 13, 1999]. This study, paid for by the Summit Water Quality Committee, evaluated the contribution of dissolved organic carbon, algae, and “other factors”, including bacteria and very fine particulate matter. The main source of suspended non-algal material affecting transparency was found to be external from the tributaries rather than from internal (i.e. lake processes) sources. This study determined that over 90% of the extension of light in Dillon Reservoir was attributable to substances dissolved and suspended in the water and not absorption of light though the water. Algae were responsible for one quarter of the total extension of light, dissolved organic carbon accounted for about one quarter of the total light absorption, and that “non-algal particulate” material is responsible for 30-50 percent of the light absorption. The report concluded “The results suggest that emphasis on algae, with respect to the appearance of Lake Dillon, is warranted but perhaps is overly one-sided, and that a better balance of results might be achieved through practices that control not only phosphorus but also transport of particulate material associated with development.”

2.6 Lower Blue River (Blue River Stream Segments 16, 17, 18, & 20)

The Blue River downstream from Dillon Reservoir (Stream Segment 17) was assessed by the NWCCOG's Water Quality Program for possible water quality changes due to mining, urban runoff, and point source discharges from Silverthorne. Agricultural, construction, and recreational activities are assessed further downstream (Segment 17). Downstream changes in water quality also were evaluated in terms of the conditions of the stream as a fisheries resource.

The lower Blue River flows through alluvium underlain in descending order by: Pierre shale; the Cretaceous Niobrara formation; and Dakota sandstone. Sulfate concentrations measured at sites in this reach of the stream (Silverthorne to Green Mountain Reservoir) indicate some contact with these formations, either through direct contact with surface water or through ground water return flows which have been in contact with these formations. The dissolved solids concentrations did not increase in this reach of the river [USGS, 1979]. Downstream from the Dillon-Silverthorne wastewater treatment plant discharge, concentrations of total cadmium, lead, and zinc exceeded standards for aquatic life, and dissolved manganese exceeded water supply stream standards (Segment 17) [USGS, 1979]. This site is probably affected by a sand and gravel mining operation immediately upstream. However, a complete recovery was seen in trace element concentrations at the nearest downstream site (above Pass Creek). The dissolved oxygen concentration was higher than the minimum standard for cold water aquatic life on all locations on the lower Blue River.

Approximately 725 platted lots in nine un-sewered subdivisions exist adjacent to the Town of Silverthorne. Although there is no current indication of surface or ground water contamination, the potential exists, due to clayey soils, gravely soils, small lots and/or shallow ground water in these areas.

In 1977, the highest benthic organism diversity in Summit County was measured in the lower Blue River downstream of the area where water quality recovers from the effects of mining, construction, and urban activities upstream (USGS, 1979). The Blue River from Dillon Dam to the confluence with the Colorado River below Kremmling is designated a Gold Medal fishery.

Although the Division of Wildlife assessment has not been completed in 2001, preliminary results indicate that fishery in the Blue River through Silverthorne has declined since its designation as a gold medal fishery.

The WQCD water quality monitoring data for the Blue River below Dillon Reservoir during the period 1979-1987 were analyzed by NWCCOG for the 1988 208 Plan. Occasional exceedances in the numeric standard for cadmium were observed. This finding was verified in the Two Forks EIS. The WQCD water quality monitoring data for the Blue River below Dillon Reservoir during the period 1988-1994 were analyzed for cadmium. Of 43 samples, there were 8 detections of cadmium with no exceedances of numeric standards. Since April of 1992 cadmium has not been reported above the detection limit.

Summit County High School no longer monitors water quality of the lower Blue River at the Silverthorne Factory Stores as part of the Division of Wildlife's River Watch Program. November 1992-January 1994 data does not include metals analyses. Dissolved oxygen concentrations range from 5 to 10 mg/L (the standard for coldwater aquatic life is

6 mg/L, and 7 mg/L when fish are spawning). Only once was dissolved oxygen observed at less than 6 mg/L.

Summit County Middle School monitors the Blue River above Bushee Creek below Silverthorne as part of the Division of Wildlife's River Watch Program. Data available is from November 1992 through February 1994. Dissolved oxygen (7 - 13 mg/L) and pH values (7.7 - 8.4) are excellent for aquatic life protection. Hardness values ranged from 76 - 162, with an average of 100. Monitoring occurred between 1992 and 1998. Total cadmium was detected in 10 of 40 samples, but levels never exceeded 0.39 ug/L total cadmium. The standard for cadmium at 100 hardness is 2.24 ug/L dissolved cadmium.

In 1999 the Summit Water Quality Committee received the results of the special study titled “Effects of Urbanization on Water Quality in the vicinity of Silverthorne, Summit County, Colorado”. The study was designed to provide representative information on potential water quality impairment caused by development in and near the Town. The results indicated that development caused mobilization of suspended solids, soluble phosphorus, and particulate phosphorus. There is also some mobilization of ammonia, but this is not very significant. Mobilization of heavy metals in soluble form is minor or undetectable.

Monitoring (1985 -1989) conducted by the Summit Water Quality Committee (SWQC) indicates annual total phosphorus concentrations ranging from 0.011 to 0.016 mg/L on the Blue River just above Green Mountain Reservoir. In 1993, phosphorus loading to Green Mountain Reservoir was the highest since 1985, although point source loading was the lowest on record. The Two Forks EIS reported no exceedances for the metals cadmium, copper, lead or zinc on the Blue River above Green Mountain Reservoir.

West Grand High School monitors water quality at two stations on the Blue River below Green Mountain Reservoir: Knorr Ranch road bridge; and Trough Road. Total metals data is collected at these stations. Dissolved oxygen and pH at these stations appears good for aquatic life. Total cadmium was occasionally detected, with the highest value of 0.33 ug/L being observed. Total zinc was also regularly detected, with values ranging from 0 to 78 ug/L between 1992 and 2000. Assuming an average hardness of 100, the chronic dissolved zinc standard would be 117 ug/L.

2.7 Green Mountain Reservoir (Blue River Stream Segment 17)

Average growing season total phosphorus concentrations in Green Mountain Reservoir were 9.0 ug/L in 1993, just below the median values for the last ten years [SWQC Lake Dillon/Green Mountain Reservoir Monitoring Report, 1993]. Average growing season chlorophyll concentrations in 1993 were 3.6 ug/L, higher than the median value over the last ten years of 3.0 ug/L. The hydraulic residence time in 1993 (0.37 years) was also above the ten-year median value of 0.35 years. Based on the seasonal chlorophyll and Secchi disk depth (3.4 meters in 1993, ten year median 3.2 meters), Green Mountain Reservoir can be classified as a mesotrophic reservoir.

In 1999 the hydraulic residence time in Green Mountain Reservoir was 0.29 years. The growing season average phosphorus concentration in the reservoir was 7.6 ug/L and the growing season annual average chlorophyll concentration was 2.2 ug/L. The Secchi disk depth average for 1999 was 4.4 meters, which was the highest annual average (a

good thing) ever observed by the Summit Water Quality Committee's Green Mountain Reservoir sampling effort.

Green Mountain Reservoir underwent an analysis of the lake's trophic status and sources of nutrient enrichment study that began in 1987. This study, sponsored by the SWQC, the Colorado River Water Conservation District and the Denver Water Department was completed in 1990 and documented the trophic state indicators and nutrient sources in relation to land use. Results indicated that phosphorus concentrations in the Green Mountain Reservoir watershed are higher than the Dillon Reservoir watershed. Otter Creek, a tributary to the Reservoir has been identified as carrying sediment and elevated phosphorus loads that come from natural geological sources. The study found that 1/4 of the phosphorus reaching Green Mountain Reservoir comes from Dillon Reservoir, 1/4 from background runoff, 1/4 from agricultural land use, and the final 1/4 from all other sources combined. Point sources account for approximately 2%, and septic systems account for approximately 1/8 of the total load (based on work done on septic systems upstream of Dillon Reservoir).

Hydraulic retention time was found to be the most significant controlling factor in the growth of algae in the Reservoir. Full expression of algal growth in the reservoir does not occur until the hydraulic residence time increases to 0.8 years, and the average hydraulic residence time under present operating conditions is about 1/3 of this (0.27 years). The factor most responsible for algal concentrations, management of reservoir operations, is not subject to water quality control regulations. According to statute (CRS 25-8-104-1), "no provision of this article shall be interpreted so as to supersede, abrogate, or impair rights to divert water and apply water to beneficial uses . . .." Thus numeric standards for nutrients cannot, by law, impair the beneficial uses of the reservoir. Nutrient standards are meaningless without recognition of the operational characteristics of the reservoir. It is not recommended that nutrient standards be applied to Green Mountain Reservoir unless it can be worked out to optimize water quality issues through operational management without impairing water rights.

2.8 Watershed Instream Flows

Appendix 14 lists the Colorado Water Conservation Board's (CWCB) instream flow filings in the Blue River watershed. Colorado statute (CRS 37-92-102(3) recognizes that preserving the natural environment to a reasonable degree, through the protection of instream flows and maintenance of natural lake levels in natural lakes is a beneficial use of water. Under the same statute, the Colorado Water Conservation Board is declared the exclusive agent authorized to appropriate water rights for the purpose of preserving the natural environment, although water rights can be donated to the CWCB for instream flow protection. It is also stated that the acquisition of the water rights to protect minimum instream flows has to be made within the context of existing water rights appropriation regulations. Minimum instream flows are therefore subject to appropriation dates, and the CWCB can only call out water rights junior to their own for maintenance of those flows. Most of the appropriation dates in the Blue River watershed are between 1977 and 1989.

A table with minimum instream flow information, including the stream name, length of segment, amount of flow and appropriation date for all CWCB instream flow appropriations in the watershed can be found in Appendix 14.

The CWCB appropriation flows, determined in consultation with the Division of Wildlife and the Division of Parks and Outdoor Recreation, are the flows necessary "to preserve the natural environment to a reasonable degree" (CRS 37-92-102(3)). The fact that the CWCB has filings for these instream flows does not ensure that stream flows will always exceed the minimum necessary to protect the natural environment, as the water rights associated with these flows have relatively junior appropriation dates. Exercise of water rights that are senior in date to the CWCB instream flow appropriation dates can result in stream flows lower than the CWCB appropriation amount.

3.0 WATER QUALITY ISSUES

3.1 Point Source Issues

Point source (discrete, identifiable water pollutant discharges) problems in the Blue River watershed were extensively evaluated by the Colorado Department of Health in 1974 as part of the Blue River Basin 303(e) Plan. Point source treatment needs, consolidation of wastewater treatment facilities, waste load allocations, treatment alternatives and other related matters were addressed in the basin plan. The principal problems included the needs for phosphorus removal capability at wastewater treatment facilities to protect Dillon and Green Mountain Reservoirs from accelerated eutrophication and the feasible extent of providing service to relatively rural parts of the basin. Since the adoption of the basin plan in 1974 and the 1978 version of the 208 Plan, the development of wastewater treatment facilities has generally proceeded in accordance with its recommendations. Facility plans under Section 201 of the Clean Water Act have defined the precise treatment mechanisms and locations for wastewater treatment and have implemented the recommendations of both the 208 and basin plans.

3.1.1 Municipal Discharges

The larger (over 10,000 gallon per day) point source discharges in the Blue River watershed are municipal or domestic wastewater treatment plants, listed in Table 7 along with their Colorado Discharge Permit System number and their hydraulic capacity.

Table 7. Blue River Watershed Domestic Wastewater Treatment Facilities

CDPS #	Facility Name	Responsible Party	Hydraulic capacity MGD
CO-0041581	South Blue River	Breckenridge SD	0.012
CO-0029211	McDill Placer	Breckenridge SD	0.020
CO-0029611	Skiers Edge	Breckenridge SD	0.014
CO-0027197	Valley of the Blue	Breckenridge SD	0.004
CO-0045420	Iowa Hill	Breckenridge SD	1.500
CO-0021539	Farmers Korner	Breckenridge SD	1.50
CO-0042731	Vail Pass	CDOT	0.012
CO-0020451	Copper Mountain	Copper Mt. Consol.	0.700

		Metro D	
CO-0020451	Frisco	Frisco SD	1.200
CO-0023876	Arapaho Basin	Dundee Reality	0.035
CO-0027995	Keystone Summit House	Keystone Resorts	0.021
CO-0029955	Snake River	Summit County	1.25
CO-0020826	Blue River	Silverthorne/Dillon Joint Sewer Authority	2.700

A more detailed list of the wastewater treatment facilities in NWCCOG's Region XII is included in Appendix 3. This appendix includes information on the region's wastewater treatment plants' capacities, average and peak flows, treatment type, biosolids processing and disposal practices, permit expiration dates, discharge locations, condition, and expansion plans. The sanitation districts in Summit County have or are developing agreements with Climax Molybdenum Company for a joint biosolids disposal program at Climax Mine.

Snake River Wastewater Treatment Plant

The Snake River Wastewater Treatment Plant discharges to Soda Creek, directly upstream of Dillon Reservoir. The plant is an activated sludge facility with tertiary treatment for phosphorus removal. It is currently under a $17 Million expansion in 2001-2002 which will increase capacity to 2.6 MGD and serve the needs of the service area's projected build-out equivalent population of 10,400 taps. The current hydraulic capacity of the facility is 1.25 MGD and the organic capacity of the facility is 3,130 pounds of BOD per day. The utility's discharge permit is currently under administrative extension and review by CDPH&E with plans to issue the renewal in 2002. A facility plan has been developed for the Snake River plant which includes the possibility of discharging to the Roberts Tunnel a portion of plant effluent containing no more than Summit County's annual phosphorus allocation to Chatfield Reservoir.

Breckenridge Sanitation District

Farmer's Korner Wastewater Reclamation Facility
The main Breckenridge Sanitation District wastewater treatment facility located at Farmer's Korner, adjacent to Dillon Reservoir discharges to a diversion channel from the Blue River which discharges to Dillon Reservoir. The wastewater treatment plant is a 3.0 MGD activated sludge facility with tertiary treatment for the removal of phosphorus. The organic capacity of the Farmer's Korner facility is rated at 8,760 pounds of BOD per day. The discharge permit for this facility expires November 30, 1999, but has been administratively extended in order to evaluate ammonia effluent limits in light of new mixing zone guidance.

Iowa Hill Wastewater Reclamation Facility
A new plant named the Iowa Hill facility with an 1.5 MGD flow capacity was permitted in 1999. The organic capacity of the facility is rated at 3,753 pounds of BOD per day. The

facility includes: an influent pump station, rotary bar screen and grit removal, activated sludge, biological aerated filters, floculation/ sedimentation, final filtration, chlorine disinfection and dechlorination. The facility provides ammonia and phosphorus removal. An interim limit of 10 mg/L of ammonia until December 2002 has been included in the discharge permit to allow the State Water Quality Control Division to evaluate the cost of additional ammonia treatment. The facility was designed with an ultimate hydraulic capacity of 3.0 MGD. The discharge permit expires December 31, 2004.

South Blue River Wastewater Reclamation Facility
A new South Blue River Plant (rotating biological contactor) was constructed in 1995 and is now owned and operated by the Breckenridge Sanitation District. The facility's hydraulic capacity is rated at 0.04 MGD and organic capacity is rated at 123 pounds of BOD per day. The plant currently treats an average of 14,000 gallons of sewage per day. The new plant is designed to accommodate additional areas in the upper Blue River area and will allow abandonment of the Skier's Edge Wastewater Treatment Plant. The District has submitted a site application for an increase in the capacity of the facility to 0.1 MGD. The discharge permit for this facility expired March 31, 1999, but has an administrative extension.

Valley of the Blue Wastewater Reclamation Facility
The facility is an extended aeration package plant which discharges to a septic tank and leach field. The leach field was replaced in 2000. The hydraulic capacity for the facility is rated at 2,700 gallons per day and the hydraulic capacity is rated at 5 pounds of BOD per day. The discharge permit for this facility expired March 31, 1999, but has an administrative extension.

McDill Placer Facility
In 1987 the Breckenridge Sanitation District expanded its boundaries to include the McDill Placer, Skier's Edge and Valley of the Blue developments. The facility is hydraulically rated at 0.015MGD and the organic capacity is rated at 23 pounds of BOD. The McDill Placer system currently discharges an average of 2,500 gallons per day and is an activated sludge plant which discharges to a leach field. The Quandry Condominiums system was abandoned and connected to the Skier's Edge facility, an activated sludge plant discharging to a soil absorption system with an average daily discharge of 7,000 gallons per day. The Valley of the Blue discharges an average of 900 gallons per day (1993). It serves 8 town homes and discharges to a septic system and leach field. The discharge permit expires March 31, 1999 but has an administrative extension.

The Swan's Nest wastewater treatment facility is a 0.05 MGD activated sludge (extended aeration) with chemical addition and filtration provided for phosphorus removal between Breckenridge and Farmer's Korner. Soil absorption beds are utilized for effluent discharge. The Water Quality Control Commission has indicated it would not permit an expansion of this facility. The metropolitan district, in 1998, is in negotiation with Breckenridge Sanitation District for inclusion of Swan's Nest into the Breckenridge Sanitation District boundaries and probable abandonment of the facility. This facility has been abandoned and the area has been incorporated into the Breckenridge Sanitation District's service area. The area's wastewater is treated at the Farmers Korner facility.

Small municipal wastewater discharges to the Upper Blue River have been a source of

concern to water quality officials for over 15 years. These include the Quandary Condominiums, Skier's Edge, Valley of the Blue, and McDill Placer wastewater treatment plants. These facilities had a history of non-compliance with the Colorado Department of Public Health and Environment requirements prior to management and operation by the Breckenridge Sanitation District. Plants have been consolidated, upgraded, and included in the Breckenridge Sanitation District service area. As a result, all plants are now meeting or exceeding Department regulations.

In the January 8, 2001 Dillon Reservoir Control Regulation Rulemaking Hearing, Breckenridge Sanitation District's phosphorus wasteload allocations for each facility were consolidated into one wasteload allocation. Instead of seven individual allocations, one allocation of 708.8 pounds of phosphorus per year for the District is shown in the regulation (5-CCR 1002-71). This change was made at the request of the District and the Summit Water Quality Committee to provide streamlined facility consolidation, flexibility in operation, and improved reporting to the Division.

Vail Pass Rest Area

The Vail Pass Rest Area is served by a 12,000 GPD sequencing batch reactor facility with chemical/physical phosphorus removal and discharging to two leach fields. The organic capacity of the facility is rated at 52 pound of BOD per day. The facility is owned and operated by the Colorado Department of Transportation. The permit for this facility expires December 2003. CDOT has experienced staff operation and maintenance problems with this facility. The discharge permit for this facility expires December 31, 2003.

Copper Mountain Consolidated Metropolitan District

Copper Mountain Consolidated Metropolitan District wastewater treatment plant discharges to Tenmile Creek, just above the confluence with West Tenmile Creek. The plant is a 0.7 MGD activated sludge facility with tertiary treatment for phosphorus and ammonia removal. The District has entered into an agreement with Frisco Sanitation District in order to acquire an increase of 40 pounds to their phosphorus wasteload allocation. Frisco Sanitation District will connect serve 80 homes currently on septic systems. The phosphorus load from 80 homes with an estimated 3 persons per home is calculated at 1 pound per home. This increased wasteload allocation for Copper Mountain Metro District to 205 pounds of phosphorus has been reflected in the Dillon Reservoir Control Regulation #71 (5CCR 1002-71). The current plant capacity is 0.7 MGD, and has reached 95% of hydraulic capacity during peak season in 2002. Need for expansion may occur by 2002. The discharge permit expires December 31, 2003.

Frisco Sanitation District

The Frisco Sanitation District wastewater treatment plant discharges to Dillon Reservoir at Miner's Creek. The plant is an activated sludge facility with tertiary treatment for the removal of phosphorus. Frisco expanded their plant capacity in 1994 at a cost of 5.4 million dollars. Current hydrologic capacity is rated at 1.2 MGD, which will serve 4,000 taps. The organic capacity of the facility is currently rated at 2,500 pounds of BOD per

day. The utility is applying for a capacity upgrade to 1.65 MGD, which is expected to build out Frisco. Centrifuges were added to the treatment plant in 2001 for sludge disposal. The permit is currently under administrative extension while the Water Quality Control Division evaluates the permit under the new State mixing zone and antidegradation guidance documents.

Silverthorne/Dillon Joint Sewer Authority

The Silverthorne/Dillon Joint Sewer Authority (JSA) wastewater treatment plant is a 2.7 MGD facility with a conventional activated sludge process, tertiary treatment for phosphorus and aerobic digestion of biosolids. The organic capacity of the facility at 2.7 MGD is rated at 5,840 pounds of BOD per day. The facility provides tertiary treatment for removal of phosphorus and ammonia. JSA has completed the design for the expansion of the plant to 4.0 MGD. Expansion is scheduled to take place in phases with the first phase to occur in 1999 and additional work to occur in 2005. The 1999 expansion will expand the tertiary portion of the facility and take the plant from 7,650 to 10,000 equivalent residential units. The Silverthorne/Dillon wastewater treatment plant discharges to the lower Blue River at the north end of the Town of Silverthorne. The discharge permit expires January 31, 2006.

The ski areas in the Blue River watershed either have their own wastewater treatment plants (Arapaho Basin, Keystone Summit House and Copper Mountain), or are connected to a municipal wastewater treatment facility (Breckenridge and Keystone).

3.1.2 Population Statistics and Projections

Population projections for the county and the municipalities in the Blue River watershed are listed in Table 8. Summit County's permanent population in 1980 was 8,848, in 1990 it was 12,881, and in 2000 it was 23,548. The percent change between 1980 and 1990 was 45.5% and between 1990 and 2000 it was 82.8%.

Table 8. Summit County Population Estimates and Projections

	Permanent Population[1]					
Entity	1980	1990	2000	2000 projected[2]	2010	2020
Summit County	8,848	12,881	23,548	15,799	31,340[3]	37,587[3]
Blue River	230	440	685	551		
Breckenridge	818	1,285	2,408	1,626		
Dillon	337	553	802	690		
Frisco	1,221	1,601	2,443	2,028		
Montezuma	17	60	42	71		
Silverthorne	989	1,768	3,196	2,298		

[1]: Information from the US 2000 Census, Denver Post Census 2000 special report, March 20, 2001

[2]: 1996 NWCCOG 208 Plan based on State Demographer's 1994 projections

[3]: Population projections: State Department of Local Affairs, State Demographers Office,

October 2000 projections

Table 8 (continued). Summit County Population Statistics by Area*

Area	1990			2000			2010		
	Resident	2nd home	Peak pop.	Resident	2nd home	Peak pop	Resident	2nd home	Peak pop
County	13,123	58,622	88,750	20,946	80,450	121,496	28,867	116,789	167,332
Snake	1,875	9,487	18,053	2,939	14,862	24,801	4,013	20,788	32,101
U Blue	4,140	22,218	30,977	6,437	29,869	42,306	8,833	44,497	59,819
Copper	151	3,810	8,549	229	4,590	9,819	346	6,540	12,549
Frisco	2,023	5,686	7,962	3,535	9.078	13,113	4,907	12,847	18,304
S/D	4,638	16,473	21,956	7,360	20,829	29,689	10,190	30,248	41,988
L Blue	296	938	1,253	446	1,222	1,768	577	1,869	2,571

*: Information from Summit County Planning Department, Table A-13, Jerry Vest, 2000.

As growth continues in the watershed, water diversions will increase, leading to lower instream flows and increased water consumption. Stream flows approaching the CWCB minimum instream flows will occur on a more frequent basis. Augmentation plans for maintaining minimum stream flows will need to be critically examined by the State Engineer's Office and the CWCB.

As future wastewater treatment plant expansions are considered, it is critical that the water and sanitation districts consider the effects of increased diversion on instream flows and the effects of movement of return flows. Reuse of wastewater should be examined as one method of reducing stream diversions.

3.1.3 Industrial Discharges

Industrial discharges in the Blue River watershed include: construction dewatering activities throughout the watershed, stormwater permits for construction activities throughout the watershed, Climax Mine discharge to Tenmile Creek and gravel mining activities along the upper and lower Blue River. Other than Climax Mine, these activities have, for the most part, small quantities of discharge, but cumulatively are significant. Occasionally these discharges affect water quality, but usually these effects are temporary in nature. The greatest concern with these discharges is the cumulative impact (especially with respect to sediment) these discharges have on the Blue River.

3.1.4 Point Source Issues - Summary

In summary, the current point source water quality issues in the Blue River watershed are:

Nutrient enrichment due to both point and (primarily) non point source contributions of phosphorus to Dillon and Green Mountain Reservoirs with potential to cause excessive algal growth. Although the point source contribution of phosphorus is regulated to the maximum extent feasible with advanced waste water treatment, increases in phosphorus loading is expected as a result of future growth. Maintaining phosphorus loading to

Dillon Reservoir at 1982 levels requires a coordinated effort of point and nonpoint source control as described in Appendix 7. Reduced releases from Dillon Reservoir may concentrate nutrients in Green Mountain Reservoir and increased residence time in either reservoir will increase algal productivity.

Continuing to avoid ammonia toxicity problems in the Blue River. Current levels of wastewater treatment are adequate to meet existing water quality standards, but decreased levels of stream flows due to upstream water development projects may require higher levels of treatment to maintain existing water quality in the Blue River. Significant reductions in annual average stream flow will result in corresponding increases in pollutant concentrations downstream of point source discharges.

Instream depletions are becoming greater. Both diverters and dischargers can help to alleviate the problem through water conservation and wastewater reuse programs. Pump back systems and satellite wastewater treatment plants operated by the major sanitation districts are other methods which should be explored to alleviate instream flow depletions.

Elevated metal and sulfate levels in Tenmile Creek, which result, in part, from the Climax mine.

Gravel mining operations adjacent to the Blue River have, upon occasion, had releases of significant suspended and dissolved solids.

3.2 Point Source Recommendations

Policy 1 - Water Quality; Policy 2 - Water Use and Development; Policy 4 - Domestic, Industrial and Municipal Wastes; and Policy 6 - Management System Recommendations; should be implemented by the appropriate local agencies in the Blue River watershed, in order to address the point source issues listed in Section 3.1.3.

As future wastewater treatment plant expansions are considered, it is critical that the water and sanitation districts consider the effects of increased diversion on instream flows.

The antidegradation rule should be used appropriately by the Water Quality Control Division prior to triennial review of basin water quality standards to evaluate the extent of potential changes in water quality.

Reuse of wastewater should be examined as one method of reducing instream flow diversions.

The County should examine methods for alleviating the ground water situation (lowering of the ground water table) in the Upper Blue watershed, such as rezoning, and requiring water conservation and the use of native plant landscaping.

The County should examine opportunities to connect homes in the un-sewered subdivisions adjacent to the town boundary to the Silverthorne/Dillon Joint Sewer Authority wastewater facility. The cost of connection has been estimated at $15,000 per lot for water and $20,000 for sewer service [Letter to South Forty Property owners from

Rick Pocius, County Engineer, June 4,1999].

3.3 Nonpoint Source Issues

The major nonpoint source water quality issues in streams and lakes in the Blue River watershed include: the effects of both existing and inactive mining activities; urban and construction activities (including septic systems); agricultural activities (specifically silvicultural), and hydrologic modifications.

3.3.1 Mining Impacts

Excessive trace element concentrations are found in the Upper Blue, the Snake River and Tenmile Creek as a result of drainage from historical mining areas. Activities are currently underway in the Snake River basin, as previously discussed in section 2.2 and in French Gulch in section 2.3 to decrease water quality impacts from mines in these areas. Climax Mine is actively reclaiming the mine site and water quality downstream of the mine is improving, however there are numerous "orphan sites" located on federal lands, which continue to impact water quality in Tenmile Creek.

Additionally, hydrologic modification impacts can result from mining activities. An example of this is the Blue River between the confluence of Swan River and Breckenridge. Historical use of mechanical dredge boats for mining placer gold has resulted in the loss of surface water flows during low stream flow periods, loss of channel stability, and loss of aquatic and riparian habitat. Although not a direct impact to water quality, this activity has resulted in significant negative impact to the classified aquatic life beneficial use.

3.3.2 Urban and Construction Activities

Relatively high (compared with background) nutrient loads are found in the tributaries to Dillon and Green Mountain Reservoirs. Maintaining phosphorus loading to Dillon Reservoir at 1982 levels will require a coordinated effort of point and non point source control. Actions taken to date to control these sources include locally adopted regulations for construction activities and stream setbacks. In 1993 the Summit Board of County Commissioners passed a resolution approving a Water Quality Mitigation Plan. In 1994 the SWQC began work on improvements to the phosphorus trading procedures that were originally approved by the Water Quality Control Commission in 1987. In addition, a number of water quality projects for the control of runoff from urban areas have been implemented in Summit County in an effort to reduce nutrient loads. Projects in Breckenridge, Dillon, and Frisco include underground vaults and groundwater infiltration to trap sediment and reduce phosphorus loads to Dillon Reservoir. These projects are being monitored to document their effectiveness. Other significant activities include the continued implementation of a stormwater management plan for the Town of Silverthorne, which incorporates stormwater detention for pollutant removal.

Inconsistent enforcement of erosion control and stream setback regulations by local governments continues to be an issue related to urban and construction activities. In 1998 the Summit Water Quality Committee implemented an Erosion and Sediment

Control Specialist program to address this issue (see Chapter 4). This project has received substantial local public support and is being used in 2002 as a model for other watersheds.

The impact of urban lawn irrigation is another example of water quality impacts from urban activities, resulting in increased nutrient and other pollutant loads and increased water consumption.

The expanded use of septic systems can increase nutrient loading. Documented water quality problems from septic systems include high levels of bacteria in private and public water supplies and elevated levels of nutrients [Septic Tank System Effects on Ground Water Quality, Canter and Knox, 1985; SWQC An Evaluation of Methods to Control Phosphorus Contributions to Lake Dillon From Onsite Sewage Disposal Systems, 1988]. Regulation of septic systems is performed by Summit County utilizing state and local criteria. The requirements for installation of septic systems are currently being rewritten to comply with new state guidelines and County interests. In Summit County, the Dillon Reservoir Clean Lakes Study and subsequent special studies have documented the contribution of nutrients from areas served by septic systems. At present it is not clear if the elevated nutrient levels in Blue River watershed which have a relatively high number of septic systems are due to a few failing systems or the general performance of septic systems. After a thorough review of existing literature it was determined that the most cost effective approach to controlling phosphorus from septic systems is by targeting systems which perform poorly and correcting those systems, rather than requiring more sophisticated designs on new systems being installed.

A study was sponsored over two years by the Summit Water Quality Committee entitled "The Use of Nitrogen Stable Isotope Signature for Nitrate as an Indication of contamination in Well Water Subject to Septic System Influences in Summit County, Colorado". This report (2000) summarizes the findings of the nitrogen isotope concentrations and nitrate concentrations in wells from three areas of Summit County that are served by residential septic systems. Overall, the results indicate that all of the wells show some proportion of nitrogen derived from septic system effluent, with proportions varying from 30% to 100%.

Summit County's Environmental Health Department has tested private drinking wells since 1994 in response to the Board of County Commissioners adoption of the Summit County Water Quality Mitigation Plan, which placed significant responsibility for man-made nonpoint source phosphorus loading to Dillon Reservoir on septic systems. The Department focused on total coliform and nitrate as parameters for sampling, as there are no drinking water standards for phosphorus and nitrate and bacteria are known to move more readily than phosphorus through soils under certain conditions. Sampling has been conducted on both a "shotgun" approach and in more focused efforts (subdivision level). Several areas have been identified with what the County would consider possible emergent drinking water quality issues related to ISDS, but much more intensive study is necessary to confirm this relationship. Almost 1,200 unique wells have been sampled between December 1994 and March 2001, with 8.2% of the wells having positive bacterial samples (this includes repeat samples). Of 2,370 well nitrate samples, 83.9% were considered to be at background levels (below 2 mg/l nitrate), 16.2% of the total nitrate samples from drinking water wells were considered above background concentrations. 0.5% of the samples were above the 10 mg/L drinking water standard. Subdivisions of the county that had relatively high incidences of

bacteria detections and above background nitrate concentrations included Ten Mile Vista, Frisco Terrace, Lakeview Meadows, and 39 Degrees North.

3.3.3 Hydrologic Modifications

Water diversions reduce instream flows. Both trans-basin and in-basin diversions impact water quality in those segments in which the water is lacking. Trans-basin diversions, which often occur high in the watershed, reduce flows below their point of diversion, without a point of return in the basin, thus being 100% consumptive in the basin of origin. In-basin diversions are generally on the order of 10-50% consumptive with the majority of the wastewater returned to the stream at some point downstream.

3.3.3.1 Hydrologic Modifications Associated with Trans-basin Diversions

Increased trans-basin diversions occurring above Dillon Dam would increase the average concentration of pollutants in the lower Blue River through the reduction of dilution flows. The average virgin flows for the Blue River, 1958-1982, were calculated to total 349,059 acre feet per year for the entire watershed (Summit County Small Reservoir Feasibility Study, September 1989). Denver Water's PACSM model calculates the virgin flow of the Blue River at the mouth for 1958 – 1982 to be 372,246 acre-feet [Denver Water correspondence to NWCCOG March 13, 2002, Chris Schuyler-Rossie]. There is 50 cubic foot per second bypass requirement from Dillon Reservoir to maintain minimum instream flows necessary to protect the environment to a reasonable degree.

Trans-basin diversions could divert 2/3's of the virgin yield of the Blue River above Dillon Reservoir through the existing Blue River system. Table 9 lists the current trans-basin diversions which take water out of the Blue River, the amount diverted in the 2000 water year (November 1999 to October 2000, and the ten-year annual average.

Table 9. Blue River Watershed Trans-basin Diversions

Diversion	Principal owner	Quantity (acre-feet)	
		2000	10-year avg
Roberts Tunnel	Denver Water Board	94,768	64,689
Hoosier Tunnel	Colorado Springs/Aurora	9,295	9,325
Vidler Tunnel	Vidler Water Company	332	638
Straight Creek Tunnel	Coors, CDOT	220	289
Boreas Pass Ditch	Englewood	124	167

In 2000, 104,739 acre-feet of water were diverted to the eastern slope from the Blue River watershed [2000 Annual Report, Division 5 Water Resources]. To put this in perspective, in the 2000 water year 150,576 acre-feet of water flowed past the USGS gage 0.3 miles below Green Mountain dam [USGS, 2000 Water Resources Data, Colorado Volume 2]. The trans-basin water diversions, therefore account for approximately 40% of the total stream flow in the Blue River watershed.

Existing water development projects have had an effect on the water quality and Colorado River salinity. Diversion of snow melt high in the basins with very low salinity

results in less dilution of downstream salinity inputs.

Wastewater treatment needs in the area have been affected by the creation of reservoirs, requiring the provision of advanced wastewater treatment for phosphorus removal to prevent eutrophication.

Existing wastewater treatment levels have been based on meeting water quality standards under existing hydrologic conditions. Changes in the operations of the reservoirs to increase system yields, including reduction in residence times, second fill rights, and routing of new sources of nutrients to Dillon and Green Mountain Reservoirs, have the potential to modify future wastewater treatment requirements to maintain the same level of water quality. The concern is that discharge permit limits can be made more stringent to meet instream water quality standards, when actual discharge quantities have not changed. For example, plants discharging to Dillon Reservoir could have significantly more stringent permit limits, and thus increased treatment costs, as a result of changes in Dillon Reservoir operations. This was made very obvious when the Breckenridge Sanitation District conducted a mixing zone study in the spring of 1995 under low reservoir elevations and in the fall of 1995 when the reservoir was full [Breckenridge Sanitation District, personal communication, 1995].

Wastewater treatment levels for the Silverthorne/Dillon treatment plant downstream of Dillon Reservoir may also be affected by changes in the operational hydrology which are currently being planned. Existing treatment levels are determined, in part, by the one day in three year low flow event (1E3, used for establishing acute level discharge limits) and 30 day in three year low flow events (30E3, for establishing chronic level discharge limits). With consistently lower stream flows, average concentrations of pollutants will increase and the flow available for dilution will also decrease. Because ambient conditions are considered in effluent permit discharge limitations, more stringent permit limits could result from increased average concentrations of pollutants even though flow levels are not below the permit's low flow criteria.

The State’s antidegradation policy for streams which are not "Use Protected" requires waters to be maintained at their existing quality unless lowering water quality is necessary to accommodate important economic or social development in the area. Plant discharge concentrations would have to decrease if stream flows decreased, in order to maintain the existing water quality, although the antidegradation policy is not applicable unless a plant expands or the permit expires. These triggers will most likely pass the "necessary to accommodate" test.

The ability of the Blue River downstream of Dillon Reservoir to carry peak flows without channel cutting and the loss of aquatic habitat has been diminished as a result of lower flows. Channel stability impacts have occurred in the Blue River downstream of Dillon Reservoir due to channel encroachment by vegetation.

Green Mountain Reservoir has the potential for increased or decreased eutrophication as a result of modified operational criteria affected by water resource development activities. The hydraulic residence time, dictating the algal concentrations will impact the trophic status of the reservoir.

3.3.3.2 Hydrologic Modifications Associated with In-basin Diversions

In-basin diversions, although not on the scale of trans-mountain diversion, also impact water quality in the Blue River. This is especially true in the Blue River Segments 1 and 2, where water is diverted at Goose Pasture Tarn to serve the Breckenridge community, and the return flows are to Dillon Reservoir. In that intervening distance are numerous pollutant sources, such as French Gulch, urban, industrial, and construction activities that impact the river. The lower stream flows diminish the stream's ability to dilute these pollutant sources.

Hydrologic modification impacts due to snowmaking are also a significant impact. These diversions occur during the time of lowest stream flows, when the streams are least able to meet fishery flow requirements, and returns occur when least needed - during the spring runoff. Snow making is estimated to be approximately 20% consumptive by the State Engineer's Office Division Five Engineer, as part of the work done on the Clinton Reservoir agreement [Scott Fifer, Resource Engineering, personal communication, 2001]. These impacts are also discussed under recreational activities (3.3.5).

3.3.4 Agricultural Activities

Timbering activities which disturb large areas of land can produce a significant water quality impact. A study funded by the Summit Water Quality Committee examined three types of forest management practices in Summit County: control (no action); overstory removal (partial removal of timber); and clear cut (complete removal of timber). Eight sites were studied over a two-year period. The combined data show beyond reasonable doubt (better than 90% confidence) that increased phosphorus loads may result from areas subject to overstory removal and that clear cutting can increase the phosphorus load by as much as 30 times higher than background phosphorus yields. Thus clearcutting, in particular, could be a significant source of phosphorus for Dillon Reservoir. For example, a 1,000 hectare clearcut would be estimated to yield 1,200 pounds of phosphorus (the regulatory load limit to Dillon Reservoir is approximately 8,500 pounds per year based on an inflow of 212,000 acre feet).

Agricultural activities in the lower Blue River area (including cattle grazing and hay production) contribute phosphorus and nitrogen to the aquatic environment, although the significance of this contribution is unknown.

3.3.5 Recreational Activities

Numerous recreational activities impact water quality. These include golf courses; snow making for skiing; and activities associated with water features such as fishing, rafting, etc.

Development of new homes and associated infrastructure, secondary impacts from recreational development, are a significant impact on water quality.

Some of the activities associated with skiing which impact water quality include: snowmaking (reduced stream-flows at low flow times), large scale soil disturbance activities during construction of ski runs, runoff from denuded slopes that are not well vegetated, increased urbanization and impervious surfaces, and habitat loss (wetland

and riparian areas).

Golf courses impact water quality through fertilizer and pesticide runoff, large scale soil disturbance during construction, increased runoff, and watering practices.

Activities associated with water features can impact the riparian and aquatic community as well as water quality. Erosion from foot and vehicle traffic; increased stream bottom disturbance; inadequate toilet facilities; and littering can all lead to water quality impacts.

3.4 Nonpoint Source Recommendations

Policy 1 - Water Quality; Policy 2 - Water Use and Development; Policy 3 - Land Use and Development; Policy 4 - Domestic, Municipal, and Industrial Wastes; and Policy 5 - Chemical Management; in Volume I should be implemented by the appropriate management agencies in the Blue River watershed to address nonpoint source issues discussed in Section 3.3.

Water conservation practices, including in-home, landscaping, and wastewater reuse need to be vigorously pursued.

Municipal and county nonpoint source water quality improvement projects should continue to be supported by local, state and federal funding.

It is recommended that the County explore opportunities for incorporation of areas adjacent to Silverthorne currently served by septic systems (excluding Ruby Ranch, because of the size of the parcels) into the Silverthorne/Dillon Joint Authority wastewater treatment system.

The Summit Water Quality Committee should continue to monitor and evaluate water quality throughout the watershed. Green Mountain Reservoir should continue to be monitored on a regular basis to assess water quality. This monitoring would be useful in assessing any management changes that might be contemplated.

The Snake River watershed and French Gulch mine sites should continue to be high priority remediation sites.

Collaborative efforts such as the Colorado River Headwaters Forum should continue as a means to integrate water quality and water quantity planning and include consideration of negative water quality impacts of trans-basin diversions, so that constructive arrangements, such as the Clinton Reservoir agreement, can be created.

In-basin storage, or other projects designed to augment or improve instream flows, should be pursued.

Reduction of agricultural impacts in the riparian and wetland areas through the voluntary implementation of best management practices, such as riparian area fencing, intensive grazing management, and bank stabilization, could potentially improve water quality.

4.0 WATERSHED IMPROVEMENT PROJECTS

4.1 Existing Projects

4.1.1 Town of Frisco Stormwater Project

The purpose of this project was to reduce phosphorus concentrations in stormwater runoff from the Town of Frisco into Dillon Reservoir. The project consists of drop inlets, underground sedimentation vaults, and perforated pipe. Four years of monitoring have indicated phosphorus removal levels of 67 to 163 pounds of total phosphorus per year.

The Frisco phosphorus control project was constructed in a joint effort by the Town of Frisco, the Frisco Sanitation District, and the Colorado Department of Health using EPA 319 funding. EPA provided grant funds for half of the project, with the Town and the Sanitation District splitting the other half. Total cost of the project was approximately $180,000. The original project built in 1985 drains 120 acres, with a second project in 1993 draining an additional 20 acres. Additional information can be obtained by contacting the Town of Frisco.

4.1.2 Town of Dillon Stormwater Project

A drainage and water quality enhancement system was incorporated in the "Dillon Town Center Project" and constructed in 1993 and 1994. The drainage improvements included 26 inlets, 7 roof drain connections, 8 manholes, 3 sediment vaults, and various sections of perforated pipe. Total cost of the project was approximately $258,000. Phosphorus removal was an important part of the design because the project discharges to Dillon Reservoir. The project design assumes removal of 24.6 pounds of phosphorus per year, based on modeling. Monitoring for total dissolved phosphorus and particulate phosphorus will commence in 1995 and continue for three years. Additional information can be obtained by contacting the Town of Dillon.

4.1.3 Town of Breckenridge Blue River Restoration

The Town of Breckenridge has completed a three year, $3.5 million restoration project on the Blue River through the core of town. The project re-channelized and lined 2000 lineal feet of the Blue River which was dredged for gold during the early 1900s. Mining operations left the river barren of vegetation and without surface flows for seven months of the year. A liner was installed to achieve year-round surface flows in a new channel designed for 100 year flood stability, fish habitat, and public accessibility. Additional information can be obtained by contacting the Town of Breckenridge.

4.1.4 Town of Breckenridge Stormwater Quality Enhancement Project

The Town of Breckenridge spent $150,000 on storm sewer improvements within the river corridor. Thirty year old storm sewers which previously discharged directly to the river were retrofitted with sedimentation vaults and infiltration galleries to improve water quality. The vaults have a baffling system to trap larger sediments, while the infiltration galleries absorb low flows, reducing discharge to the river. Monitoring has been set up to evaluate the effectiveness of the new system. Additional information can be obtained

by contacting the Town of Breckenridge.

4.1.5 Division of Minerals and Geology Peru Creek Project

Work was begun in the Peru Creek drainage in the late 1970s. A 1979 report by the Division of Mined Land Reclamation (The Restoration of Peru Creek) found that 60% of the metals in the Peru Creek drainage could be attributed to the Pennsylvania Mine, four miles above the Snake River confluence. Work began at the Pennsylvania Mine in Peru Creek in 1985 to reduce metal loading to Peru Creek.

Since 1990 pilot-scale passive mine treatment demonstrations have been conducted in an attempt to address the extreme metals loading discharging from the portal of the abandoned mine. A demonstration Passive Mine Drainage Treatment System involving an innovative hydro-powered acid neutralization system, sludge settling pond, and sulfate reducing bacteria (SRB) treatment cells (constructed by the Volunteers for Outdoor Colorado in 1994, and consisting of three large beds filled with peat, gravel, and sand, through which the mine drainage is directed, have been constructed at the site. The system has not yet been operated due to remaining long-term liability issues, and sludge disposal concerns have yet to be resolved. It is anticipated that resolution of these issues will eventually allow the demonstration project to proceed. Additional information on this project can be obtained by contacting the Division of Minerals and Geology.

A group called the Snake River Watershed Task Force was established in 1999 and has been facilitated by the Keystone Center. The group's mission is "to improve water quality in the Snake River watershed". The objectives of the Task Force are to "obtain better information on the watershed, identify opportunities for improvement, develop criteria to prioritize projects, assist in implementation for projects that meet the Task Force's criteria, and obtain reasonable standards." This group has reviewed and provided input on numerous activities sponsored by individual groups or entities that are members of the Task Force. Studies and activities have included the USGS, EPA, Summit County, the Institute for Arctic and Alpine Research (University of Colorado Boulder), and the Water Quality Control Division. The most recent initiative has been synoptic sampling by the USGS throughout the watershed, and Dianne McKnight's students' work.

4.1.6 Division of Minerals and Geology French Gulch Project

The French Gulch project is located on French Gulch two miles above its confluence with the Blue River near Breckenridge. Since 1989, the Wellington-Oro Mine and mill complex has been studied to characterize the heavy metals loading to French Gulch and the Blue River associated with historic lead-zinc mining activity. Several sources of metals have been identified at the site, including mine and mill wastes sitting in the water table, storm runoff, as well as the mine pool discharge through faults and fractures above shallow areas of the underground workings. Due to the complexity of the site and projected high costs of remediation, the site has been withdrawn as a nonpoint source remediation proposal. Additional information can be obtained by contacting the Summit Water Quality Committee, the Northwest Colorado Council of Governments, or the Division of Minerals and Geology.

Currently Summit County and the Town of Breckenridge are exploring the possibility of purchasing all of the B&B Mine's lands for open space preservation purposes, which includes the Wellington-Oro complex. An Engineering Evaluation/Cost Analysis for the clean-up of the Wellington-Oro Mine Pool is expected to be completed by March of 2002. This document will identify the appropriate response actions and remedial objectives for the site. Discussions through the French Gulch Remediation Opportunities Group (FROG), have focused on a goal of a reproducing brown trout fishery in the Blue River below the confluence of French Gulch. The Division of Wildlife (John Woodling, personal communication, January 2000) has suggesting for a goal of this nature, that a site-specific stream standard of 225 ug/L of zinc would be an appropriate target.

4.1.7 Summit Water Quality Committee Straight Creek Sediment Investigation Project

In 1992 the Summit Water Quality Committee was awarded a $20,000 EPA grant for the identification of sources of sediment to Straight Creek and quantity loads from these sources which would result in acceptable stream conditions. The work was carried out in 1993, and resulted in identification of four sources of sediment and a recommendation for appropriate physical and biological indices to evaluate stream recovery. Additional information can be obtained by contacting the Summit Water Quality Committee.

The Summit Water Quality Committee continues to coordinate the monitoring of physical and biological monitoring efforts associated with the development of a TMDL for Straight Creek, which was approved by EPA in July of 2000. (See next project for description of TMDL goals)

4.1.8 CDOT Straight Creek Sediment Retention Project

Stormwater runoff containing sand and sediment from winter highway maintenance and cut and fill slope erosion along I-70 has impacted Straight Creek. The Colorado Department of Transportation (CDOT) has undertaken many activities to reduce the loadings to Straight Creek. Some of these activities include: construction of small silt fences in the cut-slope ditch (a 319 funded EPA project); collection of sand material through sweeping and cleaning around guard rails; completion of an erosion control project and planned 1995 construction of a maintenance access road to facilitate sediment basin cleanout. The construction costs of the erosion control project, which included 13 permanent sediment basins, 55 acres of fill and cut slope seeding, pipe rundowns and drainage control, was $2,000,000. Many truck loads of sanding material have been collected through sweeping, and approximately 800 tons of highway sand and sediment have been collected by the sediment basins. Additional information can be obtained by contacting the Colorado Department of Transportation, Staff Design Branch.

A TMDL was completed by the Water Quality Control Division in 2000, and approved by EPA in July of 2000. The goal of the TMDL is the attainment of the narrative sediment standard. The water quality targets are: a minimum substrate D50 size of 60 mm or more; a maximum stream pool V* of 0.015; stable stream morphology; and five age classes of brook trout. The TMDL was developed using the participation of the Straight

Creek Clean Up Committee, which included CDOT, US FS, US EPA, NWCCOG, DOW, Summit Water Quality Committee, Summit County, Town of Dillon, and Dillon Valley Water District.

4.1.9 South Blue River Regional Wastewater Reclamation Facility

Breckenridge Sanitation District is undertaking the construction of a South Blue River regional wastewater treatment plant in 1995. The cost of the plant is $800,000 and has a permitted capacity of 40,000 gallons per day, with the capability of expansion to 0.3 MGD. This plant will also provide for future abandonment of Skier's Edge and Valley of the Blue wastewater treatment plants and expansion to allow for the conversion of septic systems in the area to central sewer. Additional information can be obtained by contacting the Breckenridge Sanitation District.

4.1.10 NWCCOG Biological Restoration Goals for French Gulch and Peru Creek

EPA awarded Northwest Colorado Council of Governments a grant in 1994 for the development of methodology for establishing aquatic biological goals for areas impacted by acid mine drainage. Out of this grant has developed a group called the FROG, or French Gulch Remediation Opportunities Group, which is developing a community-based approach to mine site reclamation. Additional information can be obtained by contacting NWCCOG.

Goals for Peru Creek and the Snake River have yet to be defined. The Snake River Watershed Task Force is the appropriate organization to develop recommendations to the State Water Quality Control Division, and likely to be involved in the development of a TMDL for this watershed. The focus on goals for the French Gulch clean up by the FROG has been on the establishment of a reproducing brown trout fishery in the Blue River below the confluence of French Gulch, which would require a dissolved zinc standard of approximately 225 ug/L..

4.1.11 NWCCOG Blue River Restoration Master Plan

EPA awarded NWCCOG a grant in 1999 for the development of a Blue River Restoration Master Plan for a 2-mile segment of the Blue River between Breckenridge and Dillon Reservoir. In this segment, dredge and placer mining destroyed the river and its adjacent floodplain. The goal of the master plan is “Enhance the Blue River for both private and public property landowners while considering the following: protect private property and owners rights, protect water rights, protect natural resources, and provide a tool for landowners to coordinate efforts and to guide river design and land use planning.” The Master Plan was completed in February 2001, and endorsed by the entire Steering Committee.

4.1.12 Climax Mine Revegetation Biosolids Partnership

A consortium of entities in Summit County have produced a solution to the challenges of mine land reclamation, wastewater treatment biosolids recycling, and wood waste

recycling. The consortium includes the Climax Mine Company, Westvac Environmental Services, Breckenridge, Copper Mountain Frisco, Silverthorne/ Dillon and Snake River wastewater districts, and the Summit Recycling Project. About 1,000 dry tons of biosolids are delivered annually to the mine, which is mixed 1:1 with wood chips, coming in large part from a large clearing operation for the Peak 7 expansion at Breckenridge Ski Area. Capital cost savings to the wastewater treatment plants have been significant, with the Silverthorne/Dillon Joint Sewer Authority avoiding the cost of a $1,000,000 digester.

4.1.13 Sediment and Erosion Control Specialist Position

The Summit Water Quality Committee established a pilot project in 1998 to provide a sediment and erosion control specialist for all local governments in Summit County. The position involves both education and enforcement of local erosion control regulations. The project has received a National Association of Counties award, and has been very well received by the local community. Over 120 individuals have received the CDOT certification training for erosion and sediment control that has been sponsored by the SWQC under this project. The project received EPA Regional Geographic Initiative funding in 2001 to implement a similar program in Eagle and Grand Counties.

4.2 Future Project Needs

Future project needs in the Blue River basin include the continued work on Straight Creek (sediment impacts); Peru and French Creeks (heavy metals and acid mine drainage impacts); Tenmile Creek (heavy metals and acid mine drainage impacts, I-70 impacts), lower Blue River (reservoir operation modifications to minimize water quality concerns, reducing nonpoint source nutrient loads); and upper Blue River (hydraulic dredging impacts); and removal of "high risk" septic systems (nutrient and potential human health impacts).

Additional project priorities in this watershed include the following:

- Blue River Restoration of hydrologic modifications
- TMDL development/implementation for French Gulch/Blue River
- TMDL development/implementation for Peru Creek/Snake River
- Sediment/Erosion Control practices for construction/land disturbance areas (including Straight Creek and other areas)
- Ground water sensitivity/enhanced septic system management
- Wetland functional assessment/ protection strategy

5.0 LAND USE REGULATIONS APPLICABLE TO WATER QUALITY PROTECTION AND IMPROVEMENT

This section summarizes the Town and County regulations applicable to water quality protection and improvement and includes such things as stream setbacks, watershed protection ordinances, "1034" regulations, Individual Sewage Disposal System regulations and maintenance and inspection program, etc. Information on specific local

ordinances is found in Appendix 10.

The County and the Town of Breckenridge have 1041 permitting authority (CRS 24-65.1-101 *et. seq.)* over a number of activities which impact water quality. The Town of Dillon is considering 1041 permitting authority with the ordinance revisions that will result from Dillon's update of its Comprehensive Plan.

Under State enabling legislation (commonly known as 1034 authority, CRS 29-20-101 et seq.) most of the towns and the county have a 25 foot stream setback requirement. All the towns and the county have construction erosion control requirements. The County's enforcement of the erosion control requirements is carried out through the Building Department, both at the planning stage, and out in the field. The County and towns also have regulations concerning stormwater runoff (off-site historical levels must be maintained), snow storage, and road construction practices.

Summit County is currently developing a comprehensive wetlands protection program that includes wetland mapping and evaluation of functional values. While the program is being developed an Interim Wetlands Setback Ordinance (25 foot setback) has also been developed. That activity is continuing to move forward in 2002.

The Town of Frisco has included wetlands as requiring a 25 foot setback. Within the setback, soil disturbance is not allowed.

The Town of Silverthorne has a Drainage Master Plan, which requires that all stormwater runoff be detained for all sites and subdivisions, except single-family and duplex units in existing subdivisions. All stormwater detention sites are required to have a 100-year design frequency and outlet works designed to release runoff at the historic rate.

In 1999 the Town of Silverthorne adopted “Waterbody, Wetland, and Riparian Protection Regulations”. This regulation requires a setback of 25–125 feet from wetlands and other waterbodies, depending on the presence of site specific features and the use of best management practices.

In 2000 the Town to Breckenridge passed an ordinance regarding a “Protective Management Area” for the Cucumber Gulch area. There are two protective boundaries within this area. One is a 100-foot setback from the wetlands, the other a 300-foot setback from primary bodies of water. The two areas were created after three consultants advised the Town to avoid the wetlands to protect existing boreal toad habitat.

6.0 WASTELOAD ALLOCATIONS

According to EPA guidance and regulations, wasteload allocations are the portion of the receiving water's loading capacity attributed to point sources; load allocations are the portion attributed to nonpoint sources.

6.1 Phosphorus Wasteload Allocations

Phosphorus wasteload allocations have been in place for the upper Blue River watershed since 1984. A control regulation enacted in 1984 established a phosphorus standard of 7.4 ug/L during the growing season in the upper 15 meters of Dillon Reservoir, in order to keep algal growth to a low to moderate level. The control regulation established a phosphorus load allocation for the dischargers upstream of Dillon Reservoir. These allocations were based on "maximum buildout" discharges and an effluent discharge phosphorus concentration of 0.2 mg/L.

The Dillon Reservoir Control Regulation (5CCR 1002-71), amended January 8, 2001 forms the basis for the phosphorus allocations which are as follows:

Major Municipal	
Breckenridge SD	708.8 pounds total phosphorus per year
Copper Mountain MD	205
Frisco SD	341
Snake River Facility	340
Minor domestic	
Bekkedal Subdivision	2.5 pounds total phosphorus per year
High Country Lodge	1.7
Arapahoe Basin	11.4
Keystone Summit House	4.4
Summit Motor Lodge	2.7
Vail Pass Rest Area	3.9

6.2 Ammonia Allocations

The Water Quality Control Division has indicated that discharges to Dillon Reservoir will be evaluated for effluent limits for ammonia when permits are renewed. The concern with respect to ammonia is its un-ionized form, due to its toxicity to fish. Initial concentrations, temperature, pH, and mixing are the key elements in determining the amount of unionized ammonia which could be toxic to fish. Thus, site specific measurements need to be collected in order to establish appropriate effluent limits and discharge concentrations. In the case of ammonia, load allocations are not appropriate for Dillon Reservoir, as it is the aquatic life in the vicinity of each discharge that is being protected, not the entire reservoir. The total load of ammonia to the reservoir is not the concern, therefore mixing zone studies are the appropriate mechanism for this issue. The districts and the Water Quality Control Division are currently negotiating the requirements for adequate mixing zone studies.

An interim ammonia wasteload allocation for the Breckenridge Sanitation District's Iowa Hills facility has been set at 10 mg/L through December 2002. The State Water Quality Control Division will re-evaluate the ammonia limit by that time.

The Copper Mountain Consolidated Metropolitan District wastewater facility has monthly ammonia limits which range from 4.2 to 30 mg/L total ammonia.

The Silverthorne Dillon Joint Sewer Authority wastewater facility has monthly ammonia limits which range from 6.5 to 16 mg/L total ammonia.

The Colorado Water Quality Control Division has administratively extended the permit expiration dates for the Snake River, Breckenridge Farmers Korner, and Frisco municipal wastewater treatment facilities. The Division has requested additional information from the Districts in order to evaluate the facilities' ammonia discharges in light of the State's new mixing zone and antidegradation guidance documents.

6.3 Nitrogen Wasteload Allocation

The WQCD has indicated their interest in determining if an antidegradation review is necessary for increased nitrogen loads to Dillon Reservoir as a result of plant expansions Breckenridge, Frisco, and Snake are all under or considering wastewater treatment plant expansions. The Summit Water Quality Committee has provided information to the WQCD which has satisfied their needs regarding antidegradation with respect to increased nitrogen loads to Dillon Reservoir.

7.0 WATER QUALITY MONITORING

7.1 Existing Water Quality Monitoring Efforts

The Water Quality Control Division as maintained five long-term water quality monitoring stations in the Blue River watershed. As a result of funding issues, the Division has proposed cutting back the number of stations in the watershed to one. The most substantial loss with respect to this cut back will be the loss of metals concentrations data in the Blue River watershed.

The Division of Wildlife has a program called River Watch which currently monitors seven stations in the Blue River watershed. These stations have been discussed in the Evaluation of Water Quality (Section 2.0).

The Summit Water Quality Committee monitors nutrient and some inorganic parameters in the watershed, but does not collect water samples for metals analysis. The loss of WQCD monitoring data will make it difficult to assess whether progress is being made with respect to historic mine site impacts on water quality.

In 1999 and continuing, the USGS has been contracted by the Summit Water Quality Committee to develop a water quality database containing information collected by various entities. That database will then be used to develop a "retrospective analysis" of water quality in the Blue River watershed. The retrospective analysis is expected to develop a recommendation regarding additional water quality monitoring and data needs.

7.2 Water Quality Monitoring Needs

Other issues requiring monitoring to either address questions or determine the success of various water quality protection or enhancement efforts include the following:

Further definition of the contribution of septic systems to water quality problems. This

includes both the Dillon Reservoir watershed, and the areas of Montezuma, areas adjacent to Silverthorne, and Heeney.

Monitoring the success of remediation efforts on French Creek, Peru Creek, and Straight Creek.

Additional monitoring to assess and improve the aquatic and recreational resources in Tenmile Creek.

Monitoring the impact of Forest Service logging on phosphorus contributions to the reservoir, with the intent of determining management approaches to minimize increased phosphorus loads from timber harvesting.

Impacts of increased snow making by the ski areas, especially the proposal for increased snow making at Arapaho Ski Basin and the effects on stream flow and associated water quality.

The potential impact of resuming operations at the Climax Mine on water quality and the aquatic community.

The impact of future Dillon Reservoir operations on reservoir trophic status and downstream water quality and the aquatic environment, especially the loss of sustained high spring runoff and resultant sediment accumulation.

Monitoring the impact of increasing ground water depletions in the upper Blue River areas on flows in the Blue River and associated water quality.

Additional metals data collected as part of the Division of Wildlife's River Watch Program throughout the watershed would be valuable, especially in light of the loss of Water Quality Control Division monitoring station reductions.

The USGS database and retrospective study includes a component to identify additional water quality monitoring activities that would be appropriate for the watershed.

8.0 WATER QUALITY STANDARDS AND RECOMMENDATIONS

8.1 Existing Classifications and Standards

The current water quality classifications, designated uses, and standards for the various water body segments in the Blue River watershed are listed in Table 9. The Blue River watershed has 18 segments identified by the Water Quality Control Commission. Six of the twenty segments have been designated "Use-Protected", while the remaining 12 are reviewable under the State's "Antidegradation" regulations.

Waterbodies in the Gore/Eagle’s Nest and Ptarmigan Peak Wilderness areas were designated “outstanding waters” in the 1999 Upper Colorado River Basin Classification and Standards hearing.

Waterbodies designated "Outstanding Waters" "shall be maintained and protected at

their existing quality" (5 CRR 1002-8, 3.1.8.1.a). These waters are considered to be of the highest quality, and are afforded the most protection.

Regulated activities taking place in reviewable waters are subject to antidegradation review.

Antidegradation review requires that regulated activities (discharges to those waters) be reviewed to: determine if the activity will result in significant degradation of that water; and if so, if "the degradation is necessary to accommodate important economic or social development is the area in which the waters are located." (5 CRR 1002-8, 3.1.8.3.d.).

Use Protected" designation indicates that those waters so designated do not require the special protection of antidegradation review (generally speaking, waters not meeting several water quality criteria or standards, or subject to significant point source discharges), but no activity can result in the exceedance of water quality standards.

Most of the segments in the watershed are classified for these uses: Aquatic Life Cold 1; Recreation 2; Water Supply; and Agriculture. The watershed has two segments which are under temporary modifications to the numeric standards: the Blue River from French Gulch to one mile upstream of the confluence with Dillon Reservoir, due to abandoned mining activities; and Peru Creek, also due to abandoned mining activities.

8.1.1 Designated Use Impairment Stream Segments

The state has listed five stream segments in the Blue River watershed as "Use Impaired". Those segments, as well as the identified constituent are listed in Table 10. Water quality limited indicates the potential impairment of the designated uses of the stream segment in the near future. This list indicates stream segments in which water quality is, or may be a concern. Partial support indicates that the designated uses are not fully impaired or supported.

Four of the stream segments listed are impacted by metals, one is impacted by sediment.

8.1.2 303(d) List

The Clean Water Act requires the state to list those stream segments or waterbodies which require Total Maximum Daily Load (TMDL) allocations in order for the segment to attain or maintain water quality standards. The State's 2000 305(b) report lists the current 303(d) list (Table 11). In the Blue River watershed, five stream segments are identified.

Table 10. 303(d) Listed Segments in the Blue River

Segment	Description	Status	Impairment	Priority
COUCBL02	Blue River, French Gulch to Swan River	Partially supporting	Cd, Zn	M
COUCBL06	Snake River, Peru Creek to Dillon Res.	Partially supporting	Cd,Cu,Pb,Mn,Zn	M
COUCBL07	Peru Creek, source to Snake River	Not supporting	Cd,Cu,Mn	M
COUCBL11	French Gulch, Wellingon-Oro to mouth	Not supporting	PH, Cd, Zn	H

COUCBL18	Straight Creek, source to mouth	Partially supporting	Sediment	M (TMDL completed)

A TMDL is the estimated assimilative capacity of a waterbody, which estimates how much of a pollutant may enter a water body without affecting its designated uses. The TMDL represents the sum of the point sources, the nonpoint sources, and a margin of safety (which can include anticipated future pollutant loadings).

Four segments are listed due to metal concentrations, and one is due to sediments. All are listed as low priority, except for Straight Creek (sediment impacts), which is listed as medium priority.

8.2 Recommendations

8.2.1 Support of Existing Standards and Temporary Modifications

Existing standards and temporary modifications in the Blue River watershed should be continued, except that the temporary standard that applies to Deer Creek (Segment 9) should be applied not to this segment but from the headwaters of the Snake River to the confluence with Deer Creek. [This issue was addressed in the 1999 Basin Classifications and Standards hearing.]

NWCCOG supports the continuation of temporary standards for segments 2 (Blue River below French Gulch), 6 (Snake River source to Dillon Reservoir), 7 (Peru Creek), and 11 (French Gulch from Wellington-Oro to mouth). TMDLs are pending for these segments and appropriate underlying standards for these segment have not yet been determined. As mentioned in previous Chapters, activities are occurring in each of these areas to assist in the development of TMDLs.

NWCCOG is supportive of the State's antidegradation provision and protection of high quality waters. NWCCOG is concerned, however that currently classified Recreation Class 2 waters will be reclassified as Recreation Class 1a unless a Use Attainability Analysis (UAA) is completed. It is highly likely that Recreation Class 2 is the appropriate classification for these segments. It is also unlikely that UAAs will be completed for all of these segments, due to financial and time constraints. In the Blue River watershed these waters are:

Segment 7 - Peru Creek
Segment 8 – Keystone Gulch, Chihuahua Gulch, North Fork of the Snake
Segment 11 – French Gulch
Segment 12 – Illinois Gulch
Segment 13 – Mainstem of Tenmile Creek from Climax flume to W. Tenmile

There are no current municipal discharges on these segments except for Segment 8, to which Arapahoe Ski Area discharges to.

8.2.2. Outstanding Waters Designations

The Northwest Colorado Council of Governments does not currently recommend any additional waterbodies to the list of "Outstanding Waters" designation. If new wilderness areas within the watershed are approved by Congress, NWCCOG recommends

investigations of waterbodies within those areas for appropriate ness of “outstanding waters” designation.

8.2.3 Use-Protected Recommendation

NWCCOG recommends a change in the designation of the Blue River segment 2 (French Gulch to Swan River) from “reviewable” to “Use-Protected”. This recommendation is based on the State’s criteria under the Basic Standards Regulation section 31.8.2(b)(i)(c) under condition ii of this section. Please see section 2.3 of this plan for more information on this subject.

8.2.4 Green Mountain Reservoir Nutrient Standards

Although NWCCOG's previous 208 Plan (1988) stated the intent to revise water quality standards for phosphorus and other nutrients in Green Mountain Reservoir, based on the detailed study of the Reservoir completed in 1990, nutrient standards for Green Mountain Reservoir are not appropriate unless some operational impacts on water quality are addressed. The Summit County Land Use and Development Code, along with the development of a septic system inspection and maintenance program is the most appropriate nutrient limitation method for protection of Green Mountain Reservoir water quality. Through the use of enforceable streamside development setbacks, wetlands setbacks, maintenance of historical runoff levels, erosion control ordinances, and other Best Management Practices that the County now requires of land development, nonpoint source nutrient loads to Green Mountain Reservoir should be minimized.

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2002 EAGLE RIVER WATER QUALITY MANAGEMENT PLAN

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1.0 WATERSHED OVERVIEW

1.1 Geography and Hydrology

The Eagle River watershed lies almost entirely within Eagle County (a small portion of northeast Pitkin County lies within the watershed) and encompasses a 944 square mile (604,160 acres) area in northwestern Colorado.

The Eagle River originates near the southeastern border of the County and flows northwesterly for about 35 miles to Dowd Junction, and then westward to the Colorado River at Dotsero. Principal tributaries of the Eagle are: Turkey Creek; an easterly tributary near Red Cliff; Cross Creek, a southerly tributary emerging from the Holy Cross Wilderness near Minturn; Gore Creek, emerging from the mountains east of Vail and flowing through the Town of Vail; Beaver Creek, a southern tributary near Avon; Milk Creek, a northern tributary near Wolcott; Brush Creek, a southern tributary and the largest tributary downstream from Gore Creek; and Gypsum Creek, a southern tributary joining the Eagle River at Gypsum. A map of the watershed in shown in Figure 7.

In the upper Eagle watershed (Gore Creek and the Eagle River above Dowd Junction), average annual precipitation is 28 inches, two-thirds of which falls as snow. In the lower areas of the watershed (below Dowd Junction), annual precipitation ranges from 12 to 19 inches, with about 60% falling as snow. Seventy-five percent of the annual runoff occurs between May and July as a result of snowmelt. Major snow fall typically occurs February through April.

Thunderstorm activity from July through September produces significant, although short lived rainfall events. Stream flows have marked seasonal variability, with highest flows occurring during the snow melt period, and low flows, sustained by ground water, occurring August through April. Stream flow also varies from year to year based on snow pack, with wet year flows being several times greater and longer in duration than dry years. Historical annual average stream flow for the Eagle River is estimated to be 415,000 acre feet below Gypsum Creek (Eagle River Assembly, Phase I Report, September 1994).

Several small storage reservoirs and one larger reservoir exist in the watershed. Homestake Reservoir is located high in the southern portion of the watershed. This reservoir has a storage capacity of 44,360 acre-feet and a surface area of 300 acres. This reservoir is used exclusively for eastern slope diversion except for in-basin releases of 500 acre-feet per year beginning in 1998. Two reservoirs are owned and operated by Climax Molybdenum Company on their property: Robinson and Eagle Park Reservoir (Industrial Pond 4), with a combined current capacity of 6,000 acre-feet. Climax has remediated Eagle Park Reservoir and marketed some of their water rights that are currently not being used. The Black Lake Reservoirs are located at the headwaters of Gore Creek. These two reservoirs have a combined capacity of 300 acre feet, and are used by the Town of Vail to augment stream flows in Gore Creek and replace water diverted for snow making. Nottingham Lake in Avon has a storage capacity of 100 acre-feet.

Figure 6. Eagle River Watershed Map.

Four trans-basin diversion projects carry water from the headwaters of the Eagle River to the Arkansas River basin. These projects divert an annual average of 34,000 acre-feet during the snowmelt period. Additional conditional water rights for out-of-basin diversions could yield an additional 100,000 acre feet if they were all developed (Eagle River Assembly Phase I Report, 1994).

1.2 Land Uses and Population Characteristics

Public lands (Forest Service at approximately 380,000 acres and the Bureau of Land Management at approximately 95,000 acres) account for 77% of the total Eagle River watershed. The major population centers are Vail, Eagle-Vail, Avon, Edwards, Eagle, and Gypsum. The 1999 July census for Eagle County was approximately 34,950 people. The average annual growth rate of the county from 1990 through 1999 has been 5.4% (Department of Local Affairs). The 2000 US Census population estimate was 41,659, and there were an additional 9,813 part-time residents. The combined hotel and condominium bed base for 2001 was estimated to be 16,990 [Vail Valley Tourism and Commerce Board, 2001].

Economic and land use activities in Eagle River watershed include: recreation; mining (largely historic); agriculture (including logging); and urban development. The major mining areas in the county are the Eagle Mine, located near Minturn; and the Climax Molybdenum Mine located on the continental divide at Fremont Pass. Agricultural products consist mainly of livestock, hay, and timber, with most of the irrigated farmland located in the Eagle River valley downstream from Gore Creek to Dotsero. Urban development in the county is primarily associated with construction of condominiums and homes along Gore Creek and the Eagle River.

In the Eagle River watershed there are 27 community, transient non-community, and private drinking water systems, serving a combined total population of 42,523 persons [Colorado Department of Public Health and Environment, Water Quality Control Division Colorado Open Records Act request, NWCCOG December 10, 2001]. Twenty-one of the systems are reliant upon ground water and six systems are reliant upon surface water. This information does not include individual systems serving less than 25 people.

1.3 Watershed Water Quality Management

An effort called the Eagle River Watershed Council, composed of local, state, and federal agencies, as well as ranchers, environmentalists, and recreational interests undertook a number of projects (mainly nonpoint source projects in the Milk and Alkali Creek areas) in the mid to late 1980s. This group is no longer active. Another group, the Eagle River Environmental and Business Alliance (EREBA), was awarded a Technical Assistance Grant to communicate clean up activities to the community and to represent the community in reviews of documents and activities associated with the Eagle Mine.

In 1994, local communities and Eagle County, recognizing the need to address issues related to the Eagle River on an integrated basis began an effort called the Eagle River Watershed Plan. The Plan, supported by the towns, the County, state and federal agencies, and local interested citizens, is attempting to address: water quantity; water

quality; recreation; wildlife; and land use issues in an integrated manner. The Plan was completed in 1996. The Plan was adopted by most of the Towns in the Eagle Valley and Eagle County.

The 1996 Water Quality Management Plan was developed during the Eagle River Watershed Plan effort, using the public outreach and input efforts of that plan. This Plan focuses more attention on the specifics of water quality - the assessment, point and nonpoint source issues, and recommendations. Both plans are attempts to identify issues related to Eagle River as a community resource, and means of protecting, and in some cases enhancing the existing uses of this asset.

A group called the Eagle River Watershed Council, has formed which has consolidated the efforts of the EREBA and the Eagle River Watershed Plan Implementation Committee. NWCCOG is working with the Council to establish a local long-term water quality and quantity forum. The development of this 2001 revision was accomplished with input from the Council's Technical Committee.

2.0 WATERSHED WATER QUALITY ASSESSMENT

Streams in the Eagle River watershed are classified for protection of cold water aquatic life (trout), secondary contact recreation (incidental contact); water supply and agricultural uses. Generally speaking, water quality of the Eagle River is very good.

During most of the year, the river and its tributaries exceed the water quality standards set to protect its designated uses.

In spite of good overall water quality, some segments of the Eagle River are not fully supportive of their designated uses, i.e. some of the uses previously mentioned are impacted by poor water quality. The Eagle River from Belden to the confluence with Gore Creek has been determined by the Colorado Water Quality Control Division to be not supporting designated uses due to metals contamination (cadmium, zinc, and manganese). The lower portion near the mouth of Cross Creek has been designated as not supporting its designated uses due to metals contamination (cadmium, zinc and manganese). The Eagle River from Gilman to its confluence with Gore Creek and from Gore Creek to the confluence with the Colorado River have received seasonal temporary modifications for manganese, under the water quality standards due to acid mine drainage. Temporary standards are less stringent than statewide standards established to allow full utilization of designated uses of the stream segment. Temporary modifications are intended to allow time for clean up of existing pollution problems.

Gore Creek and the Eagle River are water quality limited segments with load allocations requiring advanced wastewater treatment for ammonia removal for discharges at Vail and the Upper Eagle Valley to meet standards for un-ionized ammonia. The Eagle River from Gore Creek to the Colorado River is classified as not supporting designated uses due to manganese contamination. Black Gore Creek is not supporting designated uses due to sediment loading from winter sanding operations on I-70.

Other water quality concerns in the Eagle River watershed include the impact of

sediment on aquatic life in Black Gore Creek (and potentially Gore Creek), and the potential impact of increases in nutrient concentrations as a result of point and nonpoint sources.

2.1 Upper Eagle River Watershed (Eagle River Segments 1, 2, 3, 4, 5, 6, and 7)

Water quality in the upper reaches of the Eagle River is excellent. A 1993 study by Hydrosphere for Vail Associates' Snowmaking Water Supply Facilities 1041 permit application, found that water quality in the east fork of the Eagle River is generally within standards for all parameters, with occasional exceedances of standards for dissolved silver and total recoverable iron.

Fish sampling for Climax Molybdenum Company on the East Fork of the Eagle River in 1994 found brook trout, brown trout and mottled sculpin. Density and biomass estimates were 614 trout per hectare (248 per acre), and 27 kg per hectare (24 pounds per acre). 1994 fish populations were lower than in 1990 and 1991, however, the population age structure and presence of young of the year indicate an stable, naturally reproducing trout population in this section of the watershed. The presence of sculpin, a sensitive fish species, indicates good water quality. The macroinvertebrate community found at the site had a preponderance of species sensitive to water quality perturbations. Ephemeroptera (mayflies) were represented by seven species, and plecoptera, (stoneflies), coleoptera (beetles), diptera (flies), and turbellaria (flatworms) were also collected. Species densities were lower in 1994 than in 1991.

Water delivery from Climax Dam 4 (Eagle Park Reservoir) at the headwaters of the East Fork of the Eagle River (owned by Climax Mine) is assisting in stream flows in the Eagle River. The water stored in the reservoir meets all water quality standards for segment 3. Delivery began in 1998 and is nearly continuous at 3 – 10 cfs from late November to mid-March.

The wastewater flow into the municipal wastewater treatment plant at Red Cliff significantly exceed the plant's hydraulic capacity due to several issues. One is that a large majority of the citizens allow their domestic water to run continually during the colder months in order to prevent their pipes from freezing and bursting. The other cause of the overloading of plant capacity is due to severe infiltration/inflow (I/I) problems. The town is continuing to study the problem and has been working with the Department of Local Affairs and the Water Quality Control Division to find a viable solution. The Department of Local Affairs Energy Impact Assistance Grant advisory committee recommended partial funding to address collection system improvements in 1996. A renewal discharge permit was issued in 2001 with a design capacity of 70,000 gallons per day as a 30 day average, and 119 pounds of BOD per day. A compliance schedule has been set for a report on the sewer line project and an evaluation of influent flows and hydraulic capacity of the facility.

The Division of Wildlife has a sampling site below Red Cliff as a reference station for the Eagle Mine Site. Trout population estimates have been conducted each year, beginning in 1990. Number of trout per acre have ranged from 234 to 534, and pounds per acre have ranged from 70 to 148. In April 2000, the brown trout population estimate was 291 per acre, and 58 pounds per acre [Annual biological Assessment of the Eagle Mine Superfund Site, Eagle County Colorado, John Woodling and Ann Widmer, April 2000].

These numbers are indicative of highly productive waters ("Gold Medal Waters" designation has a criteria of greater than 40 pounds per acre). Gold medal waters must also have at least 12 trout 14 inches or longer per acre on a sustained basis, must be a least 2 miles long and at least 50 surface acres in aerial extent. Sculpin have also been found consistently at this site. Macro invertebrate species diversities at this site in 1993 and 1994 were 3.1 and 4.0, respectively. Sampling in 1999 at the Red Cliff site for macro invertebrate diversity showed a diversity index of 3.79 (this index was dropped in 2000. The 2000 report, identifies the number of taxa collected (39), percent Ephemeroptera (31), number of Ephemeroptera taxa (9) and EPT taxa richness (26) [Annual biological Assessment of the Eagle Mine Superfund Site, Eagle County Colorado, John Woodling and Ann Widmer, April 2000].

The USGS has water quality sampling sites on the East Fork of the Eagle River and on the Eagle River at Red Cliff.

2.1.1 Eagle River from Belden to Gore Creek (Eagle River Segment 5)

The Eagle Mine and its related facilities is a primary source of water quality pollution in the watershed. The mine is located adjacent to the Eagle River, upstream of Minturn. Mining impacts have caused concentrations of numerous metals to exceed standards adopted by the Water Quality Control Commission for protection of aquatic life and drinking water. The stream segment most affected by the mine is from Gilman to Gore Creek. In this six mile stretch, aquatic habitat and water quality is significantly degraded. Insect life and fish populations are extremely limited. Historically, water quality in this area has been worse during low stream flow periods, as higher flows during spring runoff diluted the metals present in site runoff. Downstream of Gore Creek, metal concentrations due to the impacts of the mine can also exceed stream standards, although less frequently.

The Eagle Mine has been designated a Superfund site and many aspects of the historic mining operation are being reclaimed. Water quality in the Eagle River associated with the Eagle Mine has improved due to actions by the Colorado Department of Health, the

Environmental Protection Agency, and Paramount, Inc. (the current owner of the Eagle Mine site). Biological monitoring by the Division of Wildlife in 1994 found a very limited fish population below the mine, where no fish previously existed.

A 1976 investigation of the Eagle River and its tributaries upstream from the Eagle Mine area, indicated that it contained water suitable for all uses, based on results of the chemical and biological analyses. The Eagle River downstream of the mining area had pH and concentrations of dissolved solids, dissolved copper, dissolved cyanide, dissolved and total iron, and dissolved lead which exceeded water quality standards. [Water Quality Survey of the Eagle River Basin -1975, Colorado Water Quality Control Division, 1976].

Cross Creek upstream from the mining activities had a benthic diversity of 2.47, indicating water of a suitable quality for all uses. Cross Creek downstream from the discharge of the tailings ponds had a reduced benthic population and increases in specific conductance and in concentrations of hardness and dissolved solids. Two other tributaries in the Minturn area, Two Elk and Grouse Creek, had diverse benthic

communities and water of suitable quality for all uses. Based on benthic populations, it was determined that there has been a substantial improvement in the water quality of the Eagle River in the Minturn area during the last several years, even though the toxicity problem caused by ground water seepage of dissolved metals from the tailings pond to the Eagle River still existed. Prior to the 1976 study cited above, an investigation in 1966 (US Department of the Interior, 1968) documented the complete elimination of bottom dwelling organisms in the Eagle River downstream from the tailings ponds of the New Jersey Zinc Corporation (Eagle Mine, now owned by Viacom, Inc.).

A remedial investigation of the Eagle Mine in 1985 indicated that elevated concentrations of zinc exist in the Eagle River below the confluence with Gore Creek to the Town of Eagle. Elevated levels of lead, cadmium, and copper were pervasive in the surface water, sediment, and macroinvertebrates from the mine to Gore Creek. Concentrations of cadmium, copper, and lead in surface water regularly exceeded EPA acute and chronic criteria from the roaster piles down to Eagle. Zinc concentrations exceeded EPA criteria from the roaster piles down to Eagle. The study concluded that surface water contamination and associated effects to aquatic life may have decreased over the last 35 years.

Colorado Water Control Division monitoring data shows 44% of zinc samples and 18% of copper samples exceed EPA aquatic life criteria over the period 1977-1987 at the mouth of Cross Creek. The concentrations are highest in the last three years of this period. Total manganese concentrations exceed state standards consistently with a ten-year average concentration of 3.3 mg/L.

The 1987 Colorado Nonpoint Source Pollution Assessment reports that from Red Cliff to Edwards cadmium, copper, lead, dissolved manganese, and zinc are acutely and chronically toxic to aquatic life seasonally and exceed agriculture and waster supply standards for the same parameters. The Eagle Mine is identified as a major source of these problems. Cross Creek is also identified as contributing elevated concentrations of metals. Negative impacts to both fish populations and drinking water resulting from metal concentrations are observed downstream to Edwards.

Data collected by Dames and Moore in 1994 indicates that at station E-14 (Eagle River below Cross Creek), iron and manganese continue to exceed state drinking water standards and chronic standards for aquatic life. Zinc continues to exceed the chronic aquatic life standard of approximately 0.045 mg/L (based on hardness).

The Division of Wildlife has performed biological assessments on the Eagle River Superfund site from 1990 through 2000. Results of the 1994 sampling program documented improvement in portions of the Eagle River aquatic community including somewhat higher numbers of aquatic invertebrates at some sites and brown trout at all sites. This sampling program will continue in future years. According to DOW data, manganese continues to exceed the temporary modification to the water quality stream standards (the temporary stream standard is 850 ug/l December- April and 355 ug/L May–November). Zinc also continues to exceed the temporary seasonal water quality standard of 740 ug/l (December – April) and 240 ug/l (May – November).

Active remedial clean-up of the Eagle Mine site under a 1988 court ordered consent decree began in 1988. A second consent decree, the three party consent decree between Viacom International, Inc. (Paramount), the Colorado Department of Public

Health and Environment, and the EPA signed in 1995. Remedial work and monitoring continues under the CDPHE Unilateral Administrative Order which is in full effect. This includes evaluation of runoff from roaster piles on the steep slopes. Currently no biological compliance is required, only biological monitoring.

Viacom's restoration efforts have included putting in new wells, replacing contaminated soil in the Maloit Park wetlands, removing hazardous materials from the Gilman site, consolidating metals byproducts piles from mining and smelting and capping them, removing old transformers containing PCBs, and dropping water levels in the Mine. In 2000 dissolved zinc levels below the mine generally range from 0.06 to 0.9 mg/l. [Eagle Mine Annual Site Monitoring Report 2000, URS March 15, 2001]

Fish and macroinvertebrate data show continued improvement from population information collected in the early 1990's [Annual Biological Assessment of the Eagle Mine Site Superfund Site, John Woodling and Ann Widmer, Division of Wildlife, April 2000]. The data show that metal concentrations fluctuate in a seasonal manner, with lowest concentrations occurring in June and July during runoff season, and highest concentrations in March and April when stream flows are at the lowest levels. The number of aquatic macroinvertebrates and taxa have increased at sites 3,4, and 5 in the time period 1995-2000. Brown trout populations decreased at all sites in 1996 and 1997, however increases occurred at sites 2,4,5, and 6 in 1998 and at sites 2-5 in 2000. Brown trout population estimates at sites 2.9, 3, 4, and 5 were significantly higher in 2000 than in any other year through the eleven-year monitoring period.

Water quality has been monitored below Minturn by Battle Mountain High School as part of the Division of Wildlife's River Watch Program. Data indicates the presence of cadmium, copper, iron, manganese and zinc, with zinc regularly exceeding the acute aquatic life standard. Dissolved oxygen and pH appear fine.

The State and EPA have proposed the development of site-specific water quality standards based on a 'healthy biological community', in a draft document titled "Eagle Mine Site Approach to Defining 'Healthy' Biological Community" dated March 2002. NWCCOG generally supports the development of site-specific standards for this Superfund Site using the three biological metrics proposed, and has provided comments on the draft document.

2.2 Gore Creek (Eagle River Segments 1, 6 and 8)

A 1976 study by the Water Quality Control Division concluded that the major tributaries to Gore Creek had water of suitable quality for all uses, with the exception of Black Gore Creek, where substantial quantities of sediment resulting from extensive road construction (Interstate 70) were measured. Daily suspended sediment data collected by the USGS indicated a mean concentration of 1,720 mg/L and a suspended sediment load of 1,290 tons in Black Gore Creek [Reconnaissance Evaluation of Surface Water Quality in Eagle, Grand, Jackson, Pitkin, Routt, and Summit Counties, Colorado, USGS, Open file 79-420, 1979].

The State Water Quality Control Division listed Black Gore Creek on the State's list of Impaired Waters (303(d) list) for sediment. A group called the Black Gore Creek Steering Committee has been formed to assist in the addressing the sediment impacts

from I-70. The Northwest Colorado Council of Governments has voluntarily provided meeting facilitation and support for the group and the Technical Subcommittee.

A 1980 study of upper Eagle Valley by Engineering Science, Inc. found the tributaries of Gore Creek to have high water quality, with the exception of Black Gore Creek, which was impacted by sediments, due to the construction of Interstate 70. Exceedances of stream standards for cadmium, lead, and manganese were found to occur in Gore Creek, during spring runoff, but were attributed to soils and geology of the basin. A 1990 report by Advanced Sciences, Inc. characterized water quality in Black Gore Creek, Gore Creek, and the Eagle River above and below the confluence of Gore Creek for the Vail Valley Consolidated Water District for a proposed enlargement of the Black Lake Reservoirs. That report found that the primary concern in the Gore Creek watershed is a recurring water quality standards exceedance of manganese, a condition which appears to be cause by the composition of rock minerals in Black Gore Creek. Secondary concerns are infrequent standards exceedances of copper, total iron, and silver infrequently, or occasionally exceeding stream standards at a few locations in the Gore Creek system.

The USGS was commissioned to develop a database and retrospective analysis of the Gore Creek watershed by the Gore Creek partnership (Town of Vail, Vail Associates, Eagle River Water and Sanitation District, and Upper Eagle Regional Water Authority). Key findings of the "Gore Creek Watershed Colorado – Assessment of Historical and Current Water Quality, Water Quality, and Aquatic Ecology, 1968- 98" [Kirby Wynn, USGS, personal communication 2001] are discussed below.

Surface-water nutrient concentrations generally increased as water moved downstream through the Town of Vail, but concentrations at the mouth of Gore Creek were typical when compared to national data for urban/undeveloped sites. Since the 1970's ammonia concentrations decreased and nitrate concentrations increased at the mouth because of changes in wastewater treatment methods. Total phosphorus concentrations were significantly lower at the mouth of Gore Creek during 1995-97 when compared with concentrations for the 1970s and 1980s, part of the difference being caused by dilution from the higher than average stream flows during 1995-97. Recent total phosphorus concentrations were somewhat elevated when compared to the US EPA recommended level of 0.1 mg/l for control of eutrophication in flowing water.

Historically, suspended sediment associated with construction of I-70 in the early 1970s has been to primary concern. However, recent data indicate that stream-bed aggradation of sediment originating from I-70 traction sanding currently is a greater concern. About 4,000 tons of coarse sand and fine gravel enter Black Gore Creek each year. Suspended-sediment concentrations were low in Black Gore Creek, however, bedload-transport rates of as much as 4 tons per day have been measured. Snowstorms in September and October have resulted in accumulation of traction sand in pools that otherwise could serve as brown trout spawning habitat in Black Gore Creek. The accumulated coarse sediments may reduce available over-wintering habitat for fish and macroinvertebrates.

Water samples collected during spring and fall of 1997 from five alluvial monitoring wells located throughout the Town of Vail found low nutrient concentrations, but high radon values (greater than 300 pCi/L). Low levels of bacteria and methylene blue active substances indicate that there is little or no wastewater contamination of shallow ground

water.

Differences in the macroinvertebrate community structure were found among sites in Gore Creek. More than 80% of the macroinvertebrate community at sites located farthest upstream was composed of mayflies, stoneflies, and caddisflies, indicating favorable water quality and habitat conditions. The relative percentages of midges and sludge worms greatly increased in the downstream reaches of Gore Creek, which drains relatively larger areas of urban and recreation land uses, indicating the occurrence of nutrient and organic enrichment in Gore Creek. The macroinvertebrate community in Black Gore Creek indicated adverse effects from sediment deposition. The lower four miles of Gore Creek, downstream from Red Sandstone Creek, have been designated a Gold Medal fishery in recognition of the high recreational value of the abundant brown trout community. Gore Creek contained twice as many trout as a reference site with similar habitat characteristics in Rocky Mountain National Park. Moderate increases in nutrient concentrations above background conditions have increased the growth and abundance potential for aquatic life in Gore Creek, while at the same time, aesthetic and water quality conditions have remained favorable. The fish community has benefited from enhanced biological production in the downstream reach of Gore Creek. Increases in algal biomass and macroinvertebrate abundance, in response to higher nutrient concentrations, provide ample food resources necessary to support the abundant fish community.

Trace element data for surface water, ground water, streambed sediment, fish tissue, and macroinvertebrate tissue indicate that concentrations are generally low in the Gore Creek watershed. Silver concentrations were low in stream-bed sediment samples. However, the concentration of silver was elevated in brown trout fish livers and caddisfly samples collected at the mouth of Gore Creek, compared to samples collected from sites representing mining and other land uses in Colorado and the Nation. Manganese concentrations commonly exceed the 50 ug/L stream standard in Black Gore Creek. Elevated manganese concentrations were primarily attributable to the sedimentary geology of the area.

The USGS investigated travel–time characteristics of Gore Creek and Black Gore Creek in 1997 [USGS Water Resources Investigation Report 02-4037]. During May, discharges ranged from 82 to 724 cfs at two USGS flow gaging stations – Black Gore Creek and Gore Creek at mouth. September discharges ranged from 3.6 to 62 cfs. Estimated peak travel times for Black Gore Creek ranged from 5.4 to 0.4 hours for 20 to 200 cfs, and for Gore Creek, 5.5 to 0.3 hours for 20-800 cfs.

2.2.1 Gore Creek above Black Gore Creek (portion of Eagle River Seg. 1)

A study done in 1993, by Resource Consultants and Engineers, Inc. for the Summit Water Quality Committee, used the headwaters of Gore Creek at an elevation of about 9,600 feet as an undisturbed site for comparison with Straight Creek in Summit County. The study examines sediment, benthic macroinvertebrates, and fish populations. Benthic macroinvertebrate at the two Gore Creek sites were 3.61 and 3.7, with 17 taxa and densities on the order of 750 - 1,000 organisms per square meter. Cutthroat trout were the only fish species collected, with an estimated density of 274 - 447 fish per hectare, and a biomass of 20.4 - 34.3 pounds per acre.

2.2.2 Gore Creek below Black Gore Creek (Eagle River Segment 8)

A 1987 Environmental Assessment, done as part of the 1041 permit application to Eagle County for the enlargement of Black Lake Reservoir Number 1 indicated good water quality in Black Gore Creek. The mean suspended sediment concentration in Gore Creek at Vail was 88 mg/L and the suspended sediment load was 204 tons. The sediment increase in Black Gore Creek affected the sediment discharge in Gore Creek at Vail.

A 1975 assessment of waste loads for the Eagle River and Gore Creek found that water supply stream standards were not exceeded for dissolved oxygen, temperature, dissolved solids, pH, or fecal coliform bacteria. The study found dissolved oxygen concentrations of less than 6.0 mg/L in Gore Creek at the Big Horn subdivision and at the confluence with the Eagle River. Minimum summer values were 3.9 mg/L at the subdivision and 3.6 mg/L at the confluence. The average concentrations were about 8.5 mg/L, but the minimum values are critical for support of aquatic life. According to the EPA, a dissolved oxygen concentration of 3 mg/L occurring in a stream for even part of a day causes diminished feeding and growth of the fish population. However, from eight years of record at these sites on Gore Creek, the Water Quality Control Division (WQCD) found no deficiencies in dissolved oxygen concentrations. The total ammonia concentration did not exceed the assimilative capacity of the Eagle River, but exceeded the assimilative capacity of Gore Creek downstream of the sewage treatment plant. Unionized ammonia concentrations down stream from the Vail wastewater treatment plant on Gore Creek exceeded 0.02 mg/L. It was concluded that the water quality, in terms of the unionized ammonia, was degraded at the mouth of Gore Creek and the Eagle River at Gypsum and Avon.

Further investigations were prompted by these findings and more detailed studies were conducted by the WQCD, in 1976, at sites located in the upper Eagle River, Gore Creek, and the lower Eagle River. Based on chemical and biological results, it was determined that Gore Creek upstream from Vail had water of suitable quality for all uses and a benthic community diversity of 3.21. However, in 1975, Gore Creek downstream from the Vail wastewater treatment plant to its confluence with the Eagle River contained unionized concentrations as high as 0.077 mg/L. In conjunction with the unionized ammonia concentrations, the study determined that the benthic community was adversely affected, with diversities less than 3.0 downstream, as compared to 3.4 upstream of the treatment plant. Furthermore, an investigation of the fish population found that twice the number of trout were collected in half the time upstream of the treatment plant, as compared with downstream of the plant. According to the Water Quality Control Division (1976), Gore Creek, from Vail to its mouth, was not capable of supporting fish and was unsuitable for swimming because of municipal discharges and nonpoint sources of pollution.

Fertilizer from golf courses has contributed to elevated nutrient levels. The WQCD water quality monitoring data indicates consistently high phosphorus concentrations from 1977 to 1987. Bacterial infections of trout in this reach of the river were also reported. The effects of bacteria are most prominent under conditions of low flow, high temperature, and catch and release fishing.

A portion of this segment (below Red Sandstone Creek) is now designated as a Gold Medal fishery (1988). This designation was further confirmed by the Division of Wildlife (DOW) with fish shocking surveys completed in September 1982 and October 1992 below Red Sandstone Creek. Again on April 8, 2000 the DOW did a fish shocking and confirmed the Gold Medal Status to this section of Gore Creek. The 1982 survey found brook, brown and rainbow trout, with a biomass of 58 pounds per acre, the 1992 survey found brown and rainbow trout, with a biomass of about 80 pound per acre (the Gold Medal designation requires a minimum biomass of 40 pounds per acre, along with several other criteria noted on page 7). DOW surveys were also done in the vicinity of the golf course in 1984 and 1990, again showing an increase in biomass over time.

In a USGS factsheet (186-99) by Kirby Wynn dated December 1999, a fish-community assessment of Gore Creek is documented that took place in 1998. Fish collected at all four sites included mottled sculpin, and cutthroat, brook, brown and rainbow trout. Generally, trout were larger and more abundant at downstream sites within the Gold medal fishery reach of Gore Creek than at sites farther upstream. The gold medal trout fishery appears to benefit from the increased nutrients, algal biomass and food resources associated with urban land uses in the Town of Vail.

A joint project by the NWCCOG Water Quality Program and the Town of Vail between 1992 and 1994 was conducted to: posture the Town of Vail for likely stormwater discharge permit requirements; determine if there are existing negative water quality impacts in Gore Creek which could be attributed to nonpoint sources of pollutants; and to evaluate potential sources of pollutants in order to gain information for developing effective pollution control strategies. The study found that suspended and dissolved solids, salts, phosphorus, ammonia, nitrate, and nitrite concentrations increase in Gore Creek as it runs through town. Dissolved solids and salts (both above and below Vail), phosphorus, nitrate, and nitrite concentrations (below Vail) have increased between 1979 and 1991 because of growth and increased traffic along I-70. Dissolved oxygen, fecal coliform, cadmium, copper, manganese, and zinc concentrations have improved during the same period of time. Increases in silver concentrations appear to correspond to the Upper Eagle Valley Consolidated Sanitation District (UEVCSD) Vail wastewater treatment plant discharge.

The joint project included water quality monitoring in Gore Creek following application of a fungicide to the Vail Golf Course. No pesticide was detected. Sediment sampling in the water hazards on the golf course found fairly high levels of mercury, and traces of DDE (a breakdown product of DDT) and 2,4 D (a component of the broadleaf herbicide "Trimec", which is applied to the golf course and is also available to the public). In response to the elevated mercury concentrations in sediments and because the golf course water hazards are commonly used as a recreational fishery, the USGS, in cooperation with the Gore Creek Watershed Partnership collected brown and brook trout muscle tissue samples from 2-3 year age class fish in the large water hazard near Pulis Bridge in 1998. Those results indicated that mercury concentrations were below background levels.

The joint stormwater project estimated stormwater pollutant loading to Gore Creek. It was estimated that 196,000 kg of sediment, 210,300 kg of dissolved solids, 22,000 kg of Biological Oxygen Demand, 7,200 kg of oil and grease, 400 kg of ammonia, 1,000 kg of phosphorus, and 750 kg of zinc flow into Gore Creek each year with stormwater runoff. These loads are significantly lower than load estimates made in 1980 by Engineering

Science, Inc. in their report " Upper Eagle Valley Nonpoint Source Assessment and Control Plan", but are nevertheless significant. A report on the project entitled "Vail Nonpoint Source Management Plan" includes results of the study, and policy and engineering recommendations for further improving the quality of stormwater runoff.

2.3 Lower Eagle River Watershed (Eagle River Segments 9, 10, 11, and 12)

The Eagle River downstream, from Gore Creek to its confluence with the Colorado River at Dotsero, is affected by wastewater discharges, irrigation return flows, mineralized groundwater seepage, and runoff from highly erodible soils.

There is a major natural source of chloride from rocks in the area of Lake Creek, immediately downstream from Edwards. Farther downstream, specific conductance, and concentrations of dissolved solids and hardness increase.

2.3.1 Mainstem Eagle River from Gore Creek to Dotsero (Eagle River Segment 9)

In 1997-1998 the State Water Quality Control Division obtained EPA funding to conduct a nutrient enrichment study of the Eagle River watershed. The USGS was contracted to perform the collection and analysis for chemical and biological samples, assess the habitat, nutrient concentrations, algal and macroinvertebrate communities. Five sites along the Eagle River were sampled in September 1997 and February 1998 for water chemistry, algae and macroinvertebrates. The Division also conducted monthly water samples and performed a synoptic survey of the Eagle River in March 1999. The habitat at each of the sites was considered optimal or sub-optimal. The water quality data from USGS and the Division showed similar trends. The nutrient concentrations were low at the upper most station on the Eagle River above Gore Creek. The concentrations then increased at each successive station as loading from wastewater treatment facilities and nonpoint sources entered the River, until reaching a peak at station at Eagle Springs golf Course (near Wolcott). The nutrient concentrations then decreased to station 5 at Gypsum probably due to dilution from larger tributaries such as Brush and Gypsum Creeks which have relatively low nutrient concentrations. The major sources for nutrients (both nitrogen an phosphorus)in the watershed are municipal wastewater treatment facilities (approximately 70% of the nitrogen load at Wolcott and 90% at Gypsum, and more than 90% of the phosphorus load). With respect to the algae community, each station was dominated by diatoms (more than 97% of the algal biomass). The USGS considers the Eagle River below Gore Creek to be un-enriched to moderately enriched. The macroinvertebrate communities showed a distinct shift in dominant groups, with caddis flies increasing in numbers downstream, and midges dominating the Gypsum site in February. The Shannon-Weaver diversity index showed a “fairly significant drop in diversity from the upper site to Wolcott, before increasing again at Gypsum. These decreases in diversity mirror the increase in nutrient concentrations and an argument could be made that nutrient loads are degrading the biological communities”. “Based on chlorophyll-a levels, the River would have to be considered moderately enriched at this point in time . . .. However, with continuing growth in the basin associated increases in nutrient loads from wastewater treatment plants, the potential for increasing algal growth and nuisance conditions should be considered relatively high. While it cannot be ascertained to be a problem at this time, it could portend future shifts in the biological structure of the River which could potentially

affect the existing good to excellent fishery. While the study provided a snapshot in time of nutrient levels and associated conditions in the Eagle River and established some baseline conditions in relation to future growth and nutrient loading in the basin, it did not verify the complaints as to the various nuisance conditions in the River." [Phil Hegeman, personal communication WQCD DRAFT "Summary Report on 1997-98 Investigation of Nutrient Enrichment in the Eagle River"]

Impacts associated with stormwater and urban runoff in the Vail/Avon corridor were identified in the 1987 Non Point Source Assessment and the Black Lake Reservoirs 1041 Application. The pollutant of concern was sediment, although cadmium, lead, salinity, nutrients, and oxygen demand were also documented.

As part of the Eagle Mine monitoring efforts, the Division of Wildlife has a monitoring site on the Eagle River at Arrowhead. Fish populations at this site have increased substantially since 1991 when two passes captured 70 trout, to 1994 when two passes captured 290 trout (biomass estimates were 74, 188, and 228 pounds of brown trout per acre in 1992, 1993, and 1994 respectively). Macroinvertebrate species diversity at this site in 1993 and 1994 were 2.98 and 3.66 respectively. In 1997,more brown trout were found below Two Elk Creek (Site 3) and Cross Creek (Site 4) than at Arrowhead (Site 6). The number per acre at the Arrowhead site was estimated to be 175, with an estimate of 90 pounds per acre. Two factors were suggested for the decline: increased fishing pressure and decreases in water quality. At this site water quality standards for cadmium, manganese, and zinc continue to be exceeded, according to 1997 DOW data. Sculpin, a fish indicative of high water quality, have been found to be recolonizing the Eagle River below Wolcott in 2000. Sculpin were also collected at site 6 (Arrowhead) in 1994, 1996, 1997,1998, 1999, and 2000 [Annual Biological Assessment of the Eagle Mine Superfund Site, Eagle County, Colorado John Woodling and Ann Widmer, Division of Wildlife, April 2000].

Fish kills have been observed in the lower Eagle River on an occasional basis from Edwards to Gypsum. Furunculosis (a circulatory bacterial infection) has been the primary agent responsible, but the decrease in resistance to bacterial infections has been ascribed to the increase in general stress experienced by the fish. Brown trout are the most susceptible, with the large fish succumbing first. The stress is a result of higher water temperatures, low dissolved oxygen concentrations, loss of habitat, and handling of fish being returned to the river. According to Bill Heicher, District Wildlife Manager, each year a few dead trout are found in this area during late summer low flows, but "larger scale" fish kills have not occurred since 1988-1987 [Bill Heicher, personal communication, 2001]. In 2001, the DOW estimated a Furunculosis fish kill in the hundreds (browns and rainbows), due to weeks of hot weather and low river flows.

Average zinc concentrations at Edwards for the period 1988 through 1992 (167 mg/L) exceed the state's water quality standard using the average hardness at this site for that period (164 mg/L as Ca CO3).

A review of Water Quality Control Division monitoring data from 1977 to 1994 indicates total phosphorus concentrations on the Eagle River exceed Environmental Protection Agency recommended levels (0.05 mg/L) and increase from the confluence with Gore Creek downstream to Gypsum. Concentrations are highest over the three years from 1984 to 1987, with an average concentration of 0.218 mg/L. Average concentration for the period 1977 to 1994 at Gypsum is 0.102 mg/L.

Water quality data is collected by Eagle Valley Middle School in Eagle, Gypsum and below Gypsum, as part of the Division of Wildlife's River Watch Program. In Eagle, pH and dissolved oxygen appear good (although samples have not been collected during the summer low flow period) from 1997 - 1999. Cadmium and copper are detected infrequently, and zinc does not exceed the acute aquatic life standard, although it is regularly detected. Mean hardness for this station is 211 mg/L.

Occasional exceedances occur on the drinking water standard for manganese (50ug/L dissolved manganese). This standard is a secondary standard, based on aesthetics and not on health effects. With changes in 1999 of the State's Basic Standards, existing ambient conditions of manganese will become the new standard for this segment.

In Gypsum, dissolved oxygen is low during the winter low flow period (summer samples are not collected) and metals concentrations generally meet water quality standards. Below Gypsum, water quality appears good although dissolved copper concentrations are higher than in town.

Data collected by the Eagle Valley High School on the Eagle River upstream of Gypsum Creek between 1990 and 1994 indicated occasional exceedances of the drinking water standard for manganese, one exceedance of the temperature standard, and a mean hardness of 300 mg/L.

A review of Water Quality Control Division data collected at Dotsero from 1977 to 1994, indicate that all water quality standards are met at this site, with the exception of an occasional exceedance of manganese and fecal coliform standards. Total phosphorus concentrations at this site for the period of record average 0.082 mg/L.

2.3.2 Beaver Creek (portion of Eagle River Segments 1 & 6)

Beaver Creek has been studied extensively by the Water Quality Control Division because of ski resort development in this area. The results indicate that the stream has seasonal changes in water quality, with increased concentrations of alkalinity, hardness, and dissolved solids occurring at lower flows.

2.3.3 Milk and Alkali Creeks (Eagle River Segment 11)

Milk and Alkali Creeks join the Eagle River from the north in the vicinity of Wolcott, and have been identified as contributing a very substantial amount of nonpoint source sediment and salt. Milk and Alkali Creeks have a combined land area of 63 square miles (40,320 acres). Public lands in these areas account for 56% of the total land area. The geology of the area is dominated by Pierre shale, Niobrara formation (calcareous shales and marly limestone), and Benton shale. Permeability is slow, surface runoff is rapid, and the hazard of erosion is high. Water quality samples collected by the Denver Water Department in 1976 in Alkali Creek had a specific conductance exceeding 600 umho/cm for at least one sampling period, and Muddy Creek, a tributary to Alkali Creek, had a dissolved solids concentration of 1,178 mg/L and a specific conductance of 1,180 umho/cm.

Milk, Alkali, and Muddy Creeks were reported in the 1987 NPS Assessment to be significant sediment sources to the Eagle River. 59% of salinity samples taken in the

lower Eagle River were above 500 mg/L. Saline soils as well as urban and highway salt runoff are identified as the source of the elevated salinity concentrations.

The Bureau of Land Management (BLM) has monitored water quality in Milk and Alkali Creeks between 1987 and 1996 sporadically during the summer, and have found total dissolved solids concentrations during low flow periods to average about 1,000 mg/L. Total salt load from the public lands in the two watersheds was estimated to be 2,600 tons per year. Sediment concentrations as high as 12,000 mg/L have been recorded by the BLM during spring runoff (this data was probably collected in 1987-1989). Impacts to the fisheries in the Eagle River have been documented by the DOW (1971, 1982, and 1989). The BLM has completed a management plan for that portion of the land which they hold, and have begun implementation of that plan. Additionally, the Eagle River Council obtained a EPA 319 grant in 1989 to construct check dams and drop structures on private lands in critical areas of these watersheds.

Macro invertebrate studies were done as part of the project in 1988 and 1992. Stations above and below Milk and Alkali Creeks on the Eagle River all had a mix of tolerant and intolerant species, with no major differences between sites. Overall, water quality and instream habitat conditions appeared better at all stations in 1992 than in 1988.

USGS sampled Alkali Creek in March 2000. Dissolved manganese was at 119 ug/L, total iron of 530 ug/L, specific conductance of 1110 uS/cm, suspended solids of 31 mg/L, and total dissolved solids concentrations were 768 mg/L at a flow of 1.4 cfs

USGS also sampled ¾ mile downstream of Milk Creek on the Eagle River in 2000 and 2001 on 14 different dates in each water year.

2.3.4 Brush Creek (Eagle River Segment 12)

Brush Creek is mainly affected by nonpoint sources of pollution. Downstream from Eagle, Brush Creek had a specific conductance of 427 mg/L and a dissolved solids concentration of 630 mg/L in August 1975. Benthic diversity decreased downstream, from 3.33 to 2.38, indicating water quality degradation in the downstream reaches of Brush Creek, primarily from irrigation return flow. The US Forest Service sampled Brush Creek at several sites upstream from Eagle since 1973, and concluded that the water upstream from Eagle is acceptable for all uses.

USGS has sampled Brush Creek at the mouth in 2000 and 2001 and the East Fork of Brush Creek in 2000. Data collection included chemistry, aquatic invertebrates, and algae.

2.3.5 Gypsum Creek (portion of Eagle River Segment 10)

Gypsum Creek has water of suitable quality for all uses in its upstream reaches. Increased specific conductance and increased concentrations of alkalinity, hardness, sulfate, and dissolved solids were measured downstream. The increases are possibly the result of irrigation return flow and mineralized ground water seepage. Ground water from the Eagle River Evaporite, west of Edwards, and the Pierre shale, north of Wolcott, is the most mineralized water in the lower Eagle River watershed.

2.4 Colorado Water Conservation Board Watershed Instream Flows

Appendix 14 lists the Colorado Water Conservation Board's (CWCB) instream flow filings in the Eagle River watershed. These filings are located on most of the tributaries and mainstem of the Eagle River.

Colorado statute (CRS § 37-92-102(3)) recognizes that preserving the natural environment to a reasonable degree, through the protection of instream flows and natural lake levels in natural lakes, is a beneficial use of water. Under the same statute, the CWCB is declared the exclusive agent authorized to appropriate water rights for the purpose of preserving the natural environment. It is also stated that the acquisition of the water rights to protect instream flows has to be made within the context of existing water rights appropriation regulations. Instream flows are therefore subject to appropriation dates, and the CWCB can call out water rights junior to their own for maintenance of those flows. Thus, the fact that the CWCB has filings for these instream flows does not ensure that stream flows will always exceed these minimums, as the water rights associated with these flows have appropriation dates which are not that old. Most of the appropriation dates for instream flow filings in the Eagle River watershed are between 1977 and 1980.

Enforcement of “calls” to ensure instream flows are practically nonexistent in the Eagle River watershed. Since the CWCB holds the instream rights, they are the ones that have to place the call, and since they don’t have any field personnel the instream flows are not always met. A procedure to monitor and ensure that the CWCB exercises their legal instream flow rights needs to be investigated.

The flows established are generally the minimum necessary to preserve the natural environment to a reasonable degree, and are usually fairly junior in priority. Prolonged periods of time at these minimum flows would have an impact on the natural environment and on the designated uses of that stream segment's water. There have been some discussions on the appropriateness of some of the instream flow filings, and it is recommended that the Division of Wildlife, the Division of Parks and Outdoor Recreation, and the CWCB examine the development of the instream flow filing recommendations, and potentially revise those recommendations where appropriate.

3.0 WATER QUALITY ISSUES

3.1 Point Source Issues

Most of the point source issues relate to the assimilative capacity of the stream to absorb wastewater flows. Additionally, water quality impacts from historical mining activities continue to be an issue.

3.1.1 Municipal Discharges

Point source problems were extensively evaluated by the Water Quality Control Division in 1974 as part of the Colorado River Basin 303(e) Plan. Point source treatment needs, consolidation of wastewater treatment facilities, waste load allocations, treatment alternatives, and other related matters were addressed in the basin plan. The principal problems addressed included the need for ammonia removal capability at domestic

facilities to protect Gore Creek and the upper Eagle River from ammonia toxicity and the dissolved oxygen content of the streams. Since the adoption of the basin plan in 1974 and the 1978 version of the 208 plan (which incorporated its recommendations), the development of wastewater treatment facilities has generally proceeded in accordance with its recommendations. Facility plans under Section 201 of the Clean Water Act have defined the precise treatment mechanisms and locations for wastewater treatment and have implemented the recommendations of both the 208 and basin plans. A facility plan for the expansion of the Upper Eagle Valley Consolidated Sanitation District plant (currently the Eagle River Water and Sanitation District) was the subject of an Environmental Impact Statement which also focused on the relationship between growth and development activities in the area and the need for control of nonpoint sources from urban runoff and construction activities.

The major point source discharges in the Eagle River watershed are municipal wastewater treatment plants, listed in Table 11, along with their Colorado Discharge Permit System number and their hydraulic capacity.

Table 11. Eagle River Municipal Wastewater Treatment Facilities

CDPS Permit #	Facility Name	Responsible party	Hydraulic capacity, MDG
CO-0021385	Red Cliff	Town of Red Cliff	0.070
CO-0021369	ERW&SD Vail	ERW&SD	2.700
CO-0024431	ERW&SD Avon	ERW&SD	4.300
CO-0037311	ERW&SD Edwards	ERW&SD	1.920
	Red Sky Ranch	Holland Creek Metro District	0.027 (peak)
CO-0021059	Eagle	Town of Eagle	0.546
COG-584001	Gypsum	Town of Gypsum	0.960
	Dotsero Mobile Home Park	Dotsero MHP	0.002
	Two Rivers Village	Two Rivers Village District	0.150

Red Cliff Wastewater Treatment Plant

The Red Cliff wastewater treatment facility is a 70,000 gallon per day maximum hydraulic capacity activated sludge plant providing secondary treatment, constructed in 1972. It has average flows of 225,000 gallons per day and peak flows frequently exceed 500,000 gallons per day. It is well over its capacity due to infiltration/inflow problems and extremely high water usage by the inhabitants who keep tap water running during cold weather to prevent waterline breaks (bleeding). Estimates of winter bleeding are on the order of 100,000 gallons per day. The 1994 draft 201 plan estimated the cost of upgrading wastewater facilities for Red Cliff to be 3.9 million dollars. The July 1993 population estimate of Red Cliff was 302. According to a May 1994 draft 201 plan for the plant, the population is 440. Additional work is being done by the town to examine alternatives and decrease costs for providing wastewater treatment to the community. A new 201 Plan was released in May of 1995. The recommended alternatives in this 201 Plan included: repair collection system and treat flows using Upper Eagle Valley Consolidated Sanitation District facilities ($6,400,000); repair collection system and treat

flows using a submerged rotating biological contractor ($4,530,000); and no improvements to the collection system and treat flows of 100,000 to 900,000 gpd using a dual system of screening, filtration, and disinfection for high flows and a physical/chemical treatment process for low flows ($2,080,000). The Department of Local Affairs Energy Impact Assistance Grant advisory committee recommended partial funding to address collection system improvements in 1996.

A renewal discharge permit was issued June 29, 2001 with a design capacity of 70,000 gallons per day as a 30 day average, and 119 pounds of BOD per day. A compliance schedule has been set for a report on the sewer line project and an evaluation of influent flows and hydraulic capacity of the facility. Ammonia removal is not required due to the size of the facility and flows in the Eagle River. The discharge permit expires July 31, 2006.

Vail Wastewater Treatment Facility

The Vail wastewater treatment facility is a 2.7 million gallon per day (MGD) tertiary treatment facility which treated an average flow of 1.88 MGD in 2000. The peak weekly flow was 2.77 MGD. The aeration capacity of the plant was upgraded in 2000 to serve 7,500 SFEs (single family equivalents). The design capacity of the plant is now 7,450 pounds of BOD per day based on a 30 day average. The plant treats for ammonia removal and has ammonia concentration discharge limits.

There is a system interconnect with the Avon plant which will allow peak flows in excess of the plant's capacity to be treated down valley. Biosolids are moved to the Avon Wastewater Treatment facility via gravity flow through a trunk line. The Vail facility discharge permit expires in 2006.

Avon Wastewater Treatment Plant

The Avon Wastewater Treatment Plant is a tertiary treatment facility. It underwent an expansion that was completed in December of 1996 increasing its capacity to 4.3 MGD. Included in the expansion was a new headworks process, primary sedimentation tanks, and ATAD digesters with the ability to pre-thicken waste sludge. De-watering the sludge is made possible with centrifuges. A state to the art odor control process was also installed to treat any fugitive odors. Flow and loading to the plant vary throughout the year. An average flow is approximately 2.1 MGD and peak flows are 3.5 MGD. The solids handling process treats the sludge to a Class A biosolids product. Effluent monitoring standards include pH, BOD, total suspended solids, fecal coliform, and ammonia. BOD and total suspended solids must also meet an 85% reduction rate. The plant serves an estimated population in excess of 15,000 people and also processes the waste solids from Vail Wastewater Treatment Plant. The expansion is expected to meet the needs of the Avon, Minturn, and West Vail area through the year 2015. The Avon WWTP discharge permit expires December 31, 2003.

Edwards Wastewater Treatment Plant

The Edwards Facility is a 1.92 MDG secondary treatment plant which currently receives

average daily flows of 1 MGD and peak daily flows 1.5 MGD. The plant can serve an estimated population of 24,500 at 0.17 pounds of BOD per person per day, or a total of 4,165 pounds of BOD per day. Ammonia removal capability was included in the latest expansion along with UV disinfection and autothermal thermophilic aerobic digestion (ATAD) for treatment of all waste biosolids. Chronic ammonia discharge limits vary by month from 3.1 to 18 mg/l total ammonia.

In order to produce high quality biosolids, new waste sludge processing facilities were added into this recent facility upgrade. The ATAD system will meet the Federal 503 Class A requirements. All Class A biosolids are sold for soil enhancement around the community. The Edwards discharge permit expires July 30, 2005.

Red Sky Ranch

This facility is composed of three Water Quality Control Division permitted on-site wastewater systems discharging soil absorption fields to serve a 27 residential unit cluster and two golf course club houses. Each clubhouse system is designed for an average daily flow of 4,000 gallons per day (gpd), and peak flows of 6,000 gpd. The 27 residential units cluster system is designed for an average daily flow of 5,832 gpd, and a peak daily flow of 8,775 gpd. Along with these three State permitted systems, three additional clustered systems have been designed to serve four, six, and seven residential units, each of these systems having a design capacity to treat less that 3,000 gpd peak daily flows. Total peak daily flow from these combined systems is not expected to exceed 26,832 gpd. All the systems in the Holland Creek Metro District incorporate the same level of treatment, including de-nitrification.

Eagle Wastewater Treatment Plant

The Town of Eagle operates a wastewater treatment facility (extended aeration, activated sludge plant) with a rated capacity of 0.546 MGD. The Town completed the project and began operations on December 1, 1997. Flow rates as of February 1998 are 0.292 MGD. The Plant is not required to meet ammonia effluent limits, but the plant is required to monitor ammonia discharge concentrations. Sludge disposal is currently accomplished through contracted mobile de-watering and thereafter hauled. In 2000 the highest daily flow was 439,000 gallons (in September), and the median daily flow was approximately 345,000 gallons per day. The Town will be studying sludge disposal alternatives because of the phase out of the Eagle River Water and Sanitation District's composting program. Discharge is to the Eagle River downstream of Brush Creek (segment 9 of the Eagle River). The discharge permit for this facility expires December 31, 2003.

Gypsum Wastewater Treatment Plant

The Gypsum wastewater treatment plant is a secondary treatment 0.35 MGD aerated lagoon system with chlorination and dechlorination of effluent which discharges to the Eagle River in Gypsum. It receives average flows of 0.177 MGD and peak flows of 0.286 MGD. The plant does not have ammonia discharge limits, but is required to monitor ammonia discharge concentrations. Sludge disposal occurs on a five to ten

year basis due to the lagoon treatment. The plant serves the Town of Gypsum and the Eagle County Airport. A renewal permit for the existing facility was issued December 1999, with an expiration date to December 31, 2004.

An extended aeration mechanical plant with secondary clarification and nitrification/de-nitrification ("Aeromod" system) is currently under construction and should be operational December 2001 to replace the lagoon system at the existing site, due to hydraulic and organic capacity issues. The system is designed for 0.96 MGD average daily flow and an organic loading capacity of 2,000 Pounds of BOD per day. The facility has been engineered to allow for expansion to 2.0 MGD. No ammonia removal is required, however there is a requirement for monitoring ammonia effluent concentrations. The Town will be composting biosolids to Class A standards on the site with a facility designed by Engineered Compost Systems. The permit for this facility was issued January 1, 2001 and expires December 31, 2004.

Dotsero Mobile Home Park Wastewater Treatment Plant

The Dotsero Mobile Home Park wastewater treatment plant is a Rotating Biological Contactor plant (RBC) covered under the state's general permit for discharges to groundwater.

Two Rivers Village

This proposed planned unit development housing project in the Dotsero area, just below the confluence with the Eagle River, has been granted site approval for a 0.15 MDG facility (1,500 population equivalents). The Colorado Water Quality Control Division has extended the Site application permit for this facility to October 9, 2002. The proposed facility includes two lift stations, and an extended aeration activated sludge process ("Aeromod" System) followed by sand filtration and ultraviolet disinfection. [This facility is also mentioned in the Upper Colorado River Water Quality Management Plan]

3.1.2 Population Projections

Population projections for the county and the municipalities in the Eagle River watershed are listed in Table 12. The percentage permanent population increase from 1980 to 1990 was 64.6%, and from 1990 to 2000 was 90.0%.

Table 12. Eagle County Population Estimates and Projections - Permanent Population[1]

Entity	1980	1990	2000	2000 projected[2]	2010	2020
Eagle County (excluding Basalt)	12,791	20,932	38,978	29,091	49,835[3]	63,507[3]
Avon	640	1,798	5,561	2,893		
Eagle	950	1,580	3,032	2,014		
Gypsum	743	1,750	3,654	2,379		
Minturn	1,060	1,066	1,068	1,387		

Red Cliff	409	297	289	356		
Vail	2,261	3,659	4,531	4,731		

[1]: Information from the US 2000 Census, Denver Post Census 2000 special report, March 20, 2001
[2]: NWCCOG 1996 208 Projection based on 1994 State Demographer's Office
[3]: Population projection, State Department of Local Affairs, State Demographer's Office, October 2000 projection
Note: Permanent population projections are not available for Towns.

Peak Populations

In addition to the full time population in Eagle County, the Vail Valley Tourism and Convention Bureau estimated Eagle County to have 9,813 part-time residents and an Eagle Valley bed base of 16,990 in 2001 [Vail Valley Tourism and Convention Bureau, Vail/Eagle County Information and Vail Valley Bed Base information, 2001]. Peak Skier numbers at Vail are estimated to be 16,000 per day and at Beaver Creek 6,500 skiers per day [John Garth, Vail Valley Tourism and Convention Bureau, personal communication, December 10, 2001]

As growth continues in the State of Colorado, both in-basin and trans-basin water diversions will increase, leading to lower instream flows and increased water consumption. As future plant expansions are considered, it is critical that the water and sanitation districts consider the effects of increased diversion on instream flows. Reuse of wastewater should be examined as one method of reducing instream flow diversions. Additionally, pump back systems to return reclaimed wastewater to the point of diversion should also be considered to minimize instream flow depletions.

3.1.3 Industrial Discharges

Industrial discharges to the Eagle River and its tributaries include the Eagle Mine, the Eagle County airport, construction dewatering projects throughout the watershed, stormwater permit for construction activities throughout the watershed, and sand and gravel mining in the lower reaches of the Eagle River. These discharges are all permitted through the Colorado Discharge Permit System, administered by the Colorado Water Quality Control Division. These activities have, for the most part, small quantities of discharge. Occasionally these discharges affect water quality, but usually these effects are temporary in nature. The greatest concern with the discharges (outside of the Eagle Mine) is the cumulative impact (especially with respect to sediment) that these discharges have on the Eagle River.

3.1.4 Point Source Issues - Summary

In summary, the current point source water quality problems of streams in the Eagle river watershed are:

Continuing to provide for an adequate level of ammonia removal to avoid ammonia toxicity problems in Gore Creek and the upper Eagle River. Current levels of waste water treatment are adequate to meet existing water quality standards but decreased levels of stream flow due to upstream water

development projects may require higher levels of treatment to maintain existing water quality levels in the upper Eagle River.

The wastewater treatment system at Red Cliff needs to be improved. The control of sediment from industrial discharge permits as it relates to the cumulative impact of sediment on the Eagle River is also important.

3.2 Point Source Recommendations

The district consolidation accomplished by the Eagle River Water and Sanitation District is strongly supported by the Northwest Colorado Council of Governments, and should be used as a model for the development of regional sanitation districts whenever feasible. The economic, political, and environmental benefits of regional wastewater management cannot be overstated.

Red Cliff wastewater treatment facilities must be improved to meet wastewater treatment standards.

Ammonia wasteload allocations need to be carefully monitored with respect to potentially decreasing low stream flows (1E3 and 3E30 conditions).

As future water and wastewater treatment plant expansions are considered, it is critical that the districts consider the effects of increased diversion on instream flows. Reuse of wastewater should be examined as one method of reducing instream flow diversions. Another consideration should be the location of diversion and return flow structures, which should be located in close proximity to each other.

The need for a wastewater treatment facility in the Wolcott area is currently being explored by the Eagle River Water and Sanitation District.

3.3 Nonpoint Source Issues

The major nonpoint source water quality issues, listed in priority order, in the Eagle River watershed include: urban and construction activities [moved from second priority to first]; mining activities (primarily historic) [moved from first priority to second]; hydrologic modifications, recreation, and agricultural activities.

3.3.1 Urban and Construction Activities

Urban and construction activities have been shown to impact water quality [Vail Nonpoint Source Water Quality Management Plan, 1995]. These impacts include sediment, nutrients, metals, fecal, and organic pollutants. Loss of riparian area vegetation through stream side development and other activities also impact water quality and the aquatic community.

An increase in nutrient loading is caused by the increased use of septic systems [Dillon Reservoir Clean Lakes Study, 1982]. Septic system management is addressed under Policy 4, which addresses domestic and municipal wastes. Documented water quality problems from septic systems include high levels of bacteria in private and public water

supplies and elevated levels of nutrients. Regulation of septic systems is performed by the County, using state and local criteria (the local criteria have to meet minimum state criteria). The state requirements for installation of septic systems have recently been upgraded (1994) to address water quality problems. A number of studies in the Blue River watershed have documented the nonpoint source increase in nutrients from septic systems, although the studies did not determine if the elevated levels were due to a few failing systems or due to the general performance of septic systems. A septic system inspection and maintenance program should be initiated in the basin to identify and correct failing septic systems.

Increased consumption of water through increased development could potentially lead to decreased instream flows and increased concentrations of pollutants, due to loss in dilution flows.

As growth continues to occur throughout the watershed, it becomes more imperative that these activities minimize and/or mitigate their impacts upon water quality, in order to protect existing quality.

3.3.2 Mining Impacts

Excessive trace element concentrations exist in Cross Creek and the upper Eagle River as a result of drainage from historical mining areas including the Eagle Mine. This site has been designated a Superfund site under CERCLA and an analysis of the sources contributing to these surface and groundwater problems has been completed. A great deal of progress has been made in improvements in water quality and biological restoration as a result of remedial activities at the Eagle Mine Superfund site.

The potential exists for future mining in the Eagle River watershed. If the activity is not strictly regulated, water quality could be negatively affected.

3.3.3 Hydrologic Modifications

3.3.3.1 Trans-basin Diversions.

Current trans-basin diversions account for approximately 6% of the total stream flow in the watershed (Eagle River Assembly, Phase I Report, 1994). In 2000 29,506 acre-feet of water in the Eagle River watershed were diverted out of the basin (2000 Annual Report ,State Engineer's Office, Division V Water Resources diversion records). Out of basin diversions are 100% consumptive, i.e. none of that water is returned to replenish the stream. These diversions include: the Homestead Tunnel (27,333 acre-feet per year, 2000 ten year diversion average); the Wurtz Ditch (2,854acre-feet per year, ten year diversion average); Columbine Ditch (1812 acre-feet per year, ten year diversion average); and Ewing Ditch (1,083 acre-feet per year, ten year diversion average). Additionally, there are several substantial conditional trans-basin diversion rights totaling an additional 100,000 acre-feet (Homestake II has approximately 22,000 acre feet of conditional rights). It should be noted that these trans-basin diversions occur primarily during the spring runoff, and therefore do not affect instream flows during the times of critical low flow, due to senior downstream appropriations (Eagle River Assembly, Phase I Report, September 1994).

There are increased water development activities associated with trans-basin diversions to the eastern slope of Colorado including the Denver Water Department's Eagle-Piney and Eagle-Colorado projects, and the expansion of the Homestake project on the upper Eagle River. These projects have the potential to increase the concentration of pollutants (through a reduction in the amount of dilution flows in the Eagle River), including ammonia and chlorine at existing point source discharges, and significantly modify the hydrology of the Eagle River. According to the Eagle Mine Remedial Investigation performed for the Colorado Department of Public Health and Environment, concentration of metals in the upper Eagle River would be increased as a result of diversions from the Homestake II project. This could affect public drinking water supplies downstream and eliminate some of the potential benefits to aquatic life, which result as a consequence of the remedial actions at the Eagle Mine site. Details of these water development projects would be evaluated at the time of review of development applications under local land use regulations.

In the 1993, water year those diversions accounted for 36,121 acre-feet of water. As a comparison, the State's Water Resources Division has estimated that in-basin diversions for that same period were 6,800 acre-feet. However, it should be noted that the trans-basin diversions generally occur during the spring runoff, when low instream flows are not a concern, while in-basin diversions occur throughout the entire year and do exacerbate low stream flows at critical times.

As a result of discussions held through the Eagle River Assembly, convened by the Colorado River Water Conservation District, Colorado Springs and Aurora agreed to release 300 acre-feet of Homestake Reservoir project water to the Eagle River upon request by in-basin interests during low flow periods.

3.3.3.2 In-Basin Diversions

Throughout the Eagle River shortages in stream flow occur. A shortage is defined as an event when stream flow is lower than the CWCB instream flow amount for several consecutive days (Eagle River Assembly, 1994). Depending on the stream reach and the time of year (late summer or early winter) these shortages occur with a frequency of 1 in 2 years to 1 in 10 years (with the exception of the Eagle River between Brush Creek and the Colorado River confluence, when instream flow shortages appear to occur only during the late irrigation season in dry years).

In-basin water users divert water for domestic, irrigation, snowmaking, and industrial uses. Although the total amount of water diverted by in-basin users is less than trans-basin water users, these uses occur during periods when stream flows are low (Eagle River Assembly, 1994). It should also be noted that not all of the water diverted is consumed, with consumption ranging from 5-10% for domestic purposes to 50-70% consumption (or greater for golf courses) for irrigation. Water withdrawals impact water quality due to lower stream flows, which, as previously mentioned, lower the flow and assimilative capacity of the stream.

An additional concern is the use of water augmentation plans that allow diversions from the Eagle River and its tributaries to be made up with releases to the Colorado River which meet the need of downstream senior rights but impact stream flows within the

Eagle River valley. These water augmentation plans impact stream flows and water quality.

3.3.4 Recreation

Recreational activities can have an impact on water quality. These impacts range from disturbance, soil compaction, and erosion in riparian areas, to snow making and golf course water withdrawals, to littering and associated water pollutants.

3.3.5 Agricultural Activities

Agricultural activities (from livestock grazing, hay production, and logging) have been documented to impact water quality, especially when those activities take place in riparian areas, but also when good management practices are not implemented in upland areas. Locally appropriate Best Management Practices (BMPs) are recommended for agricultural activities (see Policy 3 - Land Use and Disturbance).

3.3.6 Milk and Alkali Creeks

These creeks contribute a significant amount of sediment and salt to the Eagle River, due to the naturally high erosive soils in these drainages and poor vegetative cover. It is not known how controllable the sedimentation is in Milk and Alkali Creeks, and how much these sources of sediment actually impact aquatic resources in the Eagle River. Additional information on these topics would be useful in determining appropriate next steps.

3.4 Nonpoint source Recommendations

Policy 1: Water Quality; Policy 2: Water Use and Development; Policy 3: Land Use and Development; Policy 4: Domestic Municipal, and Industrial Wastes; Policy 5: Chemical Management; in Volume I should be implemented by the appropriate management agencies in the Eagle River watershed to address nonpoint source issues discussed in section 3.3.

Urban runoff and construction activities in Gore Creek and the upper Eagle Valley will continue the need for control of these sources of water degradation as identified in Policy 3 - Land Use and Disturbance - Implementation Recommendations.

Water augmentation plans for proposals within the basin should be encouraged to provide augmentation water from within the basin and above the point of diversion.

Municipal, county, and other agency nonpoint source water quality improvement projects should continue to be supported by local, state, and federal funding.

4.0 WATERSHED IMPROVEMENT PROJECTS

The following projects in the Eagle River watershed have been undertaken to improve water quality in the basin.

4.1 Existing Projects

4.1.1 Eagle Mine Site Remedial Action Plan and Record of Decision

A number of actions have taken place at the Eagle Mine as a result of the Remedial Action Plan and Record of Decision. Included in these activities were: consolidation of the mine tailings (Consolidated Tailings Pile, CTP); a wastewater treatment system which cleans water from the CTP and the mine itself; a sludge dewatering system at the wastewater treatment plant; capping of the CTP; reclamation of a wetland impacted by tailings (approximately 13 acres); and monitoring activities. Water quality and the fishery appears to be improving as these activities have taken place. For more information on the Eagle Mine clean up, contact the Viacom Project Manager at Eagle Engineering Services, the Colorado Department of Public Health and Environment's Hazardous Materials Division Project Manager, or the EPA Project Manager.

4.1.2 Vail Nonpoint Source Management Plan

Beginning in 1992, the Town of Vail and the Northwest Colorado Council of Governments cooperated in developing a model Nonpoint Source Management Plan for the Town of Vail, based on the stormwater permit requirements for large municipalities (greater than 100,000 population). Land use based estimates of pollutant loads were done using stormwater samples collected from various land uses, historical water quality data was statistically analyzed to determine trends, a wetland survey was performed, and various management practices were recommended. The plan was completed and approved by the Town of Vail in 1995.

For more information contact the Town of Vail Community Development Department Senior Environmental Planner or the Northwest Colorado Council of Governments' Water Quality Program.

4.1.3 Milk and Alkali Creek Drainage Project

In 1989, the Colorado Water Quality Control Division provided nonpoint source pollution control funding (Section 319 funding) to the Eagle River Council for initiation of the Milk and Alkali Creek Project Implementation Plan. The 1989 plan included the placement of large and small rock structures, as well as straw bales structures in key locations engineered to trap sediment carried through these drainages. In 1992 the project was revised to demonstrate effectiveness of different technologies. An existing structure was repaired and additional types of structures were constructed (log deflectors, rock retaining wall, and a third rock structure) in an ephemeral drainage where two structures already existed. This was done to see if a cumulative effect on sediment trapping is demonstrated. The long term impact to water quality as a result of this project is not known. A macroinvertebrate sampling was also done on the Eagle River as part of this project. For more information, contact Eagle County Department of Environmental

Health, or the Water Quality Control Division Nonpoint Source Program Coordinator.

4.1.4 Black Lakes Enlargement Project

The Black Lakes Enlargement Project was designed to provide additional drinking water for the Town of Vail. As part of the development of the project, some of the water was set aside to augment instream flows during low flow periods in the lower Gore Creek. 300 acre- feet of water from the Black Lakes is now available to augment winter low flows in Gore Creek.

4.1.5 Eagle River Watershed Plan

The Eagle River Watershed Plan Project was initiated by the Minturn Town Manager in 1994, through an application for National Park Service Trails and Corridors Grant assistance. Eagle County acted as the grant applicant. The effort has resulted in the Eagle River Watershed Plan, which has been approved by the town and the County in the Eagle River watershed. The Plan includes chapters on water quantity, water quality, wildlife, recreation, and land use, as well as implementation recommendations.

4.1.6 Gore Creek Partnership

A number of entities in the Gore Creek Watershed joined together in 1995 to develop a monitoring program, database, and a water quality management program. These entities include: the Town of Vail; Vail Associates; Eagle River Water and Sanitation District. The USGS has been contracted to develop a water quality database, design and implement a long-term water-quality and stream ecology monitoring program, and conduct a comprehensive retrospective analysis of the data. Since 1996, four interpretive reports, describing water quantity, water quality, and stream ecology have been prepared by the USGS for the Gore Creek watershed, largely in cooperation with the Gore Creek Watershed partnership. Since 2001, USGS monitoring and assessment and database management efforts for the Gore Creek watershed have been combined with similar efforts for the Eagle River watershed, described in section 4.1.9.
They combined funding efforts to establish a USGS National Water Quality Assessment Program site at the mouth of Gore Creek and have applied for Great Outdoors Colorado funding to assist in the creation of the database and management program.

4.1.7 Eagle River Watershed Council

In 2000 the Eagle River Watershed Council was officially formed with a Board of Directors, bylaws, and 501(c)(3) non-profit status. The Council has been very involved in the Eagle Mine Clean-up and the Black Gore Creek Steering Committee.

4.1.8 Black Gore Creek Steering Committee

The Black Gore Creek Steering Committee was established by Eagle County and Northwest Colorado Council of Government staff. The group membership includes:

Eagle County, Forest Service, Colorado Department of Transportation, Division of Wildlife, Water Quality Control Division, USGS, Eagle River Water and Sanitation District, the Town of Vail, the Eagle River Chapter of Trout Unlimited and the Eagle River Watershed Council. The group is attempting to reduce the impacts of sediment on Black Gore Creek. In September of 2002, the Steering Committee, lead by the Eagle River Watershed Council, was successful in getting Black Gore Creek listed on the State's 303(d) list of impaired waters. The Committee hopes this will help them obtain federal funding to address the sediment impacts caused by the I-70.

4.1.9 USGS Retrospective Analysis

The USGS has been contracted to develop a water quality database, design and implement a long-term monitoring program, and conduct a comprehensive retrospective analysis of the data. Detailed information about the project can be found at http://co.water.usgs.gov/projects/CO326e/CO326e.html. Cooperators in the study include: Eagle County, Eagle River Water and Sanitation District, Upper Eagle Regional Water Authority, Vail Associates, Town of Vail, Red Cliff, CDOT, Town of Eagle, City of Aurora, Colorado Springs, Colorado River Water Conservation District, Eagle River Watershed Council, Town of Gypsum, and the Town of Eagle. The USGS has conducted synoptic water-quality, stream habitat, macroinvertebrate, and algal community samplings in August 2000 and August 2001 in order to establish current low-flow baseline conditions. Quarterly to monthly water quality data are collected at 6 sites along the Eagle River and at the mouth of Gore Creek. The database, including a map-based web interface has been established, and the data collection and analysis is on going though 2004. In addition to availability via the Internet, data are also published in Volume 2 of the annual USGS data report for Colorado.

4.2 Future Project Needs

A recommended watershed project is the establishment of a watershed water quality group, as discussed in the Eagle River Watershed Plan. Other potential projects include further work on Milk and Alkali Creeks, and public education on nonpoint source water quality impacts and minimization practices.

Additional projects in order of priority are being explored for future funding opportunities. These include:

- Continuation of the USGS Retrospective Analysis
- Erosion and sediment control (both from construction sites and from I-70, specifically in the Black Gore Creek drainage); in-stream flow augmentation in the Eagle River;
- Ground water sensitivity mapping exercise to be used in determining potential for groundwater aquifer contamination;
- Riparian and in-stream habitat improvement in the Upper Eagle River watershed area (using Natural Resource Damages monies);
- Further studies regarding nutrient enrichment of the mainstem of the Eagle River;
- possible means to improve the dissolved oxygen/temperature issue in the Edwards to Gypsum area;
- and a Geographical Information System project for determining priority ranking for clean-up of abandoned mine tailings and failing mine tailing cribbing.

- Minimum stream flow monitoring and active exercise of the CWCB instream flow rights.

Sources of funding include EPA 104(b)3, State 319, and Natural Resources Damages funds.

5.0 LAND USE REGULATIONS APPLICABLE TO WATER QUALITY PROTECTION AND IMPROVEMENT

This section is intended to summarize existing local land use regulations applicable to water quality protection and improvement.

As of January 1996, the streamside setbacks in place in Eagle County vary by locality. Eagle County and the Town of Eagle require a minimum 50 foot setback from the high water mark of any live stream (which generally refers to area creeks and the Eagle River). Vail requires a 50 foot setback from the centerline of the stream. Minturn, Red Cliff, and Avon require a 30 foot setback from the high water mark. Gypsum has 25-foot stream setback regulations in place.

The Town of Eagle in actual practice attempts to implement the Eagle River Watershed Plan, which recommends a 75 foot setback and/or protection of the riparian corridor, whichever is greater.

Eagle County is the only jurisdiction that currently exercises state enabled "1041" powers. Under the County's 1041 authority, permits are required for extensions of water and sewage treatment systems and industrial and municipal water projects.

Stormwater and erosion control ordinances are in place in Eagle County (which relies primarily on state standards), Vail, and Avon.

Floodplain control ordinances are in place in Eagle County, Vail and Avon.

All jurisdictions rely on federal wetlands regulations for wetlands protection and none have additional, specific provisions related to wetlands in place currently.

6.0 WASTELOAD ALLOCATIONS

6.1 Ammonia Wasteload Allocations

Most streams in the watershed are classified to protect cold water aquatic life, thus they have stringent unionized ammonia standards (0.02 mg/L). The unionized fraction of ammonia in the water depends on stream pH and temperature. Streams in the watershed tend to have higher pH values, and this has resulted in wastewater facility requirements for advanced wastewater treatment to reduce ammonia concentrations. In the Eagle River watershed, the Vail, Avon, and Edwards wastewater treatment plants have installed advanced (tertiary) treatment to decrease ammonia concentrations.

Facility: Vail Wastewater Treatment Facility Discharge to: Gore Creek
Wasteload allocation: 1.5 - 3.5 mg/L total ammonia Period: monthly

Facility: Avon Wastewater Treatment Facility Discharge to: Eagle River
Wasteload allocation: 3.1 – 10 mg/L total ammonia Period: monthly

Facility: Edwards Wastewater Treatment Facility Discharge to: Eagle River
Wasteload allocation: 3.1 – 18 mg/L total ammonia Period: monthly

7.0 WATER QUALITY MONITORING NEEDS

7.1 Existing Monitoring Efforts

Entities monitoring water quality in the Eagle River watershed include: Viacom (Eagle Mine); the Water Quality Control Division, the Division of Wildlife; Vail Associates; Eagle River Water and Sanitation District; the USGS; the Town of Vail; the cities of Aurora and Colorado Springs; the Colorado Division of Wildlife's River Watch Program; the US Forest Service and Bureau of Land Management; and public water providers. Additional information on specific monitoring efforts can be found in Appendix 5 (Select Water quality Data From Region XII, with References For Expanded Water Quality Data).

Historically, individual agencies have tended to monitor water quality without regard to long term goals, coordination between agencies, and other monitoring efforts. In addition, an extremely valuable long term Water Quality Control Division data collection effort at nine stations in the Eagle River watershed is being reduced to one station. The Gore Creek Partnership is addressing this issue in the Gore Valley, and this effort could be extended to include the entire Eagle River watershed.

USGS has been contracted by a group of interested jurisdictions to develop a water quality database of existing information (see Chapter 4). The database has been created and is currently accessible on the Internet. Part of the contract is to provide a retrospective analysis of the existing data and provide input regarding additional data needs.

7.2 Water Quality Monitoring Needs

Accordingly, the Eagle River Watershed Plan, and this plan are recommending that a committee be established to examine existing monitoring programs, compile and analyze existing data, provide for monitoring program development and execution, and public information dissemination.

Specific areas of the Eagle River watershed that warrant continued monitoring include: Gore Creek, where entities in the drainage have expressed interest in establishing a database and acquiring additional information on the state of the creek; the lower Eagle River where fish kills have historically occurred; the Eagle Mine site; potential water quality changes due to increased density of homes on septic systems; stormwater impacts from urbanized areas, and the Milk, Alkali, and Ute Creeks for additional nonpoint source sediment control projects.

Additional physical and biological data is needed to determine the status of Black Gore Creek as to whether it meets the State's guidance as a stream impacted by sediment. This is indicated by the segment being on the State's monitoring and evaluation appendix list to the 1998 303(d) list. The Black Gore Creek Steering Committee's Technical Committee has initiated sampling on Black Gore Creek to assist the State in its determination.

NWCCOG recommends that Milk, Ute and Alkali Creeks (Eagle River segment 10) be added to the State's Monitoring and Evaluation List for determination if these segments are impacting aquatic life as a result of sediment inputs. This segment is classified Aquatic Life coldwater class 2 and designated "use-protected". This evaluation would be useful in determining if additional efforts are necessary to address the sedimentation issue in this segment.

Additional information is needed regarding subsurface hydrology in the Eagle River watershed. Characterization of environmentally sensitive areas for additional management of septic systems and other potential sources of groundwater impacts would provide additional information for appropriate regulation of sources.

The loss of the Water Quality Control Division's long term monitoring stations in the Eagle River watershed will significantly impact the ability of planning and management agencies in assessing the watershed's existing water quality trends, and impacts as a result of watershed projects, planning, and management.

8.0 WATER QUALITY STANDARDS AND RECOMMENDATIONS

8.1 Existing Classifications and Standards

The current water quality classifications, designated uses, and standards for the various stream segments in the Eagle River watershed are listed in Table 16. The Eagle River watershed had 12 segments identified by the Water Quality Control Commission. Two of the segments have been designated "Use Protected", while the remaining ten are reviewable under the State's antidegradation regulation. Most of the segments in the watershed are classified for these uses: Aquatic Life, Cold 1; Recreation 1; Water Supply; and Agriculture.

One stream segment in the Eagle River watershed is designated Use Protected **(**Milk and Alkali Creeks from their source to the confluence with the Eagle River**)**. All other stream segments in the watershed are reviewable under the State's antidegradation regulation except for Segment 1, waters in the Gore/Eagles Nest, and Holy Cross Wilderness areas, which are designated "Outstanding Waters". Three stream segments are under temporary modifications to the water quality standards. These segments are all under the influence of the Eagle Mine site.

8.1.1 Designated Use Impairment Segments

The 2000 "Status of Water Quality in Colorado " Report, or 305(b) Report, lists three

Designated Use Impairment stream segments in the Eagle River watershed. The three stream segments are listed because of metal concentrations in vicinity of the Eagle Mine. This list indicates stream segments, which exceed or come close to exceeding water quality standards.

In "[t]he Status of Water Quality in Colorado 2002" prepared by the Water Quality Control Division under Section 305(b) of the Clean Water Act, the Eagle River segment 9 (Eagle River from Gore Creek to the Colorado River) is listed as impaired as a result of manganese. As stated in section 2.3.1, due to changes in the Basic Standards in 1999, this segment is now in attainment of standards, which is defined as existing in-stream manganese concentrations as of January 1, 2000.

8.1.2 303(d) List Segments

The Clean Water Act requires that the State compile a list of those waters for which the basic effluent limitations are not stringent enough to implement water quality standards, and thus require Total Maximum Daily Load (TMDL) allocations. The State's 1998 303(d) list for the Eagle River watershed lists three segments (Table 13).

Table 13. 303(d) Listed Segments

Segment	Description	Status	Impairment	Priority
COUCEA05	Eagle River, Belden to Gore Creek	Partially supporting	Cd, Zn,	Low
COUCEA07	Cross Creek, lower portion near mouth	Not supporting	Cd, Zn,	Low

All three segments are listed due to metals concentrations. Three of the segments are in the upper reaches of the Eagle River (and include Cross Creek), and are listed as a low priority.

NWCCOG recommends segment 9 be removed from the State's 303(d) list as a result of the Basic Standards changes in 1999 which allows existing quality as of January 1, 2000, for concentrations of iron, manganese, and sulfate.

One stream segment is listed for monitoring and evaluation for potential impairment as a result of sediment impacts from I-70 (Black Gore Creek portion of Eagle River segment 6).

Monitoring and Evaluation Recommendation for 2002 303(d) List

The Northwest Colorado Council of Governments recommends that Milk, Ute and Alkali Creeks (Eagle River segment 10) be added to the State's Monitoring and Evaluation List for determination if these segments are impacting aquatic life as a result of sediment inputs. This segment is classified Aquatic Life coldwater class 2 and designated "use-protected". This evaluation would be useful in determining if additional efforts are necessary to address the sedimentation issue in this segment.

8.2 Water Quality Standards Recommendations

The recommendations for water quality standards and regulations in the Eagle River watershed follow.

8.2.1 Support of Existing Standards and Temporary Modifications

It is recommended that the existing standards and temporary modifications in the Eagle River watershed be continued.

Work to improve water quality in all three stream segments with temporary modifications is continuing. A 1993 Record of Decision for the Eagle Mine site will ensure that continued progress will be made in improvements to Eagle River water quality. The Water Quality Control Division, the Environmental Protection Agency, and Viacom, Inc. have agreed to examine the development of aquatic biological goals for the site and the impacted aquatic environment.

NWCCOG is supportive of the State's antidegradation provision and protection of high quality waters. NWCCOG is concerned, however that currently classified Recreation Class 2 waters will be reclassified as Recreation Class 1a unless a Use Attainability Analysis (UAA) is completed. It is likely that Recreation Class 2 is the appropriate classification for some of these segments. It is also unlikely that UAAs will be completed for all the segments in Region XII, due to financial and time constraints. In the Eagle River watershed these waters are:

Segment 11 – Alkali Creek

There are no current municipal discharges to this segment.

8.2.2 Outstanding Waters Designation

The Northwest Colorado Council of Governments does not currently recommend any additional waterbodies to the list of "Outstanding Waters" designation. If new wilderness areas within the watershed are approved by Congress, NWCCOG recommends investigations of waterbodies within those areas for appropriate ness of "outstanding waters" designation.

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2002 NORTH PLATTE RIVER WATER QUALITY MANAGEMENT PLAN

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1.0 WATERSHED OVERVIEW

1.1 Geography and Hydrology

The North Platte River basin, which encompasses all of Jackson County and a part of Larimer County to the east, drains 2,030 square miles - the smallest drainage area of the State's nine river basins. Principal tributaries to the North Platte River included in this study are: the Canadian River, the Michigan River, the Illinois River, Willow Creek; Grizzly Creek, Hell Creek; and Pinkham Creek. A map of the watershed is provided as Figure 8. This watershed flows to the east of the continental divide, the only watershed east of the continental divide within Northwest Colorado Council of Government's regional boundary.

Elevations in the watershed range from approximately 12,180 feet along the continental divide (to the west) and 12,940 on the east (Medicine Bow Mountains) to approximately 8,000 feet where the North Platte River leaves Colorado. The average annual rainfall varies from approximately 35 inches at the higher elevations in the Routt National Forest to 10 inches at the lower elevations. Precipitation is highest in April and July, with April receiving the highest snowfall with 18.7 inches.

1.2 Land Uses and Population Characteristics

Jackson County, in the northernmost part of Colorado has an area of 1,628 square miles. The county is sparsely populated with only approximately 1,733 inhabitants [August 1995 NWCCOG Demographic Report]. Nearly one-half the population is centered around the town of Walden. Of the 63 counties in Colorado, Jackson County ranks 60th in population density [1988 208 Plan].

Ranching is by far the predominant land use, not only on privately owned land but also on lands managed by the US Bureau of Land Management and the US Forest Service lands. In 1995 there were approximately 6,000-7,000 yearlings and 15,000 cow-calf pairs grazed in the North Park Basin [Jackson County Extension Office, 1995]. The number of cattle held and grazed in Jackson County in any given year will be greatly influenced by annual precipitation and the corresponding available forage. Secondary land uses include timbering, oil production, recreation and the production of liquid carbon dioxide and dry ice.

In the North Platte River watershed there are 10 community, transient non-community, and non-transient non-community drinking water systems, serving a combined total population of 2,241 persons [Colorado Department of Public Health and Environment, Water Quality Control Division Colorado Open Records Act request, NWCCOG December 10, 2001]. Nine of the systems are reliant upon ground water and one system is reliant upon surface water. This information does not include systems serving less than 25 people.

Figure 7. Upper North Platte Watershed Map.

1.3 Watershed Management

There are on-going efforts in the North Platte watershed, which are attempting to develop and utilize adaptive long-term landscape management programs, policies and practices. These efforts include the Owl Mountain Partnership and the North Park Habitat Partnership Program.

1.4. Watershed Plan Revision Process

This plan was based on the 1988 208 Plan, with input from the Jackson County Board of County Commissioners and the County Manager, National Resources Conservation Service District Conservationist, Jackson County Water Conservancy District, Colorado State Forest, Water Quality Control Division, and Division of Wildlife personnel.

2.0 WATERSHED WATER QUALITY ASSESSMENT

The 1988 208 Plan documented that historically, there are only two sites in the County where water-quality data have been routinely collected. The water in the North Platte River is of suitable quality for all uses, with no deterioration in water quality evident. However, data analyzed by the Colorado Department of Public Health and Environment for the 303(e) Basin Plan indicate that several of the dissolved-oxygen measurements during a five-year period exceeded dissolved-oxygen criteria recommended for aquatic life, and the stream was almost always under-saturated. These observations are unusual for mountainous streams in Colorado, which normally have supersaturated dissolved-oxygen concentrations, but many Jackson County streams are meandering streams with a low slope, unlike other streams in Colorado which flow over rock stream beds and, thus, naturally become more saturated.

The Jackson County Water Conservancy District has been directing a watershed –wide water quality monitoring effort in 2000 and 2001, with the assistance of federal Clean Water Act Nonpoint Source funding. Approximately 32 sites have been sampled for physical and chemical parameters. With the exception of iron and manganese, all metals concentrations were well below primary and secondary drinking water “maximum contaminant levels”. Iron and manganese appear to coming from natural sources. Dissolved oxygen levels met the State standard of 6.0 mg/L in all cases. Actual data can be found in Appendix 5.

2.1 Michigan River (North Platte River Segment 5)

The 1988 208 Plan stated that the "Michigan River was assessed for possible water-quality changes in downstream reaches resulting from construction and agricultural activities. The Michigan River is unsaturated with respect to dissolved oxygen. The smallest dissolved-oxygen concentrations were measured during winter. This condition during the winter is probably due to a lack of re-aeration and photosynthesis because of ice cover. Much of the under-saturation of dissolved oxygen in the Michigan River, as well as in other streams in Jackson County, may be due to the small slope of the

streams which have minimal natural re-aeration as compared to other mountainous streams in Colorado."

The 1988 208 Plan stated that a "review of the Colorado Health Department water quality monitoring data on the Michigan River at Walden indicates that ten year average concentrations (1977-1987) for copper, nickel, and silver exceed current state standards. Although the database for silver and nickel is very limited, silver concentrations appear to be very high. The most recent three years of this period did not contain a sampling record for nickel and silver, however, three year average concentrations of copper were just equal to the state standard." According to the Water Quality Control Division (WQCD), the silver data collected by the WQCD was all below the limit of detection, and the copper standard was based on the old state total recoverable standard [Bill McKee, Dennis Anderson, WQCD, 1995].

Between 1988 and 1992, the WQCD collected 17 dissolved copper samples (the state standard is now based on dissolved concentrations) at the Michigan River at Walden station. Dissolved copper was not detected in any of the samples.

A review of Colorado Department of Public Health and Environment data collect on the Michigan River in Walden between 1988 and 1992 indicated good water quality. Individual fecal coliform counts have exceeded standards, but usually are acceptable. The source of the coliform bacteria has not been identified. Manganese has also occasionally exceeded stream standards, and iron concentrations are high (100 - 720 ug/l dissolved iron). Dissolved oxygen and pH at this station appears excellent, and total suspended solids, phosphorus, unionized ammonia, copper, cadmium, lead and zinc are all at low concentrations.

2.2 Canadian River (North Platte River Segment 4)

The 1988 208 Plan stated, "the Canadian River has been evaluated to determine the effects of agricultural and mining activities in downstream reaches. A control site was established on the Canadian River above Muddy Creek, and at this site, the water was of suitable quality for all uses, except for concentrations of dissolved iron which exceeded the water supply standard. The iron is probably derived from ground water draining from the lower Tertiary Coalmont Formation, which contains large amounts of iron."

Total coliform bacteria increased in the Canadian River downstream of this control site established to determine the impacts of agriculture and mining. According to the USGS study [Reconnaissance Evaluation of Surface-Water Quality in Eagle, Grand, Jackson, Pitkin, Routt, and Summit Counties, Colorado, 1979], the increases were not attributable to over-wintering cattle, based on the total coliform/streptococcus ratio and that complete ice cover precluded surface runoff to the river. Due to the age of this data, further monitoring would be warranted.

2.3 Illinois River (North Platte River Segment 4)

The 1988 208 Plan stated "the Illinois River drainage basin has been assessed for possible water quality effects resulting from agricultural activities that include cattle grazing, irrigation, and timber production in the upper reaches of the drainage basin near

Rand. In Willow Creek, bacteria concentrations were larger than in the Illinois River. A part of the fecal coliform concentration may originate from seepage from septic systems in the vicinity of Rand". Due to the age of this data, further monitoring would be warranted.

The smallest dissolved oxygen concentrations for the Illinois River sites and for Willow Creek occurred in the winter. During the winter, because of the lack of re-aeration and photosynthesis, the oxygen resources of the streams are reduced [1988 208 Plan].

Total-iron and mercury concentrations exceeded the standards for aquatic life and dissolved iron and manganese concentrations exceeded the water supply standards. The iron and manganese are probably derived from geologic formations that contain significant amounts of these constituents. Documentation of manganese concentrations in groundwater samples from the geologic formations along the Illinois River has not been made. However, in other counties, manganese often has been associated with iron in surface and ground waters [1988 208 Plan]. Changes in the Basic Standards regulation in 2000 changed the secondary drinking water standards associated with iron, manganese and sulfate to ambient conditions.

A Fishery and Habitat Analysis of the Illinois River and its tributaries for the Arapaho National Wildlife refuge was conducted by the US fish and Wildlife Service and Colorado Division of Wildlife in 1998. The survey found that overall, “the aquatic habitat on the Arapaho National Wildlife Refuge is in good, stable condition.” Three sites on the Illinois River yielded 17 macroinvertebrate taxa. In general, both numbers and taxa decreased from upstream to downstream.

An additional finding of this study regarded ponds and reservoirs. The study states that “water depth and winter survival is the limiting factor in most of these systems. With the large amounts of aquatic vegetation growing in the standing bodies of water, wintertime BOD does not allow the survival of fish, due to low oxygen. Winter kill is a common problem with many of the lakes in the lower elevations of North Park. Without some major habitat renovations, little can be done to improve the fishery potential of the standing water resource.”

2.4 Grizzly Creek (North Platte River Segment 4)

Grizzly Creek and Little Grizzly Creek were assessed to determine effects on water quality from previous coal mining activities and to establish water quality conditions. High concentrations of dissolved iron in the Grizzly Creek drainage have been attributed to natural drainage. The dissolved oxygen concentration has been documented to be under-saturated in the winter as with other streams evaluated in the area [1988 208 Plan].

Water sampling in 1979 on Grizzly Creek indicated excessive trace element concentrations. Total cadmium and iron concentrations exceed standards for aquatic life at three sites. In general, the largest concentrations occurred during the periods of higher flows. Dissolved oxygen concentrations also did not meet the minimum criteria for support of aquatic life in the winter [1988 208 Plan]. As this sampling data is dated, further monitoring should be undertaken to further evaluate these water quality parameters.

Little Grizzly Creek from Coalmont to the confluence with Grizzly Creek exceeds agricultural standards for total manganese and the recommended water supply standard for iron, according to the 1988 Colorado Nonpoint Assessment Report. Source of the metals is most likely the North Park coal mining district [1988 208 Plan]. This information is likely to be dated and may not be accurate.

Fisheries data collected by the Division of Wildlife in September 1993 on Grizzly Creek (Levis Ranch) and Little Grizzly Creek (old Peterson lease) found numerous species of fish, with the most prevalent being white suckers, cutthroat-rainbow trout hybrids, and rainbow trout. Greater numbers of fish per hectare were found on Grizzly Creek, however, the biomass per hectare was significantly greater in Little Grizzly Creek than in Grizzly Creek (202 versus 17 kg/ha). These numbers are relatively low.

According to the Natural Resources Conservation Service [Al White, District Conservationist, per. comm., 1995], Grizzly Creek serves as a significant source of sediment to the North Platte River. Currently, any elevated metals (manganese, iron) in this area are probably due to natural weathering of volcanic materials.

Grizzly Creek and Little Grizzly was placed on the State's 1998 Monitoring and Evaluation list for determination of aquatic life impairment based on Division of Wildlife fishery surveys. The cause of potential impairment is not known.

2.5 North Platte River (North Platte River Segment 3)

The North Platte River and its tributaries have been assessed for possible water quality changes from agricultural activities and from influences of oil and gas production and fluorspar mining activities. The North Platte River near Hebron (below the confluence of the Grizzly and Little Grizzly Creeks) had water suitable for all uses, with the exception of unsaturated dissolved oxygen concentration during the winter. The dissolved solids concentration was small and only total iron concentration exceeded water quality standards. A total organic carbon concentration indicated that hydrocarbons from oil and gas fields in the basin may be in the water and increasing total organic carbon concentrations in the North Platte River and its tributaries [USGS, 1979, 1988 208 Plan].

During USGS sampling on Hell Creek [USGS, 1979], cattle were observed grazing on and near the streambed, however, bacterial concentrations during both sampling periods indicated no deleterious effects from cattle grazing at that time.

Previously, Pinkham Creek exhibited fluoride concentrations which were significantly higher compared to other streams in the county, indicating some water quality effects from fluorspar mining operations. The source of fluoride is probably from ground water seepage from this mineralized area into the stream [1988 208 Plan].

The Pinkham Creek Mine has been closed since 1974 and it is expected that fluoride concentrations in Pinkham Creek (North Platte River Segment 6) have decreased as a consequence of the closure.

The Jackson County Water Conservancy sampling effort in 2001 documented slightly elevated above background fluoride concentrations (0.6 mg/L), but well below the

primary drinking water standard of 4.0 mg/L and the Water Quality Control Commission Table Value Standard of 2.0 m/L for domestic water supplies.

In 1988, sediment impacts to North Delany Butte Reservoir were identified [1988 Colorado Nonpoint Assessment Report]. A drop structure was installed at the inlet to North Delany Butte Reservoir in 1993 by the Division of Wildlife in cooperation with the National Resources Conservation Service. This structure has corrected the impacts on the trout egg production facility and fishery.

In 1993, the Division of Wildlife conducted a fishery sampling on the North Platte River at the Hudspeth site. Six species were collected, with white suckers, cutthroat-rainbow hybrids, and brown trout predominant. Total fish biomass at the site was estimated to be 95 kg/ha, with white suckers making up the majority of the biomass.

2.6 Watershed Instream Flows

Appendix 14 lists the Colorado Water Conservation Board's (CWCB) instream flow filings in the North Platte River watershed. Colorado statute (CRS 37-92-102(3) recognizes that preserving the natural environment to a reasonable degree, through the protection of instream flows and maintenance of natural lake levels in natural lakes is a beneficial use of water. Under the same statute, the Colorado Water Conservation Board is declared the exclusive agent authorized to appropriate water rights for the purpose of preserving the natural environment, although water rights can be donated to the CWCB for instream flow protection. It is also stated that the acquisition of the water rights to protect minimum instream flows has to be made within the context of existing water rights appropriation regulations. Minimum instream flows are therefore subject to appropriation dates, and the CWCB can only call out water rights junior to their own for maintenance of those flows. Most of the appropriation dates in the North Platte River watershed are between 1978 and 1981.

The CWCB appropriation flows, determined in consultation with the Division of Wildlife and the Division of Parks and Outdoor Recreation, are the flows necessary "to preserve the natural environment to a reasonable degree" (CRS 37-92-102(3)). The fact that the CWCB has filings for these instream flows does not ensure that stream flows will always exceed the minimum necessary to protect the natural environment, as the water rights associated with these flows have relatively junior appropriation dates. Exercise of water rights that are senior in date to the CWCB instream flow appropriation dates can result in stream flows lower than the CWCB appropriation amount.

Instream flow filings and appropriations in the North Platte River in Colorado are above existing and decreed water diversion structures. The 1945 Nebraska versus Wyoming Supreme Court Decree and 1953 Decree modification enjoins the State of Colorado from diverting or permitting the diversion of water from the North Platte River and its tributaries for the irrigation of more than a total of 145,000 acres of land in Jackson County, Colorado, during any one irrigation season and from storing or permitting the storage of more than a total amount of 17,000 acre feet of water for irrigation purposes from the North Platte River and its tributaries in Jackson County, Colorado, between October 1 of any year and September 30 of the following year. Under the basic tenets of Colorado water law at C.R.S. 37-92-102(3) it is stated “Nothing in this article shall . . . deprive the people of the State of Colorado of the beneficial use of those waters

available by law and interstate compact." With that portion of the statute and the decree in Nebraska v. Wyoming in mind, the Jackson County Water Conservancy District required that the Water Conservation Board insure that there is no interference from instream flow appropriations to prevent the irrigation of the maximum acreage allowed pursuant to Nebraska v. Wyoming. The Colorado Water Conservation Board agreed to adjust its instream flow filings to be above decreed water diversion structures so that instream flow appropriations would not impair the irrigation of the total acres of land allowed in the Supreme Court Decree.

3.0 WATER QUALITY ISSUES

3.1 Point Source Issues

Point source problems were extensively evaluated by the Colorado Department of Health in 1975 as part of the North Platte River Basin 303(e) Plan. Point source treatment needs and other water quality considerations related to increasing levels of coal production were addressed in the basin plan [1988 208 Plan].

3.1.1 Municipal and Domestic Wastewater Treatment

There is one municipal wastewater treatment plant in the North Platte River watershed, which serves the Town of Walden.

Walden Wastewater Treatment Plant
The Town of Walden's wastewater treatment facility is a 0.215 MGD extended aeration package plant that discharges to the Michigan River (segment 5 of the North Platte River). The organic capacity of the facility is rated at 362 pounds of BOD per day. The facility consists of an aeration basin with a jet aerator and a secondary clarifier. In addition to the package plant, the facility has a 6.2 MG storage lagoon (unlined). Disinfection is provided by chlorination and dechlorination. Infiltration and inflow (I/I) increase influent flows by as much as 100% during the irrigation season, however the facility can easily handle the increased flows, and treatment appears more cost effective than removal of the I/I. Average flows are 0.091 MGD. Due to the 1997 closure of the local solid waste landfill facility, the Town needs to develop an alternative biosolids disposal option. Additionally, the Town is considering its wastewater treatment facility needs. The discharge permit for the facility expires October 31, 2002.

An evaluation of the facility was completed in November 1998. Performance improvement recommendations included additional aeration, building replacement, biosolids management, and infiltration/inflow and ammonia studies. In 2001 the Town was awarded a Department of Local Affairs grant and loan for wastewater treatment plant improvements.

Table 14 Jackson County Population Estimates and Projections.

Jackson County Population Estimates and Projections[1]

ENTITY	1980	1990	2000	2000 projected[2]	2010	2020
Jackson County	1,863	1,597	1,577	2,090	2,136[3]	2,471[3]
Walden	947	890	734	982		

[1]: Data from US Census as reported by Denver Post, 2000 Census Special Report, March 20, 2001.
[2]: 1996 NWCCOG 208 Plan, projected population based on State Department of Local Affairs, State Demographers Office, 1994.
[3]: Population projections, State Department of Local Affairs, State Demographer's Office, October 2000 projections.

3.1.2 Industrial Discharges

The industrial wastewater discharge permits in the North Platte watershed are mainly for mining and oil and gas related activities, issued to the Kerr Coal Company. Most of the current activities related to mining involve reclamation efforts, and as a result it is anticipated that water quality is improving downstream of these sites.

3.1.3 Point Source Issues – Summary

In summary, there are no point source water quality problems documented in streams in Jackson County.

3.2 Point Source Recommendations

There are no recommendations for point source issues, as no point source water quality problems have been documented.

3.3 Nonpoint Source Issues

The potential nonpoint source water quality issues of streams and lakes in the North Platte River Basin in Jackson County include:

Under-saturated dissolved oxygen concentrations probably resulting from small streambed slopes that cause decreased re-aeration and photosynthesis [1988 208 Plan]. This is a natural condition, but could potentially be addressed through stream improvement projects.

3.3.1 Mining Impacts

The previous 208 Plan [1988] indicated excessive total organic carbon concentrations in streams draining coal, oil, and gas fields. Since most of the current mining activities are related to site reclamation, it is expected that this water quality concern is being addressed.

The previous 208 Plan [1988] indicated excessive fluoride concentrations from past fluorspar mining operations. The fluoride concentrations in Pinkham Creek are expected to have decreased due to the mine closure and site reclamation at the fluorspar mine.

More recent sampling by the Jackson County Water Conservancy District (May 2001), indicates that fluoride concentrations in Pinkham Creek have decreased and are currently meeting the Water Quality Control Commission's domestic water supply standard of 2.0 mg/L.

3.3.2 Urban and Construction Activities

Due to lack of urban and construction activities in the watershed, these activities are generally not a concern in the watershed at this time.

3.3.3 Hydrologic Modifications

There is one trans-basin diversion in this watershed. 60,000 acre-feet in any 10 year running period are diverted by the City of Fort Collins through the Michigan River ditch. This equates to an average annual diversion of 6,000 acre-feet per year. Stream flow in the Michigan River are adequate to meet Walden's wastewater treatment plant discharge concerns

The North Platte River basin is somewhat unique in Region XII, in that trans-basin diversions have been limited to no more than 60,000 acre feet of water in any period of ten consecutive years reckoned in continuing progressive series beginning with October 1, 1945 as a result of the Supreme Court decree in the Nebraska versus Wyoming case (325 US 589 (1945). In addition, irrigators in Jackson County are limited under the same case and a modification (345 US 981 (1953)) to irrigating no more than 145,000 acres and no more than 17,000 acre feet of total annual storage for irrigation purposes.

The Colorado Water Conservation Board has limited its instream flow filings to those stream reaches above irrigable lands. Thus, hydrologic modifications are not anticipated to be a problem in the North Platte watershed, unless very site specific and limited in extent.

3.3.4 Agricultural Activities

Agricultural activities in the watershed have not been documented to cause water quality concerns.

Due to the amount of grazing in the watershed (see section 1.2), this area is appropriate for the examination of Best Management Practices developed in cooperation with the ranchers, state, and federal management agencies in the basin, such as the State Land Board, Bureau of Land Management, the Natural Resources Conservation Service, and the Forest Service. Livestock grazing management can be used as a tool to improve range conditions as well as maintaining a healthy riparian ecosystem.

The Owl Mountain Partnership was established in 1993 as a prototype for "ecosystem

management" in Jackson County, as an offshoot of the Colorado Division of Wildlife's Habitat Partnership Program. Grant funding from Section 319 of the Clean Water Act was obtained in 1996 ($76,000). A second grant was awarded in 1997 for $152,000, and a third phase of the resource management project was funded in 2000 at $150,000. Through a collaborative approach, working with resource agencies and North Park ranchers, 20 ranch management plans have been developed to improve range conditions and protect water quality of streams in the Illinois, Canadian, and Michigan River basins. Wells and pipelines have been installed for a number of grazing allotments to provide alternative stock watering. Fencing best management practices have been used to better manage livestock. Spring developments have been installed in several locations. Vegetative treatments have been used extensively to improve forage for livestock and wildlife. Grant funds allow cost share for these practices, which are matched with both cash and in-kind efforts of participating producers, for both private and public lands.

3.3.5 Recreational Activities

A concern has been raised that significant increases in wildlife populations due to DOW big game management could be having an impact on water quality. The Owl Mountain Partnership may be the appropriate forum to evaluate and resolve this concern.

Elk and deer 2001 post hunt projections by the Division of Wildlife in March of 2001 were 4,387 and 4,467, respectively. Antelope and moose 2001 projections were 1,836 and 509, respectively.

3.4 Nonpoint Source Recommendations

Voluntary appropriate agricultural Best Management Practices (BMPs) that have been demonstrated to improve or protect water quality, identified through the 208 Plan and other efforts should be encouraged.

4.0 WATERSHED IMPROVEMENT PROJECTS

4.1 Existing Projects

4.1.1 Owl Mountain Watershed Project

This project is being lead by the Colorado Wildlife Heritage Foundation and is being funded in part by EPA 319 funds. The major goals of the project are to "Promote ecosystem health over large landscapes with varying ownership throughout the project area; improve soil and vegetative conditions; improve water quality to benefit aquatic and terrestrial wildlife species; promote sustainable agricultural and timber industries; and build trust between government and the local North Park community." The project area includes three major drainages - the Michigan, Illinois, and Canadian Rivers, which all flow into the North Platte River. For more information on this project see section 3.3.4

The Owl Mountain Partnership will continue to undertake projects that will not diminish

the rights of all present and future water users to divert, fully develop and use, up to Colorado's full equitable apportionment and entitlements, the waters of the North Platte River and its tributaries under the Nebraska v. Wyoming decrees as allowed under such decrees and in accordance with Colorado water law. Furthermore, the Owl Mountain Partnership agreed that they would not support or fund efforts by any entity to claim or file on or obtain any in-stream flow decree on the North Platte River or its tributaries downstream from any existing and decreed water diversion structures.

4.1.2 North Delany Butte Reservoir Drop Structure

See Section 2.5 for information on this project.

4.1.3 Colorado State Forest Ecosystem Project

The Colorado State Forest Ecosystem Planning Project was initiated in 1993, and culminated with the development of a comprehensive, integrated management plan. The project's goals were to " establish a planning and monitoring process on the State Forest for the State Land Board, provide the Board with a mechanism to define long term goals, develop management strategies for the Forest, monitor ecosystem health, and foster an environment of cooperation among the Forest stakeholders." The "Strategic Plan" developed by the Colorado State Forest Ecosystem Project was approved by the State Land Board in February 1996.

4.2 Future Project Needs

Projects may be identified through the various efforts previously mentioned.

5.0 LAND USE REGULATIONS APPLICABLE TO WATER QUALITY PROTECTION AND IMPROVEMENT

Jackson County has 1041 land use and zoning regulations. It does not appear that land use regulations beyond those currently in place, are needed to protect existing water quality.

6.0 WASTELOAD ALLOCATIONS

A total ammonia wasteload allocation has been placed on the Walden Wastewater treatment facility for the months of June, July, August, September, and October to protect the fishery in the Michigan River.

The total ammonia monthly chronic effluent limits are as follows:

June:	11.5 mg/L
July:	7.1 mg/L
August:	6.5 mg/L

September: 9.2 mg/L
October: 18.2 mg/L

7.0 WATER QUALITY MONITORING

7.1 Existing Monitoring Efforts. The Water Quality Control Division maintained a monitoring station on the Michigan River in Walden until 1992. That station is no longer active. The Division of Wildlife's River Watch Program does not maintain any stations in the North Platte Watershed. The USGS maintains two gauging stations on the North Platte, but water quality data is not collected at these stations.

The Jackson County Water Conservancy District, as previously mentioned, has undertaken a watershed-wide water quality monitoring program which was initiated in 2000, and will continue in 2002. This monitoring project is being coordinated with the Owl Mountain Partnership, and the Colorado State Forest, which although separate projects, are utilizing the same sampling techniques and analytical procedures, and have been monitoring since 1995.

The Water Quality Control Division has existing water quality monitoring sites in the North Platte watershed and has macroinvertebrate and flow data from a special study conducted in October 2000.

7.2 Water Quality Monitoring Needs

A thorough investigation of dissolved oxygen concentrations is needed to determine why streams are under-saturated. Dissolved oxygen could be monitored during several 24 hour periods seasonally, especially in streams draining areas that are heavily grazed. Photosynthesis and respiration rates need to be measured, especially during the winter when streams are frozen.

Concentrations of dissolved oxygen in stream bottom sediments need to be determined by intra-gravel techniques. An investigation of the possible contribution of ground water to the streams should be measured during the winter to study the problem of low dissolved oxygen concentrations.

A study is needed to supplement monitoring of dissolved oxygen with the collection of periphyton or benthic invertebrates for measurement of biomass by artificial substrate method. This could be a useful tool for determining seasonal and aerial changes of dissolved oxygen.

8.0 WATER QUALITY STANDARDS

8.1 Existing Standards and Classifications

Streams in the North Platte River watershed are classified for protection of cold water aquatic life (Class I), primary contact recreation, water supply and agricultural uses.

Three stream segments in the basin are listed as "Use Protected". Use protection ensures that the existing uses on these segments are protected from future antidegradation reviews. Those segments are: tributaries to the North Platte including lakes and reservoirs, except those in the Mount Zirkel Wilderness area (Stream Segment 5); mainstem of the Michigan River (Stream Segment 5); and the mainstem of Government Creek from the State Forest to the North Platte (Stream Segment 7).

8.1.1 Designated Use Impairment Stream Segments

There are no designated use impairment stream segments in the North Platte River watershed.

8.1.2 303(d) list

Section 303(d) of the Clean Water Act requires each state to identify those waters for which effluent limits are not enough to allow the waters to meet water quality standards. There are no listed stream segments in the North Platte River watershed.

Eight segments have been placed on the State's monitoring and Evaluation List. All eight segments have been identified by the US Forest Service as potentially impacted by sediment sources.

The Jackson County Water Conservancy District is in agreement that Grizzly and Little Grizzly Creek warrant continued sediment monitoring to determine if the sediment is a naturally occurring condition.

The Jackson County Water Conservancy District has monitored Newcomb, Ninegar, Pinkham, and Snyder Creeks, for sediment impacts and recommends deletion of these segments from the monitoring and evaluation list.

It is recommended that the North Platte, Grizzly Creek, Illinois River, Canadian River and Michigan River are removed from the Monitoring and Evaluation list. These segments were proposed for evaluation based on elevated iron and manganese values. In the July 2000 Rule Making Hearing, the Commission ruled that for segments with a water supply classification that have an actual water supply use, that the numerical standard would be the less restrictive of either a) the existing quality as of July 2000, or b) the water supply table value criteria. Based on the information collected by the Jackson County Water Conservancy District, it appears that the elevated concentrations of iron and manganese are naturally occurring, and that the existing quality is the appropriate standard.

8.2 Recommendations on Standards

Existing water quality standards (including use designations and criteria) for the North Platte River Basin are adequate to protect the existing uses under current conditions.

NWCCOG is supportive of the State's antidegradation provision and protection of high quality waters. NWCCOG is concerned, however that currently classified Recreation Class 2 waters will be reclassified as Recreation Class 1a unless a Use Attainability Analysis (UAA) is completed. It is likely that Recreation Class 2 is the appropriate classification for some of these segments. The Jackson County Water Conservancy District will have Use Attainability Analysis completed on the following stream segments in the North Platte watershed before March 2003:

Segment 2 – Mainstem Encampment River to Wyoming
Segment 5- Mainstem Michigan River from the source to the North Platte
Segment 6 – Mainstem Pinkham Creek from source to the North Platte
Segment 7 – Mainstream of Government Creek from boundary of the Colorado State Forest to the confluence with the Canadian River. Mainstream of Spring Creek from source to confluence with Illinois River

There is a permitted discharge to Segment 5 (Town of Walden Wastewater facility).

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2002 ROARING FORK WATERSHED MANAGEMENT PLAN

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1.0 WATERSHED OVERVIEW

1.1 Geography and Hydrology

The Roaring Fork watershed is located in Pitkin, Eagle, Garfield, and a small portion of Gunnison Counties, in west-central Colorado, comprising an area of high glaciated mountainous terrain and deep intervening valleys. Altitudes in the watershed range from 14,265 feet along the continental divide and within the Maroon Bells/Snowmass Wilderness, to 5,800 feet at Glenwood Springs. The drainage area for the entire watershed (to Glenwood Springs) is approximately 929,000 acres (1,451 square miles, US Geological Survey [USGS] Water Resources Data, 1993). A map of the watershed is provided in Figure 9.

The Roaring Fork, with headwaters in the Independence Pass area, drains most of Pitkin County, flowing northwest to its confluence with the Colorado River at Glenwood Springs. Principal tributaries to the Roaring Fork include Castle and Conundrum Creeks, flowing north to Aspen; Brush Creek, flowing east through the Snowmass Ski areas to its confluence with the Roaring Fork River at the Town of Woody Creek; the Fryingpan River, flowing westward to Basalt; and the Crystal River, flowing north to Carbondale. The Roaring Fork River contributes more water to the Colorado River than any other stream in Colorado except for the Gunnison, yielding an average of almost 1,000,000 acre-feet per year.

Major tributaries to the Crystal River are Avalanche, Coal, and Thompson Creeks.

The three major rivers in the watershed, the Roaring Fork, the Crystal, and the Fryingpan, contribute approximately 54%, 32%, and 14% of the flow in the watershed, respectively (Bureau of Reclamation, Ruedi Reservoir, Colorado Round II Water Marketing Program Addendum to the Draft Environmental Statement, 1988). Average annual water yield from the Roaring Fork watershed is 857,000 acre-feet (Bureau of Reclamation, Ruedi Reservoir Colorado Round II Water Marketing Program, Final Supplement to the Environmental Statement, 1989).

Annual precipitation in Eagle County is 14.1 inches; Garfield County, 18.6; and Pitkin County 24.5 inches (Fryingpan-Arkansas Project, Colorado, Final Environmental Statement, Bureau of Reclamation, 1975). The primary source for streamflow in the Roaring Fork is the spring melting of the accumulated winter snowpack. The annual hydrograph (stream discharge over time) shows the highest stream flows occurring during the late spring and early summer (over 50% of the stream flow in May, June and July, Bureau of Reclamation, 1975). Stream flows are at their lowest August-October and March-April (Bureau of Reclamation, 1988).

Figure 8. Roaring Fork Watershed Map.

Stream flows in the Roaring Fork watershed are affected by diversions which transport water out of the basin to the Arkansas River via the Fryingpan-Arkansas Project (approximately 157,000 acre-feet in 1993 and 97,743 acre-feet in 2000, State Engineer's Office). The Ruedi Dam and Reservoir is the only major water storage facility in the Roaring Fork watershed with an active conservation capacity of 102,369 acre-feet and a surface area of 997 acres. Ruedi Reservoir was built in 1968 and is operated by the Bureau of Reclamation to mitigate the effects of the Fryingpan-Arkansas project (Bureau of Reclamation, 1989).

1.2 Land Uses and Population Characteristics

The Roaring Fork watershed includes a portion of Gunnison County (the headwaters of the Crystal River), all of Pitkin County, a portion of Eagle County, and a portion of Garfield County. Based on very rough approximations, the Roaring Fork watershed is 929,000 acres in size (1,451 square miles). Approximately 70% of the land in the Roaring Fork watershed is managed by the US Forest Service, 5% is managed by the Bureau of Land Management, and 25% is privately owned. Most of the private land occurs along the valley floor, and most of the BLM land is located in the lower portion of the watershed.

Most of the population and the principal economic activities are centered around Aspen and Glenwood Springs. Tourism in the form of recreation and skiing is the predominant economic activity. Ski areas in the Roaring Fork valley include: Aspen Mountain, Aspen Highlands, Buttermilk/Tiehack, Snowmass, and Sunlight.

The lower Roaring Fork valley north and west of Aspen, has historically been used for ranching, but development has increased because of recreation demands further up the valley.

Mining activities are a third important part of the economy, with coal (Coal Creek and North Thompson Creek drainages) and iron-ore mining providing the greatest resources. However, mining activity is declining and the large coal mines in the Coal Creek and North Thompson Creek drainages have closed. Gravel mining continues to be an important industry in the watershed.

The 2000 population centers in the Roaring Fork basin include Aspen (5,914), Snowmass Village (1,822), Basalt (2,681), El Jebel, Carbondale (5,196), and Glenwood Springs (7,736). (US Census, as reported by the Denver Post March 20, 2001).

In Pitkin and Eagle Counties in the Roaring Fork watershed there are 31 community drinking water systems, 12 non-community transient systems (such as restaurants and campgrounds), and four non-community non-transient water systems (such a schools). Eight drinking water systems are reliant upon surface water sources (serving a population of 34,957 and 39 drinking water systems are reliant upon groundwater (serving a total population of 10,123). This does not include any systems (including private wells) serving less than 25 persons.

1.3 Watershed Water Quality Management

Because of the complexity of the different jurisdictions within the Roaring Fork watershed, watershed management is difficult. For example, the Northwest Colorado Council of Government's (NWCCOG's) planning region and authority for 208 planning includes Eagle and Pitkin counties, but does not include Garfield and Gunnison counties.

NWCCOG has informally approached Garfield County, Carbondale and Glenwood Springs concerning incorporation of their issues into this watershed plan, and has met with favorable response.

A number of public meetings were held in the Roaring Fork basin during development of the watershed's water quality management plan, sponsored by the Ruedi Water and Power Authority. Participants included local officials, the Colorado River Water Conservation District, sanitation district representatives, the Division of Wildlife, and interested members of the community.

2.0 WATERSHED WATER QUALITY ASSESSMENT

Generally speaking, water quality in the Roaring Fork watershed is excellent. The Roaring Fork and its tributaries have excellent fisheries, with several segments designated as "Gold Medal" by the Division of Wildlife. The overall concern in the watershed is the protection of the existing water quality in a rapidly urbanizing environment.

In 1999, the Roaring Fork Conservancy initiated a watershed water quality monitoring program, modeled after the Colorado Division of Wildlife's River Watch program. The program uses existing River Watch efforts and oversees/ coordinates numerous "stream teams". Between twenty-three and twenty-five stations in the watershed are monitored on a regular basis.

In 2001, the Roaring Fork Conservancy issued the "Roaring Fork Watershed State of the River Report (November 25, 2001). The report states that the major issues regarding water quality are wastewater treatment discharges, stormwater runoff and erosion and sediment loading. Additional water resource related concerns include filling of the floodplain and channel, degradation and removal of natural vegetation, and increased recreational use. Specific pollutants of concern include sediment, nutrients (nitrogen and phosphorus), bacteria, dissolved metals and salts.

2.1 Upper Roaring Fork Watershed (Stream Segments 1, 2, & 3)

Water quality data collected by Aspen Middle School through the Division of Wildlife River Watch program on the Roaring Fork at Herron Bridge Park in Aspen. Data collected in 1991 and 1992 indicates metal concentrations (cadmium, copper, iron, manganese, lead and zinc) are well below water quality standards, but that dissolved oxygen concentrations in June and July 1992 were below 6.0 mg/L, the water quality standard for a coldwater fishery. Additional sampling should be done to confirm if dissolved oxygen is a concern at this location.

The Water Quality Control Division maintained a monitoring station on the Roaring Fork below Aspen until 1992. Water quality data collected between 1988 and 1992 at this

station showed good water quality, with no exceedance of standards for metals. Total phosphorus concentrations at this station were high (a mean value of 0.089 mg/L for 49 samples), and un-ionized ammonia exceeding the standard of 0.02 mg/L (maximum value of 0.108 mg/L). The minimum dissolved oxygen concentration measured at this station between 1988 and 1992 was 7.6 mg/L.

The 1988 208 Plan stated that dissolved-solids concentrations on the Roaring Fork River have been related to geologic formations in the area. Dissolved-solids concentrations on the Roaring Fork River increase from a mean of 36 mg/L upstream from Aspen to a mean of 408 mg/L at Glenwood Springs. Conundrum Creek had a specific conductance of 850 umho/cm as a result of thermal-spring discharges. Castle Creek, upstream from Conundrum Creek, had a maximum dissolved-solids concentration of 344 mg/L and a specific conductance of 404 umho/cm for the same sampling period.

According to the USGS [USGS, Reconnaissance Evaluation of Surface-Water Quality in Eagle, Grand, Jackson, Pitkin, Routt, and Summit Counties, Colorado, Open File Report 79-420, 1979] the Upper Roaring Fork River above Aspen has water suitable for all uses, with an average dissolved solids concentration of approximately 50 mg/L.

The USGS [USGS, 1979] found that downstream from Aspen, the dissolved-solids, bacteria, hardness, and sulfate concentrations increase, as compared to upstream, with as much as a 500 percent increase in dissolved solids concentration. Chemical concentrations probably increased because of mineralized thermal springs on Conundrum Creek, which joins the Roaring Fork River at Aspen, urban and rural activities, and a greater contribution from ground water. The average concentration of dissolved solids of Conundrum Hot Springs is 2,200 mg/L.

The USGS report [USGS, 1979] stated that it is difficult to separate the effects of urban activities from natural effects on water quality. Bacterial and nutrient increases downstream from Aspen indicate a contribution from urban activities. The increased turbidity and suspended sediment concentration may be partly a result of urban runoff, but a part probably is contributed by erosion of outcrops of sandstone, siltstone and shale, which tend to be more easily weathered than the areas upstream.

According to the USGS [USGS, 1979], downstream from the Aspen sewage treatment plant discharge, sulfate, calcium, nutrient, and dissolved solids concentrations increase as compared to upstream. Turbidity and suspended sediment concentrations are also greater than upstream, probably as a result of erosion from outcrops of Mancos Shale and Maroon Formation, which are easily weathered, fine-grained sandstone and siltstone. Slight increases in nutrient concentrations, probably contributed from discharge of the sewage-treatment plant have been observed downstream of Aspen.

The 1988 208 Plan reviewed Colorado Water Quality Control Division water quality monitoring data from 1979 through 1987 at the Roaring Fork station below Aspen, and found that the average total phosphorus concentration was above the EPA recommended criteria established to minimize downstream eutrophication and prevent interference with coagulation in water treatment plants. Dissolved solids and turbidity were also reported to be at concentrations higher than EPA recommended criteria for domestic water supplies. Occasional exceedances of aquatic life standards for copper, lead, zinc, and cadmium were reported. Information on silver indicated very high concentrations but was extracted from a limited data base (1979-1983, nine samples

with a mean value of 5.7 ug/L total recoverable silver). When compared to average concentrations for the period 1984-1987 all elevated concentrations had improved and there were no standard exceedances for cadmium; silver was not monitored. Phosphorus and dissolved solids are still reported in high concentrations based on data collected by the Division between 1988 and 1992. Metals data collected by the Division during this period indicated water quality exceeding standards set for the protection of aquatic life.

Water quality modeling performed on the Roaring Fork below Aspen by the Colorado Department of Public Health and Environment's Water Quality Control Division has indicated that water quality standards violations associated with municipal wastewater treatment discharges would occur without the provision of advanced wastewater treatment. Wasteload allocations for ammonia have been established and advanced treatment has been provided to further reduce ammonia consistent with the stream standards.

The USGS report [USGS, 1979] stated that, with the exception of nutrients, the concentrations of minerals and suspended sediments increase on the Roaring Fork River downstream from its confluence with Brush Creek near Snowmass. Irrigation returns and erosion from irrigated cropland along Woody Creek, East Sopris Creek, Capital Creek, Red Canyon Creek and the Crystal River may contribute to the salinity in the Roaring Fork. Upstream from the confluence with Brush Creek, the stream and its tributaries drain outcrops of the Mancos Shale, Maroon Formation, and State Bridge Formation, all yielding calcium bicarbonate type water. The Mancos Shale is partly carbonaceous, which may account increasing concentrations of total organic carbon.

The USGS report [USGS, 1979] found that in general, trace element concentrations on the Roaring Fork River were low, although total cadmium and lead exceeded aquatic life standards during high flows in May of 1976. Lead concentrations have been documented in the 1989 Colorado Nonpoint Assessment Report [Colorado Water Quality Control Division, 1989] to exceed aquatic-life standards from Aspen to Snowmass. As previously noted, recent water quality data collected by the Water Quality Control Division (WQCD) below Aspen between 1988 and 1992, and the Division of Wildlife's River Watch Program shows metals to be meeting all water quality standards.

The 1988 208 Plan stated that from Snowmass to the Crystal River concentrations of copper, cadmium and iron are in exceedance of aquatic life standards. The 1989 Colorado Nonpoint Assessment Report also states that the Roaring Fork, from Snowmass to the Crystal River confluence, exceeds aquatic life standards for copper and cadmium. Inactive mining in the Aspen and Snowmass areas are considered possible sources of this problem. Water quality data has been collected at the Woody Creek Bridge on the Roaring Fork by the Aspen Community School as part of the Division of Wildlife's River Watch Program. Data has also been collected by Aspen Middle School at the Highway 82 Bridge below Snowmass Creek, and by Basalt High School at the 7-11 Bridge. Data collected between 1991 and 1993 did not show any exceedances of water quality standards for metals.

The Roaring Fork Conservancy's water quality monitoring program found dissolved oxygen values at the Ranch at Roaring Fork station to be excellent year- round. Of 11 observations at the site the minimum dissolved oxygen level was 8.2, and the mean

value was 9.6 [Roaring Fork Watershed 2000 Report]. One observed data point of 2.5 mg/L dissolved oxygen is not included due to the potential anomaly of the observation.

The 1988 208 Plan stated that the Roaring Fork from its confluence with the Crystal River to its mouth contained cadmium concentrations in excess of the aquatic life criteria but that despite the problems, the lower Roaring Fork River provides a good aquatic habitat and supports a good fishery.

The Roaring Fork Conservancy's monitoring program in 2000 did not identify cadmium concentrations in exceedance of State water quality standards in the lower Roaring Fork River, but did observe total iron concentrations greater than 1,000 ug/L in April 2000. This is likely due to ground water return flows with high iron concentrations during periods of low in-stream flows.

In 2001 Pitkin County contributed $20,000 to a study to determine if growth and development in the upper valley may be polluting the local watershed. The study is being conducted by Ken Kolm, Colorado School of Mines, Argon National Laboratories, and the EPA.

2.2 Brush Creek (Stream Segment 4)

Past water quality studies have documented that natural and urban storm runoff are sources of pollution affecting the water quality of Brush Creek at Snowmass [referenced by USGS, 1979]. The greatest documented nonpoint source problem was suspended sediment concentrations as a result of runoff from parking lots and recreational development. The West Fork of Brush Creek is noted as an erosion area by the Soil Conservation District.

The Brush Creek drainage downstream from the Snowmass Ski Resort was assessed for possible water quality effects from recreational and urban activities [USGS, 1979]. At a site upstream from the ski area, water quality seemed to be adversely affected only during spring runoff. A relatively high level of sediment and nutrient probably are due to the natural runoff from the erosive Mancos Shale, mudflow deposits, and unconsolidated rock debris upstream. Downstream from the Snowmass ski area and sewage treatment plant, nearly all chemical concentrations increase as compared to upstream. The larger sediment and nutrient concentrations at this site are from natural runoff and runoff from ski area facilities.

The 1988 208 Plan stated that nutrient concentrations downstream of the Snowmass Sanitation District discharge were elevated as compared to upstream values. Wasteload allocations for ammonia, chlorine and BOD have been established and advanced treatment has been provided to reduce ammonia, BOD and discharges to the maximum feasible level.

The Snowmass Ski Area Final Environmental Impact Statement (USFS, Aspen Ranger District, 1994) states "This stream [Mainstem Brush Creek] has been highly affected by human use on both National Forest Service Land and private lands, resulting in considerable habitat and water quality degradation. In many areas, riparian vegetation has been eradicated or significantly altered."

The macroinvertebrate community in Brush Creek differs from those in other streams within the assessment area, indicating poor water quality and the abundance of fine particulate organic material in the channel (USFS, 1994). Surveys conducted by the Colorado Division of Wildlife and Forest Service confirm that brook trout inhabit Brush Creek in sufficient numbers to warrant the consideration of habitat improvement. The Water Quality Control Commission has classified Brush Creek as "Aquatic Life Class 2" and "Use Protected" (not subject to antidegradation review) because of habitat limitations.

Finally, the USFS 1994 FEIS states "On National Forest Service Land, there has been a 22% reduction of riparian habitats since pre-development, while on private land the reduction is significantly higher at 66%. Most notable is the elimination of riparian floodplain areas."

In 1995 the Town of Snowmass Village applied for a nonpoint source grant from the EPA. In their application they stated that in 1993, a below average runoff year, as much as 40 tons of sediment and bedload per day was measured during peak stream runoff. Sources of suspended sediment included: construction sites (9,000 mg/L); unpaved ditches (6,900 mg/L); unpaved parking lots (6,300 mg/L); and paved sanded parking lots (800 mg/L). Natural runoff was measured at 12 mg/L.

In 1999 the Water Quality Control Commission upgraded the Classification of Brush Creek from Aquatic Life Class 2 to Aquatic Life Class 1 based on biological data that supported the change.

A draft Watershed Management Plan for Brush Creek in and near the Town of Snowmass Village was presented to the Town by Wright Water Engineers in August 2000. Generally, the report characterizes the soil characteristics for areas directly tributary to Brush Creek as moderate to severe for hazard of water erosion. Control of TSS and sediment are the highest priority issues identified in the watershed plan.

A macroinvertebrate and trout population evaluation was prepared for The Town of Snowmass Village by William Walsh in May of 2001. The best brook trout population in Brush Creek was found in the lower Golf Course section of the Creek. Both wild and hatchery trout were found in Brush Creek. It was reported that suspended sediment in Brush Creek range from 0 to 668 mg/l, and that both the trout population and macroinvertebrates could be impacted to some degree by this level of sediment.

The Roaring Fork Conservancy's site on Brush Creek has observed pH values exceeding the State standard (9.0) on a few occasions. The maximum value of 11 observations was a pH of 9.04, with two other readings to 9.02 [Roaring Fork Watershed 2000 Report].

2.3 Woody Creek (part of Stream Segment 3)

The USGS [USGS, 1979] evaluated the Woody Creek drainage for water quality conditions prior to the proposed construction of a lead and zinc mine near the town of Lenado (the mine is no longer under consideration). Water samples were collected from the stream upstream and downstream from the proposed mine site. Except for total cadmium concentrations which exceeded aquatic life standards at both sites and total

lead concentrations which exceeded standards, all trace element concentrations were low, with zinc concentrations at detection limits. The dissolved solids concentrations also were low, with a maximum observed value of 111 mg/L. In 1987 State standards for cadmium and lead were changed from total to dissolved concentrations for these (and most other) metals.

2.4 Snowmass Creek (part of Stream Segment 3)

Water quality data for Snowmass Creek does not exist, however macroinvertebrate collections indicate excellent water quality (USFS, 1994). Fisheries data collected above the Snowmass Water and Sanitation District diversion indicate a reproducing, self-sustaining population of brook trout, and possibly brown trout and sculpin population (USFS, 1994).

Water quality data has been collected on the Roaring Fork at the 7-11 Bridge by Basalt High School as part of the Division of Wildlife's River Watch Program in 1992 and 1993. The data indicates good water quality with respect to pH, dissolved oxygen, and metals.

2.5 Fryingpan River (Stream Segments 5, 6, &7)

Past studies, including the Fryingpan-Arkasas Project Final Environmental Impact Statement (1974), USGS [USGS, 1979], and Ruedi Reservoir Round II Water Marketing Program Final Supplement to the Environmental Statement [Bureau of Reclamation, 1989], have documented that the Fryingpan River has water quality suitable for all uses.

The Fryingpan River in the upper reaches at Norrie has water suitable for all uses with very low chemical concentrations [USGS, 1979]. Chemical concentrations increase downstream, especially sulfate, calcium, and dissolved solids. The lower reaches drain the Maroon Formation and various siltstone and sandstone layers, which yield calcium sulfate water. Also, there is an increased amount of flow from ground water stored in alluvial deposits in the lower reaches of the Fryingpan River. Because of this, there is a greater mineral content discharged to the stream, as compared to upstream. The dissolved-solids concentration averages about 200 mg/L, and is thus similar to the downstream reaches of the Roaring Fork River USGS, 1979]. Suspended solids average less than 10 mg/L [Bureau of Reclamation, 1989].

The Colorado River Water Conservation District and cities of Aurora and Colorado Springs are studying the possibility of pumping 20,000 acre-feet of Ruedi water across the Continental Divide each winter, the cheapest of several possible alternatives (the others being in the Eagle River watershed) that would bring water needed for growth to the two cities. Two studies, one on the economic impacts of changes in stream flow and reservoir levels and the other on aquatic life impacts, are being conducted by the Roaring Fork Conservancy, and should be completed by the middle of 2002.

2.6 Crystal River and Tributaries (Stream Segments 8, 9, and 10)

The Crystal River upstream from Redstone to Marble contains concentrations of cadmium, zinc, lead, copper and mercury that exceed values for aquatic life, according

to the 1989 Colorado Nonpoint Source Assessment Report [WQCD, 1989]. Possible sources of these metals are the Avalanche mining district in Pitkin County, the Crystal River area in Gunnison County, or the Crested Butte coal mining district. The Water Quality Control Division has indicated that claims of cadmium exceedances were based on inaccurate or misleading data.

According to the 1989 Nonpoint Source Assessment Report [WQCD, 1989] the upper portion of the Crystal River above Redstone is a poor fishery, possibly due to metals pollution or habitat problems. Water quality sampling by the WQCD at Redstone between 1988 and 1992, however, did not detect cadmium, chromium, copper, lead, or zinc in any of 20 samples (mercury was not sampled).

Calcium and sulfate concentrations are slightly increased in the upper reach of the Crystal River [USGS, 1979]. These concentrations are due to natural sources as the stream drains the Maroon Formation overlying some areas of Eagle Valley Evaporite. The influence of Eagle Valley Evaporite is even more noticeable downstream from Redstone as the sulfate concentration increased. The effect of the Redstone Sanitation Plant discharge to the Crystal River is minimal as there appeared to be no significant increases in nutrient or bacteria concentrations.

The State's 1998 303(d) list includes Coal Creek and the Crystal River below Coal Creek as a segment for monitoring and evaluation to determine if there is use impairment. In spite of this, the 1989 Nonpoint Source Assessment Report [WQCD, 1989] states that the lower Crystal River and the Roaring Fork below the Crystal River provide very good aquatic habitat and support good fisheries.

The 1988 208 Plan reviewed WQCD water quality monitoring data from 1979 through 1987 at the Crystal River station located at Redstone and found that eight year average concentrations of silver, nickel, cadmium, lead and copper exceeded aquatic life standards. Conclusions regarding nickel and silver were tenuous as there is a very limited database for these two metals. Levels of total phosphorus, dissolved solids and turbidity are also high. Comparing eight-year average concentrations with those from the most recent three year period (1984 -1987) it appeared the water quality improved for all parameters listed above. Three year average lead concentrations still exceed the aquatic life standards. Nickel and silver were not monitored in this period. Total phosphorus and dissolved solids are also reduced.

More recent WQCD water quality data at the Redstone station (1988-1992) showed high total suspended solids (average of 65 mg/L, 23 samples), did not include sampling for silver and nickel, did not detect cadmium, chromium, copper, lead, or zinc in any of 20 sampling events. Samples for un-ionized ammonia, manganese and iron never exceeded stream standards. Fecal coliform bacteria exceeded stream standards once in 22 samples (220 MPN /100 ml), while the standard is 200).

The Roaring Fork Conservancy's water quality monitoring station at Redstone could be considered the one lone metals "hotspot" in the watershed (with the exception of total iron from Coal Creek and North Thompson Creek). Exceedances of the selenium water quality standards were observed in June, August, September, and December. Exceedances of the cadmium standard was observed in June and August, and lead exceeded the water quality standard in June of 2000 [Roaring Fork Conservancy Riverwatch monitoring data].

Water quality data collected in 1975 on Coal Creek (Roaring Fork Segment 9) by the Water Quality Control Division, showed increases in specific conductance and concentrations of turbidity, suspended solids, and dissolved solids downstream from the Mid-Continent Coal Mine, compared to upstream from the mine. Previous studies documented that the dissolved and suspended sediment concentrations downstream from the mine exceeded water supply and recommended aquatic-life standards.

Studies conducted by the USGS in 1979 [USGS, 1979] assessed water quality both upstream and downstream from the Mid-Continent mine in Coal Basin. A high concentration of suspended sediment was attributed to natural runoff from the alluvium and outcrops of Mancos Shale and Mesa Verde Formation, which are fairly easily weathered, fine grained sandstones. The suspended sediment concentration decreased downstream on Coal Creek probably as a result of a decrease in stream gradient. The maximum total iron concentration of iron from wells in the Coal Creek basin that exceed water-supply standards. The total organic-carbon concentration of 24 mg/L may be due to groundwater contribution during low flow from areas of the Mesa Verde Formation containing carbonaceous shales.

The USGS monitors a site on the Crystal River between the Town of Redstone and Avalanche Creek. Data collected between 1998 and 2001 showed occasional values of total recoverable iron above 500 ug/L and three values of greater than 2,000 ug/L (May 12 and June 2, 1998, August 22, 2000). The State chronic standard for total recoverable iron for protection of aquatic life is 1,000 ug/L. All other parameters at this site meet State water quality standards.

The Division of Minerals and Geology (DMG) has reclamation responsibility for the Mid-Continent mine, which filed for bankruptcy in 1992. The DMG has been actively overseeing reclamation of the site, and is expecting completion of reclamation activities by 1998. More information on the reclamation is given in Section 4.1 - Existing Watershed Improvement Projects.

Previous studies on North Thompson Creek (Segment 10) [Colorado Department of Health and Colorado Division of Wildlife, 1977] showed increases in chemical concentrations downstream from the Anshutz Coal Mine. Studies of mine discharges, revealed a 1,000 percent increase in specific conductance and concentrations of dissolved solids, and as much as a 5,000 percent increase in suspended sediment concentrations, compared to samples collected upstream from the mine. Calcium and sulfate concentrations also increased on North Thompson Creek, downstream from the Anshutz Coal Mine. The dissolved and suspended sediment concentrations downstream from the mine exceeded drinking water and aquatic life standards in previous studies. Note that this data is extremely outdated.

North Thompson Creek was also evaluated by the USGS in 1979 [USGS, 1979] to determine possible water quality effects from the operation of the Anshutz coal mine in the drainage basin. Upstream from the mine, a total iron concentration of 3,400 ug/L, was attributed to natural runoff. On North Thompson Creek downstream from the Anshutz coal mine, dissolved solids, calcium, sodium, magnesium, and sulfate concentrations markedly increased from upstream. Dewatering of the mines or ground-water contribution may have provided greater concentrations of these constituents from outcrops of Eagle Valley Evaporite and the Maroon Formation. A high suspended

sediment concentration indicates the erosive potential of soils upstream. There also may be a large suspended sediment load downstream as a result of discharges from the Anshutz coal mine. Please note that this data is extremely dated. The mine has been closed to MLRB standards (1987) so resultant improvements in water quality may be expected. The Division of Minerals and Geology has found that suspended sediments from the site are currently (1996) at background levels. The Anshutz mine is responsible for a 17% increase in salinity to North Thompson Creek, however the conductivity of the discharge has been decreasing over the last seven years. The other remaining outstanding issue is the relatively high concentration of iron discharged from two portals. The mine, however, consistently discharges water which is better that what its discharge permit requires.

The Division of Wildlife's River Watch Program has a number of stations on the Crystal River. Carbondale Middle School monitors a station at the Division of Wildlife's hatchery. Roaring Fork High School monitors at Gray Ranch, and Marble Charter School monitors at the Genter Mine Bridge. The Gray Ranch site appears to have low dissolved oxygen concentrations during low flow conditions, which approach the standard set for the protection of coldwater fish (the standard is 6.0 mg/L). The hatchery site also appears to have low dissolved oxygen concentrations during low flow conditions. Sweet Hill Bridge appears to have the worst problem of any of the River Watch sites in the Crystal River, with respect to dissolved oxygen concentrations. Twelve of thirty samples collected between 1992 and 1993 fell below the standard set to protect aquatic life (less than 6 mg/L). If this data is accurate, it would indicate the need to do additional work to identify what is causing the dissolved oxygen problem at this site.

The Roaring Fork Conservancy's Water Quality monitoring program includes three sites on the Crystal River and one on Coal Creek, replacing the sites discussed in the preceding paragraph. These sites are: Crystal River Genter Mine bridge; Crystal River Redstone; Coal Creek at Coal Creek reclamation; and Crystal River at Coryell Ranch. High total iron values were observed in April 2000. Values for total iron exceeding the State standard of 1,000 ug/L (total recoverable) ranged from 3,545 ug/L at Coal Creek Reclamation site, to 1,441 ug/L at Park East, in April of 2000 [Roaring Fork Watershed: 2000 Report]. Additionally, high values for cadmium, lead and selenium were observed at the Redstone site. Total iron concentrations at other times of the year in 2000 met the water quality standard of 1,000 ug/L total recoverable iron.

Dissolved oxygen on the Crystal River and downstream sites of the Roaring Fork Conservancy's Water Quality monitoring program in 2000 exhibited no dissolved oxygen concerns. The minimum dissolved oxygen value recorded was 6.6 mg/L at the Coal Creek site and the mean value of 11 samples was 8.8 mg/L. All other sites below the Coal Creek site (including the mainstem Roaring Fork sites below the confluence) had mean values above 9.0 mg/L dissolved oxygen.

2.7 Lower Roaring Fork (Crystal River Confluence to the Confluence with the Colorado River, Stream Segment 3)

One Water Quality Control Division monitoring station exists on the Roaring Fork - just above the confluence with the Colorado River. Water quality data from this station indicates that water quality is good at this site, with no water quality standards being

exceeded. Phosphorus levels between 1988 and 1992 were well below the regional average, at 0.054 mg/L. Metals were all at low concentrations and the fecal coliform standard was only exceeded once.

The USGS maintains a station on the Roaring Fork at Glenwood Springs approximately 1/2 mile above the confluence. This station was sampled in 1994 by the USGS on four occasions for metals, dissolved oxygen, pH, and bacteria. All parameters met water quality standards.

Glenwood High School collects water quality samples on the Roaring Fork at the 7th Avenue Bridge as part of the Division of Wildlife's River Watch Program. Again, water samples collected at this station showed the Roaring Fork meeting water quality standards for the parameters analyzed. This continues to be the case as reported in the Roaring Fork Conservancy's Roaring Fork Watershed: 2000 State of the River Report.

2.8 Watershed Instream Flows

Appendix 14 lists the Colorado Water Conservation Board's (CWCB) instream flow filings in the Roaring Fork River watershed. Colorado statute (CRS 37-92-102(3) recognizes that preserving the natural environment to a reasonable degree, through the protection of instream flows and maintenance of natural lake levels in natural lakes, is a beneficial use of water. Under the same statute, the Colorado Water Conservation Board is declared the exclusive agent authorized to appropriate water rights for the purpose of preserving the natural environment. It is also stated that the acquisition of the water rights to protect instream flows has to be made within the context of existing water rights appropriation regulations. Instream flows are therefore subject to appropriation dates, and the CWCB can only call out water rights junior to their own for maintenance of those flows. Most of the appropriation dates in the Roaring Fork watershed are between 1973 and 1985.

The CWCB appropriation flows, determined in consultation with the Division of Wildlife and the Division of Parks and Outdoor Recreation, are the flows necessary "to preserve the natural environment to a reasonable degree" (CRS 37-92-102(3)). The fact that the CWCB has filings for these instream flows does not ensure that stream flows will always exceed the minimum necessary to protect the natural environment, as the water rights associated with these flows have relatively junior appropriation dates. Exercise of water rights that are senior in date to the CWCB instream flow appropriation dates can result in stream flows lower than the CWCB appropriation amount.

The National Conservation Fund has donated senior water rights to the Colorado Water Conservation Board to insure protection of natural stream flows in Snowmass Creek.

The City of Aspen has entered into an agreement with the CWCB for maintenance of in-stream flows in Castle Creek (set at 12 cfs by the CWCB) through a systematic program of stream monitoring and administration of the City's water rights.

It should be noted that the Roaring Fork River from the confluence with the Crystal River to the confluence with the Colorado River, and Four Mile Creek which flows into the Roaring Fork above Glenwood Springs, have no CWCB instream flow appropriation. The Division of Wildlife has indicated that they will be examining these streams for

appropriate instream flow appropriations in 1996 or at the latest 1997 [Jay Skinner, DOW, personal communication, 1996].

A Colorado Water Conservation Board instream flow appropriation on Snowmass Creek (12 cfs year round) has received important attention. In 1991, the CWCB initiated a review of its Snowmass Creek instream flow water right to verify that the Board's rights conformed to today's scientific standards. Based on those standards, the Board determined that the 17 mile Snowmass Creek right should be segmented into three shorter reaches and that flow amounts should be split into summer and winter flows. As a result of this review, Snowmass Creek Instream flow need determinations both increased and decreased, depending on the segment and time of year. The Aspen Wilderness Workshop sought an Administrative Process Act (APA) review of the CWCB's decision to reduce its Snowmass Creek instream flow water right. The Denver District Court upheld the CWCB's actions, and the decision was appealed. The Colorado Supreme Court reversed the District Court's decision, holding that the CWCB did not have the authority to reduce an appropriation and that it must implement the terms of the original decree until that decree is modified by the water court. A significant statement was made by the Supreme Court in its decision, declaring that the CWCB has a unique statutory fiduciary duty to appropriate the minimum stream flows necessary to preserve the natural environment to a reasonable degree. *Application for Water Rights to Hines Highlands Ltd. Partnership* 929 P.2d 718 (Colo.1996).

3.0 WATER QUALITY ISSUES

3.1 Point Source Issues

Point source problems were extensively evaluated by the Colorado Department of Health in 1974 as part of the Roaring Fork River Basin 303(e) Plan. Point source treatment needs, consolidation of wastewater treatment facilities, waste load allocations, treatment alternatives and other related matters were addressed in the basin plan. The principal problems addressed included the need for advanced wastewater capability at domestic facilities to protect Roaring Fork River and Brush Creek from toxicity due to discharges of ammonia, chlorine and BOD. The plan also addressed the need for future consolidation of facilities in the El Jebel area as result of anticipated growth in the area. Since the adoption of the basin plan in 1974 and development of the 208 plan (which incorporated its recommendations), the development of wastewater treatment facilities has generally proceeded in accordance with the 303(e) Plan recommendations except for the mid-valley area consolidation opportunity. Facility plans under Section 201 of the Clean Water Act have defined the precise treatment mechanisms and locations for wastewater treatment and have implemented the recommendations of both the 208 and basin plans.

3.1.1 Municipal Discharges

Table 15 lists the municipal and domestic wastewater treatment plants with average discharges of more than 10,000 gallons per day in the Roaring Fork watershed along with their Colorado Discharge Permit System number and their hydraulic capacity.

Table 15. Roaring Fork Municipal and Domestic Wastewater Treatment Plants

CDPS Number	Facility Name	Responsible party	Hydraulic capacity, MGD
CO-00263873	Aspen WWTF	Aspen Consol SD	3.0 (4.5 anticipated)
CO-0023086	Snowmass WWTF	Snowmass W&SD	3.2
CO-0022721	Aspen Village WWTF	Aspen Village HOA.	0.051
	Woody Creek WWTF	Woody Ck MHP	0.032
CO-0020303	Lazy Glen WWTF	Lazy Glen HOA	0.045
CO-0031810	Sopris Village	Sopris Village HOA	0.05
COG-584051	Ranch at Roaring Fork WWTF	Ranch at Roaring Fork HOA	0.10
CO-0021491	Basalt WWTF	Basalt SD	0.8
CO-00584007	Mid-Valley WWTF	Mid-Valley Metro Dist.	0.5
CO-0043184	El Jebel WWTF	??	0.14
CO-0023922	Redstone WWTF	Redstone W&SD	0.05
COG-584050	Carbondale WWTF	Town of Carbondale	0.995
CO-0044750	Aspen Glen WWTF	Roaring Fork W&SD	0.107
	Mountain Meadows WWTF	Mtn Meadows HOA	0.010
CO-0045331	Spring Valley WWTF	Spring Valley SD	0.052
COG-584035	H Lazy F WWTF	H Lazy F Mobile Home Park	0.040
COG-584029	El Rocko WWTF	El Rocko MHP	0.010
CO-0038598	Ski Sunlight WTF	Ski Sunlight, Inc.	0.03
CO-0020516	Glenwood Springs	City of Glenwood Spr.	2.3

A more detailed list of the permitted wastewater treatment plants in Region XII is included in Appendix 3. This appendix includes information on the regions' wastewater treatment plants' capacities, average and peak flows, treatment type, biosolids processing and disposal practices, permit expiration dates, discharge locations, condition and expansion plans. A brief description of municipal and domestic wastewater treatment facilities in the watershed follows.

Aspen Consolidated Wastewater Treatment Plant

The Aspen Consolidated wastewater treatment facility is a tertiary treatment plant with 3.0 MGD capacity that discharges to Segment 3 of the Roaring Fork. There is an anticipation that the capacity of the plant will need to be expanded to 4.5 MGD. Permitted Biological Oxygen Demand (BOD) capacity is 9,100 pounds per day. The treatment facility consists of pretreatment works (bar screen, comminuters, and grit chambers), aeration basins, secondary clarifiers, nitrification filters, final filters (rapid sand filters), and disinfection. The facility has an aerobic digestor and two centrifuges for biosolids treatment. Aspen Consolidated Sanitation District has an ongoing Capital Improvement Plan to address long-term capacity and treatment needs. The plant has an excellent history of operation and compliance with its permit. The district currently disposes of its biosolids at the county landfill, which is investigating the feasibility of use of the material for local landscaping. The plant's current discharge permit expires January 31, 2006.

Snowmass Village Wastewater Treatment Plant

The Snowmass Village wastewater treatment facility is a 3.2 MGD activated sludge plant with Rotating Biological Contactor (RBC) for effluent polishing which discharges to irrigation ponds and also directly to Brush Creek, Segment 4 of the Roaring Fork River. The plant was at 80% of capacity in March 1990. An aggressive infiltration and inflow program was initiated in the late 1980's and the district performs annual TV surveillance, cleaning and repair. Ammonia monitoring in Brush Creek was a condition of the previous permit, and at the next permit renewal (June 30, 1996), the permit may be changed to reflect new limits for total ammonia. The new draft permit includes chronic total ammonia discharge limits ranging from 1.2 to 3.9 mg/L. Biosolids disposal is accomplished by thickening and aerobic digestion, followed by disposal at a dedicated disposal site that accepts only sewage sludge from the Snowmass wastewater treatment works. An expansion has been completed for an enlarged treatment works with an average daily flow capacity of 3.2 MGD. The treatment process is conventional activated sludge, fixed media nitrification (two rotating biological contactor basins), flow equalization pond and/or effluent filtration, and UV disinfection. The renewal permit for this facility was issued September 6, 1996 and expired October 31, 2001. This discharge permit is currently under an administrative extension of the existing permit (with a 1.8 MGD hydraulic capacity and 6,000 pounds BOD). A draft renewal permit was issued in March 2002. The renewal permit recognizes a hydraulic capacity of 3.2 MGD and an organic capacity of 6,000 pounds of BOD_5 per day.

Aspen Village Wastewater Treatment Plant

The Aspen Village wastewater treatment facility is a 0.051 MGD aerated lagoon system which discharges to Segment 3 of the Roaring Fork River and is operated by Aspen Village, Inc. Organic capacity is permitted at 120 pounds of BOD per day. The facility consists of one lift station, two aerated lagoons with surface aeration, a polishing pond, and chlorination. Since the facility is a lagoon, sludge removal is infrequent. The plant has had problems with algal growth in the polishing pond, as it has residence time of 16 days (the recommended residence time is three to five days). No infiltration or inflow problems have been documented in the service area. The permit for this facility expires July 31, 2005. A compliance schedule was established for implementing a groundwater monitoring program. The District is conducting monthly groundwater monitoring.

Woody Creek Wastewater Treatment Facility

The Woody Creek Mobile Home Park is served by this facility, which has a design flow of 0.032 MGD. This facility has previously not been permitted. A permit is currently being developed by the Water Quality Control Division in 2002. The facility is a mechanical plant which was designed to discharge to groundwater. Preliminary effluent limits of groundwater discharge were issued in May of 2000 and surface water preliminary effluent limits were issued in January 2001.

Rivers Bend Apartments

This sequencing batch reactor, recirculating sand filter facility of 3,040 gallons per day facility was recommended for site approval with conditions by the NWCCOG in February 2001. The site application requested an organic loading of 7.34 pounds BOD per day. The facility serves 19 units or approximately 38 people.

Lazy Glen Wastewater Treatment Plant

The Lazy Glen wastewater treatment facility is a 0.045 MGD aerated lagoon with an organic capacity of 58 pounds of BOD per day that uses an aerated lagoon, rock filter, polishing pond and chlorination disinfection treatment process. Discharge is to the Segment 3 of the Roaring Fork. The facility serves approximately 290 people. The Lazy Glen Mobile Home Park was included in the service area of the Basalt Sanitation District in July 1999. The Basalt Sanitation District is the water quality management agency for the service area. The Lazy Glen Mobile Home Park operates the wastewater treatment plant and is the discharge permit holder. The Lazy Glen area has been incorporated into the Basalt Sanitation District's service area. The Lazy Glen wastewater treatment facility should be managed and operated by the Basalt Sanitation District.

Past problems have included inadequate chlorination, possible lagoon leakage and flooding. The lagoon is not lined and will be required to meet new Water Quality Control regulations concerning discharge to groundwater. No ammonia limits are needed due to the high calculated total ammonia effluent limits, based on stream flows and hydraulic loading. Since the facility is a lagoon, sludge removal is infrequent. Infiltration and inflow (approximately 10,000 gallons per day during the spring) do occur. A TV survey of the collection system will be done to identify problems. The discharge permit for this facility expires December 31, 2004.

Basalt Wastewater Treatment Plant

The Basalt Wastewater Treatment facility is a 0.8 MGD plant with a headworks, oxidation ditch, secondary clarifiers, UV disinfection, and a polishing pond. The plant discharges to Segment 3 of the Roaring Fork River. The organic loading capacity of the pant is rated at 1,600 pounds of BOD per day. The facility is operated by the Basalt Sanitation District and serves the Town of Basalt and surrounding area. The discharge permit does not include limits for ammonia or ammonia monitoring as calculated limits were much greater than expected effluent concentrations. Sludge from the facility is aerobically digested and de-watered with a centrifuge prior to ultimate disposal at the Pitkin County landfill which has a sludge composting program. The discharge permit for the facility is currently on an administrative extension. A new discharge permit application was submitted in February 2001. A site application was approved by the Division in August 1999 for the 0.8 MGD hydraulic capacity.

NWCCOG and its member jurisdictions have identified that Lazy Glen, Holland Hills and Wingo Junction can and should be included within the Basalt Sanitation District's service area subject to the terms and conditions of the District's rules, regulations and agreements. These communities, located along Highway 82 less than two miles up-valley of the Town of Basalt, were identified by the Basalt Sanitation District in their 1974 201 facility plan as areas appropriate for service by the District.

The Ranch at the Roaring Fork

The wastewater treatment facility for the Ranch at the Roaring Fork is a 0.10 MGD package plant using an extended aeration activated sludge process, installed in 1973 which discharges to Sopris Creek, Segment 3 of the Roaring Fork River. It is permitted at 150 pounds of BOD per day. The homeowners association is responsible for the

operation and maintenance of the facility. The facility consists of 2 gravity grit channels, 2 lift stations, 2 aeration tanks, a clarifier, chlorinator, and polishing pond. Sludge is treated in an aerobic digestor, after which it is applied to four drying beds. Dried sludge is held on site until it is transported to the Pitkin County landfill. Site application for expansion of the facility from 0.05 to 0.1 MGD was approved in 1999. The design review was completed in March 2000 that showed that the facility could meet the approved flow and loading. The facility serves the Ranch at Roaring Fork, Preshana Farms, and Saint Finbar developments. The permit for this facility expires December 31, 2004.

The Town of Marble has been platted as 1/20 acre lots on septic systems with 2,000 lots platted inside the town boundary and 1,500 outside of the town limits. The town is on central water, which is supplied by shallow wells, possibly under the influence of surface water, and possibly in the same aquifer as the septic systems. Currently there not enough taps to justify any type of community system.

Sopris Village Homeowners Association Wastewater Treatment Plant

The Sopris Village homeowners association wastewater treatment facility is a 0.052 MGD Can-Tex package treatment plant which discharges to groundwater via ex-filtration ponds. The organic capacity of the facility is rated at 91 pounds of BOD per day. The plant can be operated in a contact stabilization or conventional mode, followed by effluent chlorination, and two ex-filtration ponds Overflow from the ponds and groundwater is to segment 3 of the Roaring Fork River. The package plant consists of a bar screen, activated sludge aeration and re-aeration basins, a clarifier and an aerobic sludge digestion tank. Biosolids are trucked to the South Canyon sanitary landfill. Ammonia limitations and monitoring are not required due to the expected effluent concentrations and instream flows. The discharge permit for this facility expired November 30, 1994, but has been had been administratively extended.

Redstone Wastewater Treatment Plant

The Town of Redstone's wastewater treatment facility is a 0.05 MGD extended aeration, activated sludge plant built in 1974 which discharges to the Crystal River, Segment 8 of the Roaring Fork River. The permitted organic capacity of the facility is 85 pounds BOD per day. The facility serves a permanent population of about 170 - 200 people. The facility consists of a bar screen, aerated chamber, grit channel, and a wet well with two lift pumps followed by a package plant with a subsurface aeration basin, a center feed clarifier, gas chlorination, and infiltration/polishing pond and discharge to the groundwater and the Crystal River. Due to the large dilution factor (greater than 400:1) of the Crystal River compared to the hydraulic capacity of the plant, limits for ammonia and other mass balance parameters is not necessary. Infiltration and inflow has been documented to be about 10,000 gallons per day during wet times - especially during the spring runoff. Repairs are made as resources allow. Waste sludge is aerobically digested and land applied. In 1997 the wastewater facility was at 80% capacity. The permit for this facility expires September 30, 2002.

Mid-Valley Metro District Wastewater Treatment Plant

The Mid-Valley Metro District wastewater treatment facility is a 0.325 MGD lagoon system built in 1984, which discharges to Segment 3 of the Roaring Fork. The facility

serves the El Jebel area on the northeast side of the Roaring Fork and operates under a general discharge permit for chronic low flows: design flows of greater than 100:1. The facility consists of two aerated lagoons, a settling ponds, and chlorine contact tank, prior to discharge to the Roaring Fork River. The facility has a 30 mg/L total ammonia discharge limit. No infiltration/inflow problems have been documented in the service area. There is one lift station within the service area. In 1998 Mid-Valley Metro District is examining expanding their district boundaries to include additional development in the Mid-Valley area. NWCCOG is encouraging Mid-Valley to provide leadership in developing a coordinated approach to wastewater treatment in the mid-valley area. The Division renewed this permit on December 15, 1999, with an expiration date of December 31, 2004. The hydraulic capacity remains at 0.325 MGD and the organic capacity at 545 pounds of BOD per day. In this permit renewal the monitoring requirement for ammonia was discontinued.

On January 2, 2002, the Water Quality Control Division approved a site application from the Mid Valley Metropolitan District for a facility expansion to an average daily flow capacity of 0.499 MDG, and an organic loading capacity of 957.6 pounds of BOD per day. The approved facility is an extended aeration, secondary clarification with nitrification/de-nitrification system, and is expected to be under construction in the summer of 2002.

El Jebel Mobile Home Park Wastewater Treatment Plant

The El Jebel Mobile Home Park wastewater treatment facility is a 0.136 MGD aerated lagoon that discharges to groundwater via an exfiltration/storage pond and irrigation of hay fields adjacent to Blue Creek. The organic capacity of the facility is rated at 272 pounds of BOD per day. The facility was last upgraded in 1993 and consists of a preaeration basin (also used for grit removal and screening), two aerated lagoons, a chlorine contact chamber, and an exfiltration and storage pond. Since this is a lagoon system, sludge removal is infrequent. The discharge permit for this facility expired in April, 1999, and is under an administrative extension.

Carbondale Wastewater Treatment Plant

The Town of Carbondale wastewater treatment plant is a 0.995 MGD aerated basin facility expanded in 1976, which discharges to Segment 3 of the Roaring Fork River. The treatment works consist of a bar screen, aerated grit chamber, two subsurface aerated basins, two clarifiers, gas chlorination, and two polishing ponds. Historical infiltration and inflow problems appear to have been corrected. No ammonia limits are needed, based on mass balance calculations for the existing 0.5 MGD facility. Waste activated sludge is aerobically digested and applied to several land application sites around Carbondale using a liquid sludge truck equipped with a soil injection system. The permit for this facility expires December 31, 2004. The town submitted a Site Application to the WQCD in 1995 for an expansion to 0.995 MGD, through the addition of additional blower and digestor capacity, which is expected to meet the needs of the community through 2010. The site application was approved in 1996 for a hydraulic capacity of 0.995 MGD and an organic load capacity of 2,248 pounds of BOD per day. The design review was completed in April 1998 showing that this flow and loading could be met.

Aspen Glen Wastewater Treatment Plant

The Aspen Glen wastewater treatment facility is a 0.107 MGD facility operated by the Roaring Fork Water and Sanitation District, which is an extended aeration facility with primary and secondary clarifiers, biosolids aerobic digestor, tertiary filtration and chlorine disinfection. The permitted organic loading is 225 pounds of BOD per day. The district boundary begins just below the confluence of the Crystal and Roaring Fork Rivers and extends down both sides of the Roaring Fork River to the City of Glenwood Springs. Discharge is to wetlands tributary to Segment 3 of the Roaring Fork River. Aspen Glen Water and Sanitation District also serves Coryell Ranch, Colorado Mountain College turnoff area ("midway area") and Unical. Rose Ranch is also in the service district and will be served. Biosolids disposal is through aerobic digestion and a commercial disposal company that hauls the material to the sanitary landfill at South Canyon. The discharge permit for this facility expired December 31, 2001 and is under an administrative extension.

H Lazy F Mobile Home Park Treatment Plant

H Lazy F Mobile Home Park wastewater treatment plant is a 0.04 MGD mechanical extended aeration facility that discharges to Segment 3 of the Roaring Fork River, approximately six miles south of Glenwood Springs. The organic capacity of this facility is rated at 83 pounds to BOD per day. No infiltration/inflow problems have been documented. Sludge is hauled, as needed, to the South Canyon Landfill. Total Residual Chlorine and BOD violations were found during a State monitoring inspection in 1992. The discharge permit expires December 31, 2004.

Spring Valley Sanitation District Wastewater Treatment Facility

The Spring Valley Sanitation District (SVSD) completed a 0.499 MGD activated sludge plant in December 2001. The Discharge Permit for new facility was issued effective January 1, 2002. The new facility is expected to be on line sometime during the calendar year 2002. The facility currently in use is a 3-cell aerated lagoon system with a rated capacity of 52,000 gpd. The facility discharges to groundwater, which is thought to be tributary to the Cattle Creek drainage. A draft permit for this facility was issued in April 2002.

The new facility is based on the "Aero-Mod" technology for activated sludge (extended aeration with secondary clarification and nitrification/de-nitrification system). The facility consists of a headworks facility with bar screen and flow measurement, activated sludge treatment, chlorination and de-chlorination, aerobic digestion and sludge-handling facilities consisting of a filter press. Sludge from the facility will be hauled off site for disposal. Discharge from the new facility will be by pump station into the Landis Creek Basin (commonly known as Spring Valley), a tributary to Segment 3 of the Roaring Fork River. Ammonia limits have been calculated for the facility using the Colorado ammonia model and vary by month. De-chlorination is required because of strict residual chlorine limitations in the effluent. The organic capacity is expected to be permitted for 999 pounds of BOD. The system includes two lift stations with capacities of 300,000 and 28,000 gallons per day. The permit for this facility is expected to be issued in early 2002.

Mountain Meadows Wastewater Treatment Plant

This facility serves the Mountain Meadows Mobile Home Park. The facility, which currently operates without a discharge permit, is designed to treat approximately 10,000 gallons per day and discharge to groundwater. The leach field for this facility has failed and the facility is discharging to a ditch. The facility is currently under an enforcement order issued in 2001 by the Water Quality Control Division.

El Rocko Mobile Home Park Wastewater Treatment Plant

The El Rocko wastewater treatment facility is a 0.01 MGD extended aeration package plant built in the early 1970's which discharges to Segment 3 of the Roaring Fork River approximately three miles south of Glenwood Springs. The organic capacity of the facility has been rated at 20 pounds of BOD per day. The facility serves a house, 23 mobile homes, seven RV spaces and a laundry (approximately 75 people). The facility consists of an extended aeration package plant with a comminutor and bar screen at the inlet to the aeration basin, subsurface aeration, a double hopper bottom clarifier, tablet chlorination, a chlorine contact chamber, tablet dechlorination, and discharge either to a leach field or to the Roaring Fork River. The facility has experienced numerous problems with the leach field over the years. This facility has experienced poor operations and maintenance. Hydraulic capacity is also an issue, as flows have exceeded the hydraulic capacity of the plant. No expansion of the facility has been planned for the next five years. Sludge is disposed of by pumping and hauling to the Garfield County landfill. The discharge permit for this facility expires December 31, 2004.

Ski Sunlight Wastewater Treatment Plant

The Ski Sunlight wastewater treatment facility is a 0.03 MGD lagoon system expanded in 1990 which discharges to Fourmile Creek, tributary to Segment 3 of the Roaring Fork River. The organic capacity of the facility is rated at 60 pounds of BOD per day. The facility consists of a headworks with a bar screen followed by two subsurface aerated ponds and backup surface aerators, a polishing pond, gas chlorination, a chlorine contact chamber, and a storage pond with a direct discharge to Fourmile Creek, or effluent can be pumped to the snow making/irrigation equipment. The facility has not had a direct discharge to Fourmile Creek in several years. It is possible that the final storage pond could be discharging to groundwater through seepage. The Colorado Department of Public Health and Environment required an ex-filtration study as part of it permit renewal. Ammonia limits have been calculated for the facility using the Colorado Ammonia Model (1.1 - 8.1 mg/L total ammonia as N). Ammonia monitoring will also be required as part of permit compliance. Since the facility consists of aerated lagoons, sludge removal will probably occur infrequently. The discharge permit for this facility expired September 30, 1998, and is under an administrative extension. Ski Sunlight has submitted a site application for a 0.05 MGD extended aeration, secondary clarification with nitrification/de-nitrification facility to the Water Quality Control Division in January 2002. The requested BOD load is 84 pounds.

City of Glenwood Springs Wastewater Treatment

The City of Glenwood Springs' wastewater treatment plant is a 2.3 MGD Rotating Biological Contactor (RBC) facility that discharges to Segment 3 of the Roaring Fork

River approximately 750 feet above the confluence with the Colorado River. The organic capacity of the facility is rated at 4,320 pounds of BOD per day. The facility consists of: coarse and fine bar screens; a primary clarifier; two RBC basins with four air driven shafts each; two secondary clarifiers; gas chlorination. Average flows between 1988 and 1990 were approximately 0.8 MGD (maximum of 0.9 MGD). In the December 2001 permit renewal total ammonia effluent limits of 27-29 mg/L were imposed on the facility for the months of May, August, September, and October. Anaerobic sludge digestion occurs in both primary and secondary digestors followed by sludge holding. The facility was build in the early 1970's. Digested sludge is currently being hauled by a contract hauler and applied for beneficial use. The discharge permit for this facility expires December 31, 2006. Glenwood Springs' 201 Planning area extends to Carbondale, but the Aspen Glen Sanitation District's formation has precluded serving this extended area.

3.1.2 Population Statistics and Projections

Population projections for the counties and the municipalities in the Roaring Fork watershed are listed in Table 16. Various areas within the Roaring Fork watershed have significantly different rates of growth. Pitkin County between 1980 and 1990 experienced an increase in permanent population of 22.5%, and between 1990 and 2000 an increase of 17.5%. Peak population projections are extremely important with respect to water quality planning, as wastewater treatment plant capacity needs to be able to meet peak demand. More information needs to be developed with respect to projected peak populations for some areas in the Roaring Fork watershed.

Table 16. Roaring Fork Watershed Population Statistics and Projections

Roaring Fork Watershed Permanent Population[1]

ENTITY	1980	1990	2000	2000 projected[2]	2010	2020
Pitkin Co	10,338	12,661	14,872	17,011	18,149[3]	21,725[3]
Aspen	3,678	5,049	5,914	6,430		
Snowmass Village	999	1,449	1,822	1,725		
Basalt	529	1,210	2,681	1,699		
El Jebel[4]			4,488			
Marble		64				
Redstone						
Carbondale[5]	2,084	3,004	5,196			
Glenwood Springs	4,637	6,561	7,736			
Garfield Census trct 9518.01&02			11,114			
Garfield Co	22,514	29,974	43,791	37,521	56,822[3]	72,301[3]

[1]: US Census data, from Denver Post, Census 2000 special report, March 20, 2001.
[2]: NWCCOG 1996 208 Plan, based on projections from the State Demographer's Office, Department of Local Affairs, Dec. 1994.
[3]: Population projection, State Department of Local Affairs, State Demographer's Office,

October 2000 projections.
[4]: Census tract information for the remainder of Eagle County in the Roaring Fork watershed
[5]: Does not include Redstone, which is included in Pitkin County data.
NOTE: Permanent population projections are not available for Towns

3.1.3 Industrial Discharges

Currently there are a number of active gravel mining operations including Mountain Mobile, Mid-Valley, just inside the Garfield County line, and Mobile Premix.

Inactive mines in the area include: North Thompson Creek Mines, which is currently under reclamation by Minrec, Inc., and was shown to have significant water quality impacts to North Thompson Creek, Anshutz Coal Mine; Coal Basin, which is currently under reclamation by the Colorado Division of Minerals and Geology, and the Smuggler Mine near Aspen (no surface or ground water quality concerns have been associated with this mine).

Other industry and point sources in the Roaring Fork watershed include the Division of Wildlife Fish hatchery on Crystal River, Filoha Meadows, a health spa which discharges a design flow of 0.11 MGD - discharge from therapy pools and radiant heating unit to the Crystal River, construction dewatering, and water treatment plant backwash discharges. These discharges are all controlled by permits issued through the Water Quality Control Division.

3.1.4 Point Source Issue Summary

In summary, the point source water quality problems of streams and lakes in the Roaring Fork River basin are:

High dissolved solids, and potentially high iron concentrations in North Thompson Creek as a result of natural runoff and because of drainage from the Anshutz Coal Mine;

Excessive metal and suspended sediment concentrations in Coal Basin as a result of the Mid-Continent Resources Coal Mine;

Point source discharges to Brush Creek are impacted by seasonal low stream flows and contribute to observed water quality problems.

Anecdotal evidence suggests that nutrient concentrations (from both point and nonpoint sources) in the Roaring Fork watershed are increasing and could cause aquatic ecological changes. An increase over time in periphyton, or algae attached to the river substrate, has been noted by long- time fishermen and guides.

3.2 Point Source Recommendations

A number of consolidations of IGSs or some other method of reduction in number of small failing domestic facilities have been recommended. These include:

The Woody Creek Wastewater treatment facility permit should go through the State site application process, including antidegradation review. This facility should be operated by a management agency.

The Lazy Glen area has been incorporated into the Basalt Sanitation District's service area. The Lazy Glen wastewater treatment facility should be managed and operated by the Basalt Sanitation District.

Redstone is meeting its discharge permit but needs to be upgraded and expanded. [A site application for expansion of this facility is expected in 2002.]

Colorado Rocky Mountain School's lagoon should be abandoned and the school should be connected to Carbondale's wastewater treatment facility.

A Consolidated Sanitation Management District in the mid-valley area should be established in the future. The sanitation districts which could be managed by a single management organization include: El Jebel, Basalt, Sopris Village, the Ranch at Roaring Fork, Mid-Valley, Carbondale, and Roaring Fork Water and Sanitation District.

H Lazy F**,** Mountain Meadows, El Rocko, and other ISDS systems which lie between Glenwood Springs and the H Lazy F should be connected to the Glenwood Springs wastewater treatment facility or other management agency, such as Roaring Fork Water and Sanitation District.

Spring Ridge, a 180 unit development on Fourmile Creek - has been permitted by Garfield County such that septic systems are acceptable until 75 units are built, and then will have to go on central sewer. Glenwood Springs is the appropriate sanitation district to provide wastewater treatment management for the development at that time.

Spring Ridge and Zilm/Sunlight should be connected to Glenwood Springs wastewater treatment facility.

3.3 Nonpoint Source Issues

The major nonpoint source water quality issues in streams and lakes in the Roaring Fork watershed include: the effects of both existing and inactive mining activities; urban and construction activities (including septic systems); agricultural activities (specifically silvicultural, or logging) and hydrologic modifications.

3.3.1 Urban and Construction Activities

Relatively high (compared with background) nutrient and sediment loads are found downstream of urbanized areas. Water quality monitoring in Vail and Summit County has documented elevated levels of nutrients, sediment, and heavy metals in stormwater runoff and downstream of urbanized areas.

Inconsistent enforcement of erosion control regulations continues to be an issue related to urban and construction activities.

Brush Creek has been impacted by the development of Snowmass Ski Resort in the mid-1960s. In 1994, a below average runoff year, as much as 40 tons of sediment and bedload per day was measured during the peak runoff [Snowmass Village, Brush Creek 319 proposal, 1995]. Although Brush Creek has been identified as an erosional area by the Natural Resource Conservation Service, this serves to indicate the potential impacts to water quality from sediment in urbanized areas.

The expanded use of septic systems can increase nutrient loading. Documented water quality problems from septic systems include high levels of bacteria in private and public water supplies and elevated levels of nutrients [Septic Tank System Effects on Ground Water Quality, Canter and Knox, 1985; SWQC An Evaluation of Methods to Control Phosphorus Contributions to Lake Dillon From Onsite Sewage Disposal Systems, 1988]. In Summit County, the Dillon Reservoir Clean Lakes Study and subsequent special studies have documented the contribution of nutrients from areas served by septic systems. At present it is not clear if the elevated nutrient levels in Blue River watersheds, which have a relatively high number of septic systems, are due to a few failing systems or the general performance of septic systems. After a thorough review of existing literature it was determined that the most cost effective approach to controlling phosphorus from septic systems is by targeting systems which perform poorly and correcting those systems, rather than requiring more sophisticated designs on new systems being installed.

Eagle, Garfield, and Pitkin Counties utilizing state and local criteria perform regulation of septic systems.

Another issue concerning septic systems is that as more and more lots are developed the development of lots that were previously considered "unbuildable" are being developed. In some case these lots were considered "unbuildable" due to septic system constraints. Thus, septic systems are being developed in unsuitable locations, and the engineering of these systems is increasingly complex and the efficiency and longevity of these systems is unknown.

The loss of riparian habitat and native vegetation in urbanized areas can impact water quality. As lawns are established that encroach into the natural riparian areas, increases in nutrient and other pollutant loads occurs. Lawns are also responsible for increased water consumption.

Increased in-basin water diversions for future urban development and snowmaking will have an impact on instream water quality.

Water conservation efforts should be diligently pursued.

3.3.2 Hydrologic Modifications

Water diversions are reducing instream flows. Trans-basin diversions, which often occur high in the watershed, reduce dilution flows further down the basin. Both trans-basin, and in-basin diversions impact water quality in those segments in which the water is lacking. However, trans-basin diversions are 100% consumptive in the basin of origin, whereas in-basin diversions are generally on the order of 10 - 50% consumptive. In

other words, trans-basin diversions do not return water to the stream of origin, while for in-basin diversions, the majority of the wastewater is returned to the stream at some point downstream.

In the Roaring Fork watershed there are three trans-basin diversions, which have a ten-year average diversion of 106,391acre-feet per year [State Engineers Office, Division of Water Resources, Division V records, for water year 2000]. In 2000 the total diverted trans-basin volume was 97,743 acre-feet (Table 17). The names of the diversion structures are: the Boustead Tunnel (Fryingpan River diversion); the Twin Lakes Tunnel (Roaring Fork River diversion); and the Busk-Ivanhoe Tunnel (Fryingpan River diversion). In 2000, the annual total runoff for the Roaring Fork River calculated at the USGS Glenwood Springs gauge was 708,600 acre-feet. Thus the trans-basin diversions were approximately fifteen percent of the Roaring Fork River's flow.

Table 17. Roaring Fork Watershed Trans-basin Diversions – 2000

Name	Stream (location)	Annual Flow (acre-feet)	Receiving stream
Boustead Tunnel	Fryingpan River	50,061	Lake Fork Creek
Twin Lakes Tunnel	Roaring Fork River	41,854	Lake Fork Creek
Busk-Ivanhoe Tunnel	Fryingpan River	5,208	Lake Fork Creek

Existing water development projects have had an effect on the water quality and on Colorado River salinity. Diversion of snow melt high in the basins with very low salinity results in less dilution of downstream salinity inputs.

Existing wastewater treatment levels have been based on meeting water quality standards under existing hydrologic conditions. Changes in the operations of the reservoirs to increase system yields, including reduction in residence times have the potential to modify the future treatment requirements to maintain the same level of water quality. The concern is that discharge permit limits can be made more stringent to meet instream water quality standards, when actual discharge quantities have not changed.

Existing treatment levels are determined, in part, by the one day in three year low flow event (1E3, used for establishing acute level discharge limits) and 30 day in three year low flow events (30E3, for establishing chronic level discharge limits). With consistently lower stream flows, average concentrations of pollutants will increase and the flow available for dilution will also decrease. Because ambient conditions are considered in effluent permit discharge limitations, more stringent permit limits could result from increased average concentrations of pollutants even though flow levels are not below the permit's low flow criteria.

There is also the requirement to comply with the state's antidegradation policy. The antidegradation policy for streams which are not "Use Protected" is that waters will be maintained at their existing quality unless lowering water quality is necessary to accommodate important economic or social development in the area. This would mean that plant discharge concentrations would have to decrease if stream flows decreased, in order to maintain the existing water quality.

As previously stated (section 2.5), studies are being currently conducted to examine the potential to divert an additional 20,000 acre-feet to the Arkansas River basin from the Frying Pan River. Potential impacts from trans-basin diversions, as stated in this

section, should be thoroughly evaluated.

3.3.3 Mining

Coal mining in the Crystal River drainage has had an impact on water quality for a significant amount of time. A Crystal River Drainage Study (completed between August 1978 - May 1979 by the Division of Wildlife) stated "Coal Creek, Bear Creek, and Dutch Creek exhibited very poor water quality with high solids, sulfate and heavy metals concentrations due to the Mid-Continent Resources Coal Mines". The same report states, "[t]here exists a sufficient difference in sulfate and solids concentrations below the North Thompson Creek Mines as compared to above the mines. A healthy trout population existed in North Thompson Creek above the mines, while only stock fish were recovered below the mines."

A 1990 White River National Forest Service report "Coal Basin: Crystal River Non-point Source Sediment Report" by Linda Ulmer stated "[t]his data suggests that mining operations are contributing substantially to increased sediment within Coal Basin." A 1991 USFS Report by Tony Svatos and Linda Ulmer entitled "Coal Basin Report" further documented existing problems and provided recommendations for "resolving issues relating to associated mining activities and related facilities" because "roads and abandoned coal spoils continue to degrade water quality in the watershed's tributary streams and the Crystal River near Redstone, Colorado." As previously stated, the Division of Minerals and Geology is continuing to reclaim the Coal Basin area. In 2002 the Division of Minerals and Geology is submitting a 319 proposal for slope remediation at a cost of approximately $80,000.

3.3.4 Recreational Activities

Numerous recreational activities can impact water quality. These include golf courses; snow making for skiing; and activities associated with water features such as fishing, rafting, etc.

Development of new homes and associated infrastructure which are secondary impacts from recreational development are an important impact on water quality, as many areas which were previously undisturbed are becoming developed or urbanized.

Some of the activities associated with skiing which impact water quality include: snowmaking (reduced stream flows at low flow times), large scale soil disturbance activities during construction of ski runs, runoff from denuded slopes that aren't well vegetated, increased urbanization, and habitat loss (wetland and riparian areas). There are currently (January 1996) 4,235 acres of lift served skiable terrain in Pitkin County (Aspen Ski Corp).

Golf courses impact water quality through fertilizer and pesticide runoff, large scale soil disturbance during construction, increased runoff, and watering practices.

Activities associated with water features can impact the riparian and aquatic community as well as water quality. Erosion from foot and vehicle traffic; increased stream bottom disturbance, inadequate toilet facilities; and littering can all lead to water quality impacts.

3.3.5 Agricultural Activities

Timbering activities which disturb large areas of land can produce a significant water quality impact. A study funded by the Summit Water Quality Committee examined three types of forest management practices in Summit County: control (no action); over-story removal (partial removal of timber); and clear cut (complete removal of timber). Eight sites were studied over a two year period. The combined data show beyond reasonable doubt (better than 90% confidence that increased phosphorus loads may result from areas subject to over-story removal and that clear cutting can increase the phosphorus load by as much as 30 times higher than background phosphorus yields.

Agricultural activities in the Roaring Fork River watershed (including cattle grazing, hay production, and logging) are contributing phosphorus and nitrogen, to the aquatic environment, although the significance of this contribution is unknown. It is likely that these impacts are insignificant with respect to other sources of nutrients and sediment already described. Reduction of agricultural impacts in the riparian and wetland areas through the voluntary implementation of best management practices could potentially improve water quality.

3.3.6 Nonpoint Issues - Summary

The existing major nonpoint source water quality problems of streams and lakes in the Roaring Fork watershed include:

Excessive suspended sediment concentrations in specific areas of watershed, including the Brush and Coal Creeks, as a result of natural runoff and human land use practices;

Increases in nutrient and dissolved solids concentrations in the Roaring Fork River downstream from Aspen and other urban areas as a result of urban runoff.

Increases in direct urban stormwater runoff as well as pollutants associated with the stormwater flows.

3.4 Nonpoint Source Recommendations

Policy 1 - Water Quality; Policy 2 - Water Use and Development; Policy 3 - Land Use and Development; Policy 4 - Domestic, Municipal, and Industrial Wastes; and Policy 5 - Chemical Management; in Volume I should be implemented by the appropriate management agencies in the Roaring Fork watershed to address nonpoint source issues discussed in Section 3.3. Other recommendations include:

Municipal and county nonpoint source water quality improvement projects should continue to be supported by local, state and federal funding.

Collaborative efforts such as the Colorado River Headwaters Forum should continue as a means to integrate water quality and water quantity planning and include consideration of negative water quality impacts of trans-basin diversions, so that constructive

arrangements with respect to such things as the operation of Ruedi Reservoir and related issues can be forged.

Projects designed to augment or improve instream flows in the headwater of the Roaring Fork River should be pursued.

A county inspection and maintenance program for ISDSs should be considered.

Water conservation practices, including in-home, landscaping, and wastewater reuse need to be vigorously pursued.

Projects designed to stabilize stream banks and protect the aquatic resource.

4.0 WATERSHED IMPROVEMENT PROJECTS

4.1 Existing Watershed Improvement Projects

A number of watershed water quality improvement projects are occurring in the Roaring Fork basin. A number of the larger efforts are documented below. In addition, a number of wetland creation/improvement projects and aquatic habitat improvement projects are active in the watershed.

4.1.1 Snowmass Village Sediment Control Efforts in Brush Creek

The Town of Snowmass Village applied for an EPA Nonpoint Source Grant in 1995 to address some of the issues associated with high sediment loads in Brush Creek. The town has identified several areas within their jurisdiction which would be suitable for water quality improvement demonstration projects. $150,000 of EPA funding was requested for a total project cost of $831,300. The proposed projects include: bank stabilization; channel reconstruction; road-side wall to prevent road sanding materials from directly entering the creek, and public education.

4.1.2 Snowmass Creek Projects

Two projects in the Snowmass Creek drainage have occurred recently, both privately funded. The first was a wetland enhancement and bank stabilization project, which consisted of enhancement of a 1/4 acre of wetlands and bank stabilization on two meander lengths of Snowmass Creek about midway to the confluence with the Roaring Fork. The other project took place on 15,000 acre Wildcat Ranch (Wildcat Creek is a tributary to Snowmass Creek) and consisted of gully stabilization with drop structures and sedimentation ponds.

4.1.3 Fryingpan River Projects

Aquatic habitat work was completed on a 1/4 mile length of the Fryingpan River in the vicinity of the Norrie colony, which was sponsored by the homeowners association. A series of vortex weirs and deflectors were constructed to increase stream velocities, and

some pool areas were established. These improvements were done to offset reduced stream flows as a result of the Fryingpan-Arkansas Project. In the Basalt area a 1/4 acre wetland was created.

A “Ruedi Futures” study is being done by the Roaring Fork Conservancy which includes a user survey of Ruedi Reservoir visitors, including an estimate of total visitor use in the lower Frying Pan River, economic modeling, a fishery study, and instream flow modeling. This work is expected to run through 2002. The work is being done to evaluate potential changes in operations of Ruedi Reservoir.

4.1.4 Roaring Fork Stream Bank Stabilization near Carbondale

A stream restoration plan has been developed for a three-mile section of the Roaring Fork from the Catherine Store Bridge to the Carbondale Bridge. This plan is a result of the resolution of a major violation of Section 404 of the Clean Water Act. The actual stream restoration and bank stabilization will begin in 1996. Continuation of the project will occur as private funds become available.

4.1.5 Mid-Continent Resource Coal Mine Reclamation

The Colorado Division of Minerals and Geology (DMG) is responsible for reclamation of the Mid-Continent Resources Coal Mine site, which was declared bankrupt effective July of 1994. Approximately 200 acres of land were disturbed by coal mining activities in Coal Basin. In 1995, contractors under the direction of DMG re-vegetated two waste rock piles (pile of rejected materials from the wash plant) and two mine sites on the property. In 1996 it is anticipated that the two last un-reclaimed mine sites will be re-vegetated, that the Rock Tunnel entry will be reclaimed, and that approximately one-third to one-half of the 14 miles of roads on the property will be re-vegetated. The work on is project is being funded by sales of the property and services provided by Mid-Continent (including structural demolition). In 2002 the DMG is proposing an $80,000 319 project for slope remediation in Coal Basin.

4.1.6 Anshutz Coal Mine And Mill Reclamation

The Anshutz Coal Mine area in North Thompson Creek has been reclaimed, and suspended sediment concentrations have been reduced to background levels. Dissolved solids concentrations from the draining portals are decreasing.

4.1.7 Basalt Stormwater Evaluation and Recommendation Report

The Town of Basalt and the Roaring Fork Conservancy obtained an EPA 319 grant for the development of a Watershed Improvement and Education Project in 1999. The project had two main components, evaluation of non-point source pollutants and developing recommendations for Best Management Practices for the Town, and expansion of educational activities including water quality monitoring programs and public outreach focused on preventative strategies to minimize soil erosion and stormwater runoff.

4.1.8 Glenwood Stormwater Evaluation and Public Education

The City of Glenwood Springs and the Roaring Fork Conservancy obtained an EPA 319 grant in 2002 for the development of a project similar to the successful Basalt stormwater evaluation and public education project described above.

4.2 Future Project Needs

4.2.1 Public Education Programs

There is a need for public education programs that further the public's knowledge concerning nonpoint source water quality impacts and methods for minimizing those impacts through Best Management Practices. This includes issues regarding septic systems, household hazardous waste disposal, erosion control**,** and urban stormwater runoff.

4.2.2 Coal Basin projects

There is a need for additional reclamation work in the Coal Basin to address sediment and iron issues from activities associated with the Mid-Continent Mine.

4.2.3 Basalt Stormwater Detention Ponds

A number of detention pond projects (6) have been identified by the Basalt Stormwater 319 project, ranging in cost from $15,000 to $136,000 [Matrix Design Group September 30, 2001 Statement of Probable Cost]. These ponds are designed to improve the quality of urban stormwater runoff and reduce the velocity of the runoff to historical levels, in order to reduce the erosive nature of stormwater flows in the Basalt area.

5.0 LAND USE REGULATIONS APPLICABLE TO WATER QUALITY PROTECTION AND IMPROVEMENT

A number of land use regulations currently exist in the Roaring Fork basin which assist in minimizing water quality impacts from various land uses. Aspen/Pitkin County has "Environmentally Sensitive Lands" regulations (Division 5, Section 7-501. These regulations establish a 100 foot development setback from the Roaring Fork River and its tributary streams, and allow no development within 100 year floodplains. Stormwater runoff is required to maintain the off site historical rate of runoff for the 100 year flood.

Stormwater permits are required by the state for construction activities which disturb greater than five acres of land. The permits require erosion controls and spill protection plans. In July of 2002, stormwater discharge permits will be required for construction activities disturbing more than one acre of land. The permits are issued by the Colorado Department of Public Health and Environment’s Water Quality Control Division.

The Town of Snowmass Village requires erosion controls on construction sites.

Regulation of septic systems is performed by Eagle, Garfield, and Pitkin Counties utilizing state and local criteria.

Policies 1- 6 and the implementation recommendations found in these policies are all appropriate for implementation in the Roaring Fork watershed.

6.0 WASTELOAD ALLOCATIONS

Wasteload allocations have been established for point source discharges in the upper Roaring Fork watershed. Total maximum loads for all sources have been determined by the Water Quality Control Division. A summary of these loads is presented below:

Roaring Fork Discharger:	Aspen Consolidated	Period
Ammonia	8.6-28 mg/L	October - April
Brush Creek: Discharger:	Snowmass San	Period
Ammonia	1.2 – 3.9 mg/L	Monthly
Roaring Fork Discharger:	Mid-Valley W&SD	Period
Ammonia	30 mg/L	Annual
Roaring Fork Discharger:	Glenwood Springs	Period
Ammonia	27 – 29 mg/L	May, Aug.-Oct.
Four Mile Creek Discharger:	Ski Sunlight	Period
Ammonia	1.1 – 8.1 mg/L	Monthly

As previously stated, increases in nutrient concentrations are a concern in the Roaring Fork watershed. Sources are both point and non-point in origin.

7.0 WATER QUALITY MONITORING

7.1 Current Water Quality Monitoring

The Colorado Water Quality Control Division (WQCD) currently has one active water quality monitoring station in the Roaring Fork watershed - located just above the confluence with the Colorado River. Prior to 1992, the WQCD had four stations in the Roaring Fork watershed. The WQCD plans to do "in-depth" sampling on a five year basis in each of the major basins in the state. The Roaring Fork is included in the lower Colorado River basin, and is scheduled for monitoring in 1996.

The Division of Wildlife's River Watch Program has approximately 23 on-going monitoring stations in the Roaring Fork watershed. The water quality data collected at this sites is somewhat limited, but the monitoring efforts are extremely valuable in

augmenting other data sources.

The Roaring Fork Conservancy has taken on the task of coordinating and reporting on the River Watch program in the Roaring Fork watershed. This Water Quality Monitoring Program has produced the Roaring Fork Watershed: 2000 State of the River Report.

The USGS had one water quality monitoring station in the Roaring Fork, which has been monitored regularly (the Roaring Fork at Glenwood Springs). Additional USGS water quality monitoring sites have been established intermittently.

A study of the impacts of use of magnesium chloride as a road de-icing compound has been initiated by the Colorado Association of Ski Towns, Colorado Department of Transportation, and the USGS. The study, to assess the possible water quality and human health impacts of the use magnesium chloride and determine whether better alternatives may exist, should be completed in the spring of 2002.

The USGS was contracted by Pitkin County, the Colorado River Water Conservation District, and others in 2001 to develop a water quality database and retrospective analysis. This work is expected to be on-going for several years.

The Water Quality Control Division has monitored 7-8 sites in the Roaring Fork watershed on a frequency of 8-12 times per year in 2000 and 2001.

7.2 Water Quality Monitoring Needs

Locating sources of and monitoring concentrations of suspended sediment in Brush and Coal Creeks and nutrient and bacteria concentrations in Brush Creek would aid in evaluating effects on water quality from natural and urban runoff. This work is currently being done through efforts by the Town of Snowmass Village. Section 4.1.1 discusses the Town's current projects.

A water quality data collection program maintained on a monthly basis at sites on the Roaring Fork River, especially downstream from Aspen, would determine possible spatial or temporal changes in water quality and aid in maintaining the river as a fisheries resource. Monthly sampling of nutrients and supplemental sampling of benthic invertebrates or periphyton could be used as indicators of water quality changes.

Determination of stream flows for the purpose to insuring CWCB instream flow appropriation protection. The Division of Wildlife will be examining instream flow needs in the lower Roaring Fork watershed in 1996, and concerns in the upper watershed would be appropriately addressed at this time.

The determination of long term-water needs to meet future growth in the basin would be very useful. It is possible that the Colorado River Water Conservancy District could assist the local entities in the watershed in this effort.

Monitoring is needed to determine the quality and quantity of groundwater in the watershed and what kind of interactions exist between the ground water and surface water.

Monitoring is needed to determine the cumulative impact of ISDSs on ground and surface water quality. A groundwater sensitivity analysis could also be extremely useful in determining locations where heightened management of septic systems is warranted.

8.0 WATER QUALITY STANDARDS AND RECOMMENDATIONS

8.1 Existing Classifications and Standards

Streams in the Roaring Fork watershed are classified for protection of cold water aquatic life (Class I), primary contact recreation, water supply and agricultural uses. One tributary wetland to which the Aspen Glen facility discharges was classified as Recreation class 2. Red Canyon, except for Landis Creek from its source to the Hopkins ditch diversion upstream of the Spring Valley wastewater facility, was classified as Aquatic Life Class 2.

Brush Creek previously received a temporary modification for ammonia under the water quality standards but current treatment levels are in accordance with the defined ammonia limitations.

The watershed has one segment that is under temporary modifications to the numeric standards: the mainstem and tributaries of Coal Creek, due to mining activities. The temporary standard for iron on Coal Creek was removed in the 1999 Upper Colorado River Basin Standards hearing. The current standard for iron for this segment is 300 ug/l dissolved and 1,000 ug/L total recoverable. At the July 2000 Water Quality Control Commission Basic Standards hearing, the Commission decided that “[f]or segments with a Water Supply Classification that do not have an actual water supply use, no numerical standards for sulfate, iron and manganese will be established unless determined to be necessary and appropriate in accordance with section 31.7 as the result of a future site-specific rulemaking. For segments with a water supply classification that have an actual water supply use (as opposed to a potential use), the Commission is adopting numerical standards based on the less restrictive of (a) existing quality as of January 1, 2000, or (b) the water supply table value criteria for iron, manganese, and sulfate” [Statement of Basis, Specific Statutory Authority and Purpose, July 2000 Rule Making Hearing, CCR 1002-31.37].

Waters within the Maroon Bells/Snowmass Wilderness area and in the Hunter Fryingpan Wilderness are designated "Outstanding Waters".

Waterbodies designated "Outstanding Waters" "shall be maintained and protected at their existing quality" (5 C.R.R. 1002-8, 3.1.8.1.a). These waters are considered to be of the highest quality, and are afforded the most protection.

Regulated activities taking place in reviewable waters are subject to antidegradation review. Antidegradation review requires that regulated activities (discharges to those waters) be reviewed to: determine if the activity will result in significant degradation of that water; and if so, if "the degradation is necessary to accommodate important economic or social development is the area in which the waters are located." (5 CRR 1002-8, 3.1.8.3.d.). All waters in the Roaring Fork River except the "Outstanding Waters" and the mainstem of Brush Creek (Segment 4) are reviewable waters.

Use Protected" designation indicates that those waters so designated do not require the special protection of antidegradation review (generally speaking, waters not meeting several water quality criteria or standards, or subject to significant point source discharges), but no activity can result in the exceedance of water quality standards. Brush Creek**,** and Red Canyon, as previously described, are the only "Use Protected" segments in the watershed.

8.1.1 Designated Use Impairment Stream Segments

The state has designated one stream segment in the Roaring Fork watershed as "Use Impaired" (Roaring Fork and Crystal River).

The segment listed, Coal Creek – from the source to the Crystal River – is listed for iron, the source of which is identified as the Mid-Continent Mine.

8.1.2 303(d) List

The Clean Water Act requires the state to list those stream segments or waterbodies which require Total Maximum Daily Load (TMDL) allocations in order for the segment to attain or maintain water quality standards. The State's 2000 305(b) report lists the current 303(d) list (Table 29). In the Roaring Fork watershed, one stream segment is identified - Coal Creek (iron). This list represents stream segments that receive pollutant loads in excess of the stream's capacity to cleanse itself. Coal Creek is listed as low priority.

A TMDL is the estimated assimilative capacity of a waterbody which estimates how much of a pollutant may enter a water body without affecting its designated uses. The TMDL represents the sum of the point sources, the nonpoint sources, and a margin of safety (which can include anticipated future pollutant loading).

The State's 1998 303(d) list has an appendix for monitoring and evaluation for 303(d) list status. Coal Creek and the Crystal River below Coal Creek are listed in the Appendix for monitoring and evaluation for impairment by sediment.

Additionally, NWCCOG recommends the addition of Four Mile Creek (Segment 3 of the Roaring Fork River) for monitoring and evaluation for impacts to the aquatic life class 1 designation. Four Mile Creek is likely impaired due to low stream flows, point and significant nonpoint source inputs of nutrients, and nonpoint source sediment loading.

8.2 Recommendations on Standards

Existing water quality standards (including use designations and criteria) for the Roaring Fork River watershed are adequate to protect the existing uses under current conditions.

NWCCOG is supportive of the State's antidegradation provision and protection of high quality waters. NWCCOG is concerned, however that currently classified Recreation Class 2 waters will be reclassified as Recreation Class 1a unless a Use Attainability

Analysis (UAA) is completed. It is likely that Recreation Class 2 is the appropriate classification for some of these segments. It is unlikely that UAAs will be completed for all these segments, due to financial and time constraints. In the Roaring Fork River watershed these waters are:

Segment 4 – Brush Creek

Segment 10 – Mainstem of Thompson Creek to the confluence with the Crystal River

There is a permitted discharge to Segment 4 (Snowmass Water and Sanitation District).

8.3 Outstanding Waters Designations

The Northwest Colorado Council of Governments does not currently recommend any additional waterbodies to the list of "Outstanding Waters" designation. If new wilderness areas within the watershed are approved by Congress, NWCCOG recommends investigations of waterbodies within those areas for appropriate ness of "outstanding waters" designation.

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2002 UPPER COLORADO RIVER WATER QUALITY MANAGEMENT PLAN

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1.0 WATERSHED OVERVIEW

1.1 Geography and Hydrology

The Colorado River headwaters watershed in this plan is defined as the continental divide on the east and north, the Williams Fork Mountains ridge to the south and west, and the Gore Range ridge to the northwest (Figure 10). This area is generally defined by Grand County, which encompasses an area of 1,869 square miles (1,196,000 acres) with altitudes ranging from 13,400 feet along the continental divide to 6,800 feet near Radium. The Blue River, which flows into the Colorado River outside of Kremmling, is described in the Blue River Watershed Management Plan.

The major sub-basins in the headwaters of the Colorado River include: the Colorado River, which originates in Rocky Mountain National Park; the Fraser River; Willow Creek; Williams Fork; Troublesome Creek; and Muddy Creek. The Fraser River originates at Berthoud Pass and flows northwest to its confluence with the Colorado River near Granby. Principal tributaries to the Fraser River include St. Louis and Ranch Creeks, flowing westward and joining the Fraser River near Fraser. Other principal tributaries to the Colorado River are: Williams Fork, flowing north and joining the Colorado River near Parshall; Troublesome Creek, flowing south and joining the Colorado River at Troublesome; Muddy Creek, flowing south from Rabbit Ears Pass and joining the Colorado River at Kremmling, and the Blue River, flowing north through Summit County to its mouth below Kremmling.

The lower portion of the upper Colorado watershed includes parts of Routt (Rock Creek drainage), Eagle, and Garfield Counties, and ends at the confluence of the Roaring Fork and Colorado Rivers in Glenwood Springs. Below the confluence of the Blue River, the Colorado River flows through a remote and rural area until it joins with the Eagle River at Dotsero and then parallels the major east-west interstate Highway 70 corridor to Glenwood Springs. Tributaries to this portion of the Colorado River include: the Piney River which flows northwest to the confluence at State Bridge; Rock Creek which flows southwest to the confluence at McCoy; and Sweetwater Creek which flows southeast to the confluence about five miles upstream of Dotsero. Between the confluences of the Eagle and Roaring Fork Rivers, the Colorado River has no major tributaries.

The Colorado River and its tributaries experience widely varying seasonal fluctuations in flows. Most stream flow results from snowmelt [US Geological Survey, Hydrology of Area 58, Northern Great Plains and Rocky Mountain Coal Provinces, Colorado and Utah, 1987].

Figure 9. Upper Colorado River Watershed Map.

The spring runoff period, May through mid-July provides approximately 75% of the total annual flow. During this time there is usually a surplus of available water, however, during the late summer and fall when stream flow is low, demand continues or increases and often exceeds supply [US Forest Service, Rock Creek/Muddy Creek Draft Environmental Impact Statement, 1987]. The annual average annual runoff of the Colorado River at various locations is listed in Table 18 below.

Table 18. Upper Colorado Drainages and Average Annual Runoff*

Drainage	Area (square miles)	Water Years (Oct.- Sept.)	Annual Runoff (acre-feet)
Colorado @ Hot Sulphur Springs	825	1982-2000	207,800
Blue near Kremmling	645	2000	298,700
Colorado nr Kremmling	2,382	1962-2000	755,000
Eagle blw Gypsum	945	1947-2000	419,100
Colorado blw Dotsero	4,394	1941-2000	1,543,000
Roaring Fork @ Glenwood Spr	1,451	1972-2000	905,400
Colorado blw Glenwood Sprs	6,013	1967-2000	2,522,000

*Data comes from Water Resources Data Colorado Water Year 2000, US Geological Survey, 2001

The major storage facilities in the Upper Colorado watershed are: Shadow Mountain Reservoir, Lake Granby, Windy Gap Reservoir, Willow Creek Reservoir, Williams Fork Reservoir, and Wolford Mountain Reservoir (66,000 acre feet). In addition, a number of tunnels and diversions transport approximately 272,000 acre-feet per year to the eastern side of the continental divide [Colorado Water, League of Women Voters, 1992]. These diversions include the Gumlick and Vasquez Tunnels owned by the Denver Water Department, the Moffat Tunnel, currently owned by the Colorado Department of Local Affairs, and the Adams Tunnel, owned by the US Bureau of Reclamation and operated by the Northern Colorado Water Conservancy District.

1.2 Land Uses and Population Characteristics

The predominant land uses are woodland or rangeland and are managed by the US Forest Service (USFS) and Bureau of Land Management (BLM). The USFS manages approximately 892 square miles (Arapaho and Routt National Forests) [Statistical Abstract of Colorado, University of Colorado, Boulder, Business Research Division, 1987] and the BLM manages approximately 175 square miles, accounting for 60% of the headwaters watershed.

The economy of the headwaters watershed is based mainly on recreation. The Fraser River sub-basin, located in southeastern Grand County, contains major ski areas (Winter Park, Sol Vista, Devil's Thumb**,** Young Life Camp and Snow Mountain Ranch). Intensive recreation includes golf courses and camps.

Extensive development of condominiums and vacation homes has occurred along the Fraser River between Winter Park and Granby in the vicinity of the ski areas and recreational facilities.

The Three Lakes region, an important recreational area in the northeast part of the county, includes Lake Granby, Shadow Mountain Lake, and Grand Lake. The

economies of the Fraser River sub-basin and the Three Lakes region are based primarily on recreation *(*including significant motorized recreation) while the economy of the remaining parts of the watershed is based mostly on agriculture. Ranching, timber production, and gravel mining, are the major activities from Granby to Glenwood Springs. Recreational boating and fishing are also economic drivers in the lower area of the basin from "Pumphouse" to Glenwood Springs.

The major population centers in the headwaters portion of the watershed are Winter Park, Fraser, Tabernash, Granby, Grand Lake, Hot Sulphur Springs, and Kremmling. The seasonal population increases significantly at the ski areas in and near Winter Park in the winter, and in the Three Lakes region in the summer. For Grand County, the permanent population between 1980 and 1990 grew 6.6%, and between 1990 and 2000 grew 56.2%.

The lower portion of the upper Colorado River is remote and land uses generally consist of ranching, timbering**,** recreational boating and fishing, and mineral extraction. Population centers in the lower portion of the upper Colorado River include: Radium, State Bridge, Bond, McCoy, Burns, Dotsero, and Glenwood Springs. Below the confluence of the Eagle River, the River receives little in the way of substantial inflows and point source discharges until the confluence with the Roaring Fork River, but is impacted by its proximity to the highway, towns, and the Shoshone Hydroelectric Power Plant.

In the Upper Colorado River watershed there are 59 community, transient non-community, and non-transient non-community drinking water systems, serving a combined total population of 49,009 persons [Colorado Department of Public Health and Environment, Water Quality Control Division Colorado Open Records Act request, NWCCOG December 10, 2001]. Forty-nine of the systems are reliant upon ground water and ten systems are reliant upon surface water. This information does not include systems serving less than 25 people.

1.3 Watershed Water Quality Management

Organizations in the upper Colorado River watershed that are addressing water resource issues include: the East Grand Water Quality Board; the Upper Colorado Lakes Protection Association; and the Upper Colorado River Alliance. The latter two organizations, along with the Shadow Mountain Home Owners Association combined efforts in 1998 and formed the Three Lakes Watershed Protection Association, which was incorporated as a nonprofit entity. The East Grand Water Quality Board and the Three Lakes Watershed Association are working together to address water quality issues more holistically throughout Grand County.

2.0 WATERSHED WATER QUALITY ASSESSMENT

2.1 Upper Colorado River Headwaters (Stream Segments 1, 2,3, 4, 6a & 9)

Stream Segment 1 of the upper Colorado River includes the mainstem of the Colorado River, including the tributaries, lakes and reservoirs within Rocky Mountain National

Park, or which flow into Rocky Mountain National Park. This stream segment has been designated "Outstanding Waters", and according to regulation "shall be maintained and protected at [its] existing quality".

The USGS, as part of its National Water Quality Assessment program for the Upper Colorado River basin study unit, selected a fixed site in Rocky Mountain National Park on the Colorado River below Baker Gulch [Water Quality at Basic Fixed Sites in the Upper Colorado River Basin National Water-Quality Assessment Study Unit, October 1995-1998, Water Resources Investigation Report 99-4223]. The stream reach in which this is located (segment 1) is composed mostly of forest, tundra, and meadows; a few cabins are located within the basin. Dissolved iron concentrations reflect geologic sources of iron and the reducing environment of large wetland areas in the basin. Suspended-sediment concentrations were low (median of 2 mg/L). Concentrations of ions were fairly dilute, sediment and nutrient concentrations were low, as shown in Table 19.

Table 19. Summary of selected parameters at Colorado River below Baker Gulch Site, 1995-1998 USGS data.

Constituent	Minimum	Median	Maximum
	Mg/L		
Suspended organic carbon	<0.1	0.2	0.9
Dissolved ammonia	<0.2	<0.2	0.06
Dissolved nitrite	<0.01	<0.01	0.02
Dissolved phosphorus	<0.01	<0.01	0.03
Dissolved orthophosphate	<0.01	<0.01	0.02
Dissolved oxygen	7.5	9.3	11.0

The Three Lakes area surrounds Grand Lake, Shadow Mountain Reservoir, and Granby Reservoir. These lakes receive a high degree of recreational usage. The Three Lakes Sanitation District provides wastewater treatment for this area, and numerous homes and businesses that were previously on septic systems have been connected to the wastewater treatment plant. Water quality data is collected by the Upper Colorado Lakes Protection Association, a volunteer effort coordinated by the Water Quality Control Division. Additionally, the US Geological Survey (USGS) and the Northern Colorado Water Conservancy District collect water quality data on these lakes. Water quality data collected from the three lakes has been compiled into a water quality database by the Northwest Colorado Council of Governments. The database is updated on a yearly basis, and contains water quality data collected by these agencies since 1960. The data indicates that water quality in the lakes and reservoir is good. The table below (Table 20) lists average yearly chlorophyll, secchi disk, and total phosphorus levels in the three lakes.

This database has been incorporated into the Three Lakes Clean Lakes Assessment Grant, an EPA Section 319 Grant funded project discussed in Chapter 4.1

Table 20. Three Lakes Annual Average Trophic State Indicators

Lake	Monitored by	Year	Chlorophyll	Secchi disk	T. P.
Grand	EPA	1975	4.9 (4)	133.5 (4)	0.018 (15)
	WQCD	1990	6.6 (4)	119 (4)	0.013 (6)
	WQCD	1991	8.8 (6)	111 (6)	0.013 (5)
	WQCD	1996	10.9 (14)	107 (14)	0.010 (14)

	WQCD	1997	N.D.	138 (8)	0.014 (8)
	WQCD	1998	? (5)	78 (5)	? (5)
E. portal of Adams Tunnel	USGS	1993	N.A.	N.A.	<0.01 (6)
	USGS	1995	N.A.	N.A.	<0.01 (6)
	USGS	1996	N.A.	N.A.	0.02 (6)
	USGS	1998	N.A.	N.A.	<0.01 (6)
	USGS	2000	N.A	N.A.	<0.05 (5)
Shadow Mt.	EPA	1975	5.7 (6)	73 (6)	0.030 (6)
	USGS	1991	N.D.	83 (1)	0.060 (1)
	USGS	1992	7.0 (1)	86 (6)	0.020 (6)
	USGS	1993	2.4 (4)	80 (5)	0.020 (5)
	USGS	1994	3.6 (6)	79 (6)	0.020 (6)
	USGS	1995	6.0 (6)	77 (6)	0.010 (6)
	USGS	1996	1.4 (5)	102 (5)	<0.01 (5)
	USGS	1999	3.2 (4)	104 (4)	<0.05 (3)
	USGS	2000	1.7 (3)	107 (3)	0.017 (3)
Granby	USGS	1992	1.4 (2)	170 (2)	<).01 (2)
	USGS	1993	3.8	102 (7)	0.013 (5)
Combined sites	USGS	1995	4.4 (10)	99 (10)	0.01 (10)
At spillway and	USGS	1998	1.6 (8)	159 (8)	<0.01 (6)
Dam on Granby	USGS	1999	1.2 (8)	159 (6)	<0.05 (8)
	USGS	2000	1.3 (8)	164 (8)	0.036 (8)

Note: the numbers in parentheses in the table indicate the number of samples which make up the annual average value. Chlorophyll: ug/L, chlorophyll a; Secchi Disk: inches; TP: Total phosphorus, mg/L

As reference, the trophic state of the water bodies with these levels of chlorophyll, secchi disk depth (a measure of transparency), and phosphorus, are generally considered "mesotrophic", or having a moderate amount of nutrients. It should be noted that the database for chlorophyll, secchi disk depth, and phosphorus is extremely limited and inconsistent. Considering the limited data, different sources, and sampling locations, statements concerning trends in the lakes cannot currently be well substantiated.

Of the three lakes, dissolved oxygen concentrations pose the greatest concern in Shadow Mountain Reservoir, where values below 4.0 mg/L (affecting fish) are found at depths below 25 feet in summer and fall. In Granby Reservoir, dissolved oxygen concentrations below 4.0 mg/L are found at 40 feet and deeper. The limited data for Grand Lake do not indicate a dissolved oxygen concentration problem in this lake.

Water quality data collected by the Northern Colorado Water Conservancy District at the Windy Gap Pump Station and Colorado River at Station 1 detected the occasional presence of mercury in 1992 and 1993. The values were at or just above the limit of detection. In Shadow Mountain Reservoir manganese occasionally exceeds drinking water standards in the deeper water. There is very little data for metals concentrations in Grand Lake, however the data, which does exist, indicates no metal concerns.

Excessive phosphorus concentrations, bacteriological contamination, and accelerated eutrophication were the primary water quality problems evaluated in a 1970 study by EPA. Previous studies by the Colorado Department of Public Health and Environment (1960) had attributed water quality concerns in the lakes with poorly functioning or failing septic systems producing "nuisance" algae conditions. A subsequent EPA study

conducted in 1974 indicated that no chemical or bacteriological standards were exceeded in any of the samples collected from the lakes or from streams flowing into the lakes. However, nonpoint source runoff from land disturbance increased nutrient and sediment yields to the lakes. During this study, no adverse chemical or biological effects were measured in the lakes as a result of septic systems. The conclusion of this study was that the cause of "nuisance" algae conditions was primarily from nonpoint source runoff, rather than from septic systems in the Three Lakes region. Since 1995 septic system installations have been well documented and tracked by the County.

Land use practices and manmade activities have contributed to the majority of nutrient and sediment problems in the lakes. For example, Shadow Mountain Reservoir was built upon highly productive hay meadows. The lakes are characterized by EPA as being oligotrophic to mesotrophic (small to medium production of biota) with nitrogen the limiting factor in Grand Lake, and phosphorus and nitrogen the limiting factors in Shadow Mountain Lake and Lake Granby. Because other studies have reported excessive blue-green algae production and small dissolved oxygen concentrations in the three lakes, and the oligotrophic status probably should not be considered a stable condition.

A temporary modification for the fecal coliform standard has existed on Segment 2 of the upper Colorado River (Grand Lake, Shadow Mountain, and Granby reservoirs) but was removed in 1987 with the determination that the Recreational Class 1 goal for these waters had been reached.

An aquatic plant mechanical harvester was purchased by the US Forest Service for use on Shadow Mountain Reservoir. This harvester was purchased in order to maintain boating access to the reservoir in shallow areas where excessive plant growth was encroaching on boating channels.

In 2000 Grand County was awarded an EPA 319 “Clean Lakes” Grant to assess and develop a protection strategy for water quality in the Three Lakes. [See Project section – Chapter 4]. According to the draft Phase I Report dated April 19, 2002, using data collected since 1989, Grand Lake exhibits mesotrophy with respect to chlorophyll *a* (summer mean of 5.7 ug/L), total phosphorus (12 ug/L), and secchi disk depth (2.9 meters). No apparent trends over time were associated with these parameters. With respect to Shadow Mountain Reservoir, the water body exhibits mesotrophy with respect to 12 years of chlorophyll *a* (4.0 ug/L), total phosphorus (13.2 ug/L), and secchi disk depth (2.7 meters) data. Granby Reservoir should also be considered mesotrophic based on the data collected since 1989. Chlorophyll *a* (3.1 ug/L, actually suggests oligotrophic conditions), total phosphorus (13ug/L), and secchi disk depth (2.9 meters) values did not show any apparent trends over time.

In 1999 the Shadow Mountain Homeowners Association was awarded an EPA 319 grant to assess and provide direction regarding sediment deposition at the mouth of the Colorado River as it enters Shadow Mountain Reservoir. See Project section – Chapter 4.

2.2 Fraser River (Stream Segments 9 & 10)

A USGS 1976 -1977 study [USGS, Reconnaissance Evaluation of Surface-Water

Quality in Eagle, Grand, Jackson, Pitkin, Routt, and Summit Counties, Colorado, Open File Report 79-420, 1979] found that the Fraser River near its headwaters is relatively unproductive, with a diversity index of only 1.50 for aquatic organisms. There were no apparent differences among downstream sites. Downstream sites had the most organisms collected with 55, but the diversities among the sites were similar at about 2.80.

A four-year monitoring effort by the USGS and funded by the East Grand Water Quality Board was completed in 1994. Use of the Colorado Ammonia Model using the monitoring data has indicated that all three domestic wastewater treatment plants discharging to the upper Fraser River (Winter Park, Grand County Number 1, and Fraser) will have to significantly upgrade their facilities (provide nitrification treatment) in order to comply with instream ammonia standards established to protect the Fraser River fishery. In addition to nitrogen and flow data, conductivity, pH and temperature data has also been collected. Additional discussion on this issue is provided in the Point Source Issues Section (Section 3.1). USGS monitoring at the five stations is ongoing.

Denver Water Department water quality data have been collected at two sites on the mainstem of the Fraser River: downstream of Vasquez Creek and at Tabernash. Data collected between 1993 and 1994 at the site below Vasquez Creek shows the impact of sediment, with Total Suspended Solids (TSS) values of 2 -13 mg/L (compared with Williams Fork sites which have values of less than 1 to 3 mg/L). Total phosphorus values ranged from 0.03 to 0.26, with an average of 0.088 mg/L. In Tabernash, un-ionized ammonia values exceeding the stream standard of 0.02 mg/L occurred twice in five samples. Dissolved oxygen was 4.6 mg/L (standard is 6.0) on one of five sampling dates. Total phosphorus at the site ranged from 0.04 to 0.4 and averaged 0.144. Total suspended solids at this site ranged from 2 - 7 mg/L.

Sedimentation on the Fraser River has been identified by the Colorado Nonpoint Source Assessment Report as an issue, and this segment has been designated "Partially Supporting" designated uses in the State's 1994 305(b) Report. Division of Wildlife data from September 1979 and July 1993 indicates that the coldwater fishery is impacted as a result of stream sedimentation. A similar, but un-impacted stream (Saint Louis Creek) has approximately five to ten times the number of trout, 280-700 per acre, versus seventy per acre below the Denver Water diversion structure on the Fraser. High sediment loads in this drainage are associated with erosion from cut and fill slopes along US Highway 40 on the north side of Berthoud Pass, as well as road sanding practices. A number of entities, including the East Grand Water Quality Board, the Winter Park Recreation Association, the Denver Water Department, the Colorado Department of Transportation, the US Forest Service, and the Water Quality Control Division are exploring options for addressing this problem. Currently, the Colorado Department of Transportation is attempting slope stabilization on highly erosive slope areas at Zero Creek.

As part of this effort, the Forest Service has provided leadership in monitoring the Fraser River, and a “reference site” location in Saint Louis Creek. Fish collection data in October of 2000 found an estimate of 1,570 and 1,051 brook trout per acre in each of these streams, respectively. Fish condition, represented by weigh at a given length, tended to be higher in the Fraser River. Fish biomass was estimated to be 63 and 43 pounds per acre for the Fraser River and Saint Louis Creek. Fine sediment (less than 8 mm) in the Fraser River makes up a significantly higher proportion of the substrate than

in Saint Louis Creek, however, residual pool depths are similar (averages of 1.41 and 1.36, respectively). Macroinvertebrates were sampled in August 2000 at both sites.

A 1986 study of the assimilative capacity of the Fraser River concluded that levels of un-ionized ammonia would exceed toxic levels by 1995 without advanced wastewater treatment at the Grand County #1 wastewater treatment plant discharge. The increasing levels of ammonia are projected due to anticipated growth within the service area. A similar modeling study in 1987 evaluated the instream flow necessary to dilute sewage effluent to meet state water quality standards. Based on a peak population of approximately 40% of the potential capacity in the upper Fraser Valley, the study concluded that enhanced waste water treatment at all upper Fraser Valley facilities, or greater diluting flows in the Fraser River, will be necessary to prevent exceedance of the standard for un-ionized ammonia. Additional release flows of 1.4 cfs in Vasquez Creek and 4.2 cfs in Saint Louis Creek would be required during winter months.

Water quality monitoring data in the Fraser River basin includes that measured by the Colorado Department of Public Health and Environment's Water Quality Control Division at Granby. A review of the data from this station for the period from 1977 to 1987 indicates elevated phosphorus, mercury, cadmium, copper, silver and lead concentrations as well as pH as high as 8.5. In the most recent three years of this period only the average concentrations for lead and mercury exceed state standards. Total phosphorus is above the EPA recommended concentration.

A 1973 assessment of waste loads for the Fraser River indicated that the Fraser River receives less waste than its assimilative capacity, but point source discharges in some instances did not meet effluent standards. Waste loads of approximately twice those of the 1973 loads would cause concentrations of un-ionized ammonia to exceed the toxicity criteria for aquatic life. The 1986 and 1987 annual reports of the Water Quality Control Division list the Fraser River as threatened for un-ionized ammonia indicating that it is currently meeting the designated uses but there is a downward trend.

The USGS 1976-1977 [USGS, 1979] selected sites on the Fraser River between Berthoud Pass and Granby to determine effects from recreation and point source discharges at Winter Park and Fraser. The Fraser River upstream from the Mary Jane Ski Resort was established as a control site to determine the effects of recreational and urban activities in downstream reaches. Water at this site had a maximum dissolved solids concentration of only 68 mg/L. As a result of natural occurrence, concentrations of total cadmium, iron, and zinc exceeded standards for aquatic life downstream of the resort area.

The Fraser River near Granby was assessed for possible effects on water quality from upstream agricultural activities and from septic system use at Tabernash as a part of the USGS study [USGS, 1979]. Nutrient concentrations increased in this reach. The report stated that this increase could be due to seepage of septic systems in Tabernash and cattle grazing.

Because the Fraser River valley contains an underlying clay, sand, and gravel aquifer, the river is partly sustained during low flows by ground water. The water table is generally within a few feet of the bottom of the stream channel.

The 1979 USGS study reported that the nutrient increase in the water downstream from

Tabernash (site GC-7) is probably a result of a hydraulic connection between the stream and ground water containing septic system seepage. The dissolved solids concentrations were less than 100 mg/L. Total cadmium and lead concentrations exceeded standards for aquatic life at that time. Water quality data collected by the Water Quality Control Division between 1988 and 1992 indicates continued detection of cadmium, but at levels well below those that would impact aquatic life. Dissolved lead was not detected in any samples during this time.

The USGS Study [USGS, 1979] found phytoplankton [algae] concentrations consistently increased downstream. The largest increase corresponds with the nutrient increases previously cited. The most productive site was the Fraser River at its confluence with the Colorado River, where 30 types of algae were collected, including seven types of green algae and two types of blue-green algae. Anabaena and Chroococcus were the blue-green algae collected. Both types are considered to be polluted water algae because of objectionable taste and odor and filter clogging characteristics, but their presence alone does not indicate pollution. The phytoplankton diversities were 3.55 at site GC-6 and 3.49 at site GC-9.

The 1989 Colorado Nonpoint Assessment states that water diversions in the Fraser River headwaters, Saint Louis, and Vasquez Creek greatly reduce stream flows effecting the quality and beneficial uses of the river. Low instream flows coupled with point and nonpoint loads reduces the potential of the stream as a trout fishery.

The 1976 USGS study [USGS, 1979] selected sites on the Colorado River and tributaries to the Fraser River to examine possible water quality effects from agricultural and natural runoff. The Colorado River upstream from the Fraser River was assessed for possible water quality effects from agricultural activities upstream. The water was suitable for all uses as concentrations of all constituents were low. Downstream from the Hot Sulphur Springs sewage lagoons, nutrient and bacterial concentrations increased as compared to upstream, probably because of effluent discharges from the sewage lagoons. Total cadmium and lead concentrations exceeded standards for aquatic life.

A Water Quality Control Division (WQCD) monitoring site on the Fraser River near Granby was active between 1979 to 1992. This station showed no exceedances of water quality standards between 1988 and 1992 with the exception of occasional exceedance of the chronic dissolved iron standard (0.3 mg/L) for drinking water supplies: 17 samples collected had a mean value of 0.21 mg/L and a range of 0.10- 0.45 mg/L. There were no detections of lead between 1988 and 1992 (17 samples); no detection of mercury (16 samples);15 of 17 samples were non-detect for copper (other 2 were at and just above the detection limit). Fecal coliform samples collected between 1979 and 1992 had a maximum of 430 MPN per 100 ml, and average of 47 (the standard is 2,000). For the period 1988 through 1992, the maximum fecal coliform number was 230, with an average of 49 MPN / 100 ml. Total phosphorus between 1979 and 1992 averaged 0.078 mg/L, and between 1988 and 1992 was 0.077 mg/L, which is close to the median value (0.0775 mg/L) for all WQCD stations within the NWCCOG region.

The USGS produced a report titled “Fraser River Watershed, Colorado – Assessment of Available Water-Quantity and Water-Quality Data Through Water Year 1997” [Water Resources Investigation Report 98-4255]. Analysis of limited water quality data in the watershed indicates that changes in the land use/land cover affect the shallow alluvial

ground-water quality. Iron and manganese concentrations in eight shallow alluvial wells exceeded EPA secondary drinking water standards and radon concentrations from these wells exceeded proposed maximum contaminant levels (300 pCi/L). Surface water quality data are sparse, but two samples from two surface water sites exceeded the un-ionized ammonia chronic criteria. Spatial distribution of nutrient species (ammonia, nitrate, nitrite, and total phosphorus) shows that elevated concentrations occur primarily downstream from urban areas. Sites with five or more years of data were analyzed of temporal trends in nutrient data. Downward trends were identified for ammonia and nitrite at three sites. For nitrate one site showed a downward trend and two sites showed no trend. Total phosphorus showed no trend. Total phosphorus concentrations that exceeded 0.1 mg/L were detected in 23% of the phosphorus samples (95 analyses), with the median concentrations being similar for range and urban land uses. The surface water metals data reviewed did not indicate heavy metals concerns.

In 1996-1997 the Water Quality Control Division monitored four sites in the Fraser River basin. These sites were: Fraser River at Granby; Fraser river above Winter Park, Pole Creek near Tabernash, and Saint Louis Creek near Fraser. Nutrients, metals, and inorganic parameters were collected.

The U.S. Geological Survey, in cooperation with the East Grand Water Quality Board, began a data collection effort in August, 1990, primarily to determine existing water quality conditions for selected nutrient parameters, primarily phosphorus and nitrogen compounds. The program has grown over the years from 4 mainstem Fraser River sites sampled in 1991, to 27 sites throughout the Fraser River basin in 2001.

For 2001, periodic samples for surface-water quality were collected at 6 Fraser River sites, 2 Ranch Creek sites, 3 Crooked Creek sites, 7 Pole Creek sites, and 9 Tenmile Creek sites. The types of data collected in WY 2001 include field measurements (stream flow, water temperature, specific conductance, pH, and dissolved oxygen); nutrients (nitrogen and phosphorus compounds), major ions (chloride and dissolved-solids at all sites, calcium, magnesium, and hardness at selected sites); and Fecal coliform bacteria (at selected sites; changing to Escherichia coli in 2002). In addition, and in cooperation with other agencies, continuous records of discharge were collected at 8 sites on perennial streams in the basin, and additional surface-water quality data (primarily trace elements) were collected at 1 Ranch Creek site, and 1 Fraser River site.

For 2002, periodic samples for surface-water quality will be collected at 6 Fraser River sites, 1 Ranch Creek site, 2 Crooked Creek sites, 2 Pole Creek sites, and 3 Tenmile Creek sites. The types of data to be collected in WY 2002 include the same measurements collected in 2001. In addition, continuous records of discharge will be collected at 8 sites on perennial streams in the basin, and additional surface-water quality data (primarily trace elements) will be collected at 1 Ranch Creek site, and 1 Fraser River site.

2.3 Willow Creek (Stream Segments 6a, 6b, & 6c)

Willow Creek, a tributary of the Colorado River, which enters just north of Granby, has sediment loads (primarily due to road construction associated with logging activities) which severely impact aquatic life, according to the 1989 Colorado NPS Assessment. Willow Creek is also impacted by intensive recreation land uses in the both the upper

area (motorized and mechanized) and lower area (numerous guest ranches).

An issue currently before the Water Quality Control Commission is the temporary ammonia standard on Segments 6b and 6c. Both segments are designated "Use Protected" due to aquatic life habitat constraints. As of December 1995, the temporary ammonia standard of "ambient" in Segment 6c will remain in effect until December 30, 2000. The temporary standard will allow time for analysis of various alternatives for the Three Lakes Water and Sanitation District, with respect to discharge location (currently to Segment 6b), treatment alternatives, and the potential for coordinated siphon operation and fish management with the Northern Colorado Water Conservancy District (the siphon apparently serves as a significant source of fish to Segment 6c).

A TMDL for segment 6c was completed by the Water Quality Control Division in July 2000 and approved by EPA. The TMDL goal is the attainment of chronic and acute un-ionized ammonia standards at the top of segment 6c.

The temporary standard for ammonia is set to expire in December 2003. Prior to that time it is expected that the Three Lakes Water and Sanitation District's new mechanical wastewater treatment facility, with ammonia removal capability will be operational and meeting its discharge permit requirements. The permit limits are set to ensure protection of the stream standards.

2.4 Upper Colorado River (Stream Segments 3 & 4)

The USGS 1976 Reconnaissance Study [USGS, 1979] assessed the downstream reaches of the Colorado River were assessed for possible water quality effects from agricultural activities. Dissolved solids and nutrient concentrations generally increased at these sites.

The USGS study also found an area of iron rich sediment which is probably eroded during spring runoff between Hot Sulphur Springs and Troublesome, as the total iron increased from 850 to 11,000 ug/L in this reach of the stream. Some of the rocks along this reach of the stream are iron bearing olivine basalt, which is easily weathered.

A review of the Water Quality Control Division water quality monitoring data for the period from 1977 to 1987 indicates average concentrations for cadmium, copper, and zinc above state standards near Hot Sulphur Springs. Occasional exceedances of silver concentrations were also noted. Fecal coliform and total phosphorus levels were found to be high. However, in the most recent three years of this period concentrations of all the above water quality parameters are reduced. Data collected by the division between 1988 and 1992 indicated no exceedances of copper, zinc, or fecal coliform bacteria. Dissolved cadmium continues to be detected, but at low levels.

A 1975 Colorado Department of Health study of the Colorado River near Hot Sulphur Springs found that concentrations of several constituents exceeded water supply standards. For example, dissolved iron concentrations exceeded water supply standards, with a maximum of 1,500 ug/L. Water Quality Control Division data from 1988 to 1992 (18 samples) showed a maximum concentration of dissolved iron of 260 ug/L and an average of 176 ug/L (the standard is 300 ug/L).

2.5 Williams Fork Sub-basin (Stream Segment 8)

Water quality data in the Williams Fork area have been collected by the Denver Water Department at seven sites beginning in 1974 (one above the Williams Fork Reservoir, and six above the Henderson Mine and mill property). Recent data (from 1993 through 1994) indicates water in the Williams Fork is of excellent quality, with very low nutrients, low metal concentrations, high dissolved oxygen, and low suspended sediments. This data indicates that any previously documented problems with respect to heavy metals have been resolved.

The 1976 USGS study [USGS, 1979] on the Williams Fork near the Urad-Henderson Mine (Amax Corp.) found that the Williams Fork downstream from the west portal of the mine was not polluted by heavy metals. Also, there was no increase in heavy metals concentrations because of mining activities.

The Denver Water Department has been collecting chemical data on the Williams Fork and its tributaries since 1974. All sites evaluated showed that the water was of suitable quality for all uses. At all sites the concentrations of dissolved solids were less than 100 mg/L, and trace element concentrations and bacteria counts also were correspondingly small. Trace element concentrations at sites near the Urad- Henderson Mine did not exceed any water quality standards.

A 1974 study showed effects from the excavation of a tunnel for the Urad-Henderson Mine on the Williams Fork drainage. The Williams Fork upstream from Keyser Creek showed an increase in the concentrations of most trace elements. Concentrations of dissolved copper and lead exceeded drinking water standards and concentrations of pH, total copper, iron, and zinc exceeded aquatic life standards. The 1974 study was done at the time the tunnel was under construction.

The 1989 Colorado Nonpoint Assessment reports cadmium, copper, and silver concentrations above basic standards for aquatic life on the Williams Fork from the source to the confluence with the South Fork of Williams Fork, which carries only cadmium above standards. From the confluence to Williams Fork Reservoir it exceeds the recommended limits for cadmium, copper, and zinc, however, good trout fisheries are reported in the Williams Fork.

These two previous statements indicate that any heavy metals concerns at that time were probably not due to existing mining operations, as metals exceedances were observed above the Henderson Tunnel, where there were no current mining operations.

In the 1999 Upper Colorado River Basin Standards hearing, the point of compliance for the Henderson Mill discharge permit was determined to be a downstream well. Monitoring of the well showed that the stream standard is being attained. Additionally, the Water Quality Control Division in the 2000 Basic Standards hearing changed the aquatic life standards for manganese to a hardness-based equation, which effectively increased the numeric standard to a level, which the Williams Fork River is meeting. The “Water Quality Limited” designation on this segment was removed and reflected in the State’s 2000 305(b) report.

The Henderson Mill is, generally speaking, a non-discharging facility. Management of

the facility attempts to estimate the annual water need and capture that amount during the spring runoff. Only under high spring flows does the facility discharge, and then the amount discharged is that amount in exceedance of the process needs.

2.6 Troublesome and Muddy Creeks (Stream Segments 4, 6a, & 7a)

Through the Kremmling area the Colorado River water becomes more mineralized, as evidenced by the larger specific conductance values and sulfate concentrations. This area is underlain by Pierre Shale, parts of which are easily weathered. Red Dirt Creek, which flows into Muddy Creek from the west, also flows through Pierre Shale, but the water was suitable for all uses, although a larger total organic carbon concentration was determined as compared to sites along the Colorado River. This area contains much carbonaceous debris rich in organic material.

The Rock Creek/Muddy Creek Draft Environmental Impact Statement [USFS, 1987] found that in the Muddy Creek drainage "[w]ater quality standard violations (when water quality concentrations exceed state water quality standards) have not been attributed to any specific land use activity. It appears that the geologic input dominates surface water chemistry. Parent materials are predominantly Pierre and Mancos shales . . .." Additionally, occasional water samples were analyzed for heavy metals, with no problems identified. Nitrogen and phosphorus levels were identified as being in higher than expected concentrations (potentially due to natural background sources and poor riparian vegetation along the main channel of Muddy Creek). This, in conjunction with relatively warm water temperatures, has the potential to create water quality problems in Wolford Mountain Reservoir. Muddy Creek suspended sediments upon occasion exceeded 3,000 mg/L, and the waters of Wolford Mountain Reservoir have potential to be turbid, as many of the shoreline soils will be subject erosion from wind generated wave action.

The USGS has two sites at which they collect water quality data on Muddy Creek - one above Antelope Creek, and one at Kremmling. The water quality data from these two stations from 1992-1994 indicates high specific conductance, turbidity, hardness, dissolved solids, sulfate, iron, and suspended sediment. Nutrients are generally at low to moderate concentrations.

The 1989 Addendum to the Colorado Nonpoint Source Assessment Report states that "[e]rosion has been reported by local soil conservation districts along this portion of the Colorado River. In particular, Eightmile Creek, Little Muddy Creek, Big Muddy Creek, Troublesome Creek, and Cottonwood Creek are erosion areas; however, the reach of the river that these creeks are tributary to, just above State Bridge, does not show the effects of sediment loads. Effects within these watersheds require further documentation."

Water quality data is collected at two stations on Muddy Creek by West Grand High School as part of the Division of Wildlife's River Watch Program (at Colburn and Pinto). No metals data has been collected at the sites.

2.7 Colorado River below Blue River (Upper Colorado River Segments 3, 5, 7a, and 7b)

Segment 3 is the Colorado River from Lake Granby to State Bridge, Segment 5 is the mainstem of the Colorado River from State Bridge to the confluence with the Roaring Fork, Segment 7a are all the tributaries to the Colorado River from the Blue River to the Roaring Fork (excluding the Blue and Eagle River watersheds), and Segment 7b is the mainstem of Rock Creek.

The 1989 Addendum to the Colorado Nonpoint Source Assessment Report states that "the Colorado River mainstem begins to show impacts from sediment in the segment downstream from State Bridge. The Eagle County Soil Conservation district has designated a stream bank erosion area. This may explain the elevated sediment levels in this reach."

Rock Creek near Toponas within the Routt National Forest was assessed for possible water quality effects from upstream timber production activities. This site had water suitable for all uses, evidenced by low dissolved solids (less than 100 mg/L) and nutrient concentrations [USGS, 1979].

Although Rock Creek has a temporary modification for the mercury standard which is due to expire in 1996, the Rock Creek/Muddy Creek Reservoir Draft Environmental Impact Statement [US Forest Service Rocky Mountain Region, 1987] states "[w]ater quality analyses for Rock Creek occasionally included heavy metals analyses and, in all cases, metal concentrations were well below water quality standards". USGS monitoring on Rock Creek at McCoy and Crater between 1987 and 1993 did not detect mercury. It appears that the temporary standard for mercury should be removed from this segment.

2.8 Instream Flows

Appendix 14 lists the Colorado Water Conservation Board's (CWCB) instream flow filings in the Upper Colorado River watershed. Colorado statute (CRS § 37-92-102(3) recognizes that preserving the natural environment to a reasonable degree, through the protection of instream flows and maintenance of natural lake levels in natural lakes, is a beneficial use of water. Under the same statute, the Colorado Water Conservation Board is declared the exclusive agent authorized to appropriate water rights for the purpose of preserving the natural environment. The acquisition of the water rights to protect minimum instream flows has to be made within the context of existing water rights appropriation regulations. Minimum instream flows are therefore subject to appropriation dates, and the CWCB can only call out water rights junior to their own for maintenance of those flows. Most of the appropriation dates in the Upper Colorado River watershed are between 1977 and 1990.

CWCB appropriation flows, determined in consultation with the Division of Wildlife and the Division of Parks and Outdoor Recreation, are the flows necessary "to preserve the natural environment to a reasonable degree" (CRS 37-92-102(3)). The fact that the CWCB has filings for these instream flows does not ensure that stream flows will always exceed the minimum necessary to protect the natural environment, as the water rights associated with these flows have relatively junior appropriation dates. Exercise of water rights that are senior in date to the CWCB instream flow appropriation dates can result in stream flows lower than the CWCB appropriation amount.

A minimum stream flow agreement exists between the US department of the Interior and the Municipal Subdistrict of the Northern Colorado Water Conservation District [Colorado-Big Thompson Windy Gap Projects Colorado Final Environmental Impact Statement, Water and Power Resources Service, US Department of Interior, 1981]. The agreement requires minimum stream flows as follows: from Windy Gap diversion to Williams Fork 90 cfs; from Williams Fork to Troublesome Creek 135 cfs; Troublesome Creek to Blue River 150 cfs. Once every three years, if equivalent flows do not otherwise occur, a flushing flow of 450 cfs for 50 hours, sometime within the months of April, May, and June. Windy Gap water delivered to the Eastern Slope will average about 48,000 acre feet per year. This delivery will be relatively uniform year to year [DOI, 1981].

NCWCD is authorized to take up to 310,000 acre-feet annually, and has averaged 228,000 acre-feet in recent years. The Alva Adams tunnel passed 245,602 acre-feet in water year 2000 [Division 5 Water Resources Annual Report].

3.0 WATER QUALITY ISSUES

The major water quality issues in the upper Colorado River watershed are the impacts of water diversions upon water quality, and sediment and dissolved solids loads from nonpoint sources. In addition, some stream segments require load allocations for point source dischargers in order to meet ammonia standards.

3.1 Point Source Issues

3.1.1 Municipal Discharges

Point source problems were extensively evaluated by the Colorado Department of Health in 1974 as part of the Colorado River Basin 303(e) Plan. Point source treatment needs, consolidation of wastewater treatment facilities, waste load allocations, treatment alternatives and other related matters were addressed in the basin plan. The principal problems addressed included the future need for ammonia removal capability at domestic facilities to protect the Fraser River from ammonia toxicity. Since the adoption of the basin plan in 1974 and the 1978 version of the 208 plan (which incorporated its recommendations), the development of wastewater treatment facilities has generally proceeded in accordance with its recommendations. Facility plans under Section 201 of the Clean Water Act have defined the precise treatment mechanisms and locations for wastewater treatment and have implemented the recommendations of both the 208 and basin plans.

The major point source discharges in the upper Colorado River watershed include municipal or domestic wastewater treatment plants. The larger municipal and domestic wastewater treatment plants (greater than 0.02 Million Gallons per Day, MGD, discharge) are listed in Table 21, along with their Colorado Discharge Permit System number and their hydraulic capacity.

Table 21. Municipal and Domestic Wastewater Permits Over 0.02 MGD

CDPS Permit Number	Facility Name	Responsible Party	Hydraulic capacity, MGD
CO-0037681	Three Lakes WWTF	Three Lakes W&SD	1.3/approved for 2.0
CO-0026051	Winter Park WWTF	Winter Park W&SD	0.45
CO-0032964	Grand County #1 WWTF	Grand County #1 W&SD	0.995
CO-0040142	Fraser WWTF	Fraser SD	1.0 (average)
CO-0045501	Tabernash WWTF	Tabernash Meadows W&SD	0.2
CO-0045411	Young Life WWTF	Young Life Camp	0.034
CO-0023442	Snow Mountain Ranch	YMCA of the Rockies	0.22
CO-0020699	Granby WWTF	Granby SD	0.995
CO-0024350	Hot Sulphur Springs WWTF	Town of Hot Sulphur Springs	0.09
CO-0021636	Kremmling WWTF	Kremmling SD	0.17

Three Lakes Wastewater Treatment Facility

The Three Lakes Water and Sanitation District wastewater treatment facility is a 1.3 MGD aerated lagoon facility that discharges to an unnamed tributary to Willow Creek, Segment 6b of the Upper Colorado River. This stream segment is designated use protected, and the one-day in three year and 30 day in three-year low flow events are both 0.0 cfs (without discharge from the plant, this is an ephemeral stream). The facility consists of two aerated lagoons, one settling cell, and a chlorine contact chamber. Because it is a lagoon type treatment, sludge disposal is intermittent. A temporary modification (set at ambient conditions) on ammonia is in place, while the district completes a permit condition study of ammonia loading. The organic capacity of the facility is rated at 2,200 pounds of BOD per day. Another wastewater treatment facility owned and operated by the Three Lakes District, Sun Valley treatment facility, was being abandoned in 1995, and flows from this area were rerouted through the use of a lift station and connection to the plant discharging to the Willow Creek tributary. The district's discharge permit expires September 30, 2006.

The permit is written for a lagoon capacity at 1.3 MGD and a sequencing batch reactor (SBR) at 2.0 MGD. The 2.0 MGD facility has been rated for an organic capacity of 5,004 pounds of BOD per day. The new SBR has received site approval and is being constructed. The district's discharge permit states that the SBR is scheduled to go on-line in July of 2002.

A temporary standard for ammonia has been assigned to the stream segment below Three Lakes' discharge point, which expires in 2003. The temporary modification allows time for the new facility to be constructed and put on line. The new facility will be meeting ammonia discharge limits of 7.0 to 11.0 mg/l total ammonia.

Point source problems associated with providing wastewater treatment facilities for the Three Lakes Area was also addressed in a 1976 study by EPA. This study addressed alternative means and service areas to provide collection and treatment for domestic waste. A facility plan based upon the conclusions of this study provided the basis for point source treatment in the area.

Winter Park Water and Sanitation District Wastewater Treatment Facility

The Winter Park Water and Sanitation District wastewater treatment plant is a 0.2 MGD aerated lagoon plant that discharges to the upper Colorado River Stream Segment 10 (Fraser River). The district serves the Winter Park Ski area and residential and commercial buildings in the old town area of Winter Park surrounding the ski area.

Infiltration and inflow (I/I) has historically been a problem and the plant does not have the hydraulic capacity to meet peak flows. Notices of violations have been issued and the district is under a compliance schedule to upgrade the facility. A preliminary evaluation of the option of plant consolidation was done in 1994. A water rights evaluation done by Leonard Rice consultants, and a cost estimate of construction of a pipeline for untreated wastes down the valley and a pipeline and pump station to deliver treated effluent back up the valley (to meet water right conditions) suggested that consolidation of this facility was not feasible (the cost of pipelines and pumpback was estimated at $6.2 million, while the cost of a 0.5 MGD mechanical plant adjacent to Winter Park Ski Area as estimated to be $3.7 million). In 1997 the State approved Winter Park Water and Sanitation District's site application for a 0.275 MGD mechanical plant with aerated lagoon/activated sludge process with chlorine disinfection and ammonia discharge limits.

In 1997, two nitrification aeration basins, two clarifiers, an alkalinity feed system, and a heating system were constructed in order to meet ammonia standards. In 1999 a third nitrification aeration basin was constructed and plans for headworks were postponed. In 1999 the state approved a site application for a hydraulic capacity of 0.45 MGD and an organic capacity of 1,690 pounds of BOD per day. Permit limits for ammonia discharge range from 1.75 to 8 mg/L. The current permit expires July 31, 2005.

Grand County #1 Water and Sanitation District Wastewater Treatment Facility

Grand County Water and Sanitation District No. 1 (GCSD #1) wastewater treatment plant is a 0.995 MGD aerated lagoon discharging to the upper Colorado River Stream Segment 10 (Fraser River), in the vicinity of the town of Fraser. The facility consists of two aerated lagoons with mixers and baffles, followed by a polishing pond. No disinfection is provided. Infiltration and inflow (I/I) problems have been documented (approximately 65 gallons per day per capita), and the district has an aggressive I/I program in place. Sludge disposal is infrequent due to the lagoon treatment. The facility has an organic capacity rating 1,660 pounds of BOD per day.

Use of the Colorado Ammonia Model by consultants of the East Grand Water Quality Board indicate that stringent ammonia standards will be imposed on all three dischargers (Winter Park Water and Sanitation District, GCWSD #1, and Fraser Sanitation District) in the Upper Fraser River. All of the dischargers will need to provide significant plant upgrades to meet the projected standards. Consolidation of the GCWSD #1 and the Fraser Sanitation District plant at the current Fraser plant site has been identified. The existing permit expires January 31, 2007.

The Grand County Number 1 Water and Sanitation District has concluded that a consolidated facility is the preferred option and is moving forward to have the District’s flows treated at an expanded Fraser Sanitation District facility. Consolidated flow treatment is anticipated to begin in the fall of 2002. The discharge permit requires final compliance with effluent ammonia limits by January 1, 2004.

Fraser and Winter Park West Sanitation District Wastewater Treatment Facility

The Fraser wastewater, treatment plant is a 1.0 MGD facility with three lagoons - two aerated and one non-aerated, discharging to the upper Colorado River Segment 10. The facilities consist of a mechanical and manual bar screen, the aerated basins, a polishing pond, chlorination and dechlorination. The organic capacity of the facility has been rated at 2,085 pounds of BOD per day April through November, and 1,334 pounds of BOD per day December through March. Complete mixing occurs in the first stage, requiring sludge removal on a regular basis. Infiltration/inflow problems have been experienced, representing approximately 25% of the influent flow. The facility began rehabilitation of the I/I problem in June 1993. Sludge disposal is accomplished by removal to the sanitary landfill at Granby. Ammonia limits will be required for the facility in order to comply with water quality standards in the Fraser River. The Grand County wastewater treatment facility may be abandoned and if so, consolidation of the two plants would occur at the Fraser Wastewater Treatment Plant site. The Fraser Plant will need to be upgraded to provide nitrification of the wastewater. Currently the existing permit is being rewritten (October 12, 2001). A draft permit was issued May 12, 2000 with an expiration date of July 31, 2005.

The Fraser facility has a discharge permit with a compliance schedule of August 2002 for operational limits meeting ammonia stream standards, with discharge limits ranging from 1.8 to 14.4 mg/l.

Young Life Crooked Creek Camp

Young Life's Crooked Creek Ranch camp has discharge permit for a 0.035 MGD Rotating Biological Contactor (RBC) facility, with a primary clarifier, two aeration/ equalization basins, a secondary clarifier, and ultraviolet disinfection with chlorine disinfection back-up. The organic capacity of the plant has been rated at 60 pounds of BOD per day. A compliance schedule has been established for submitting a special ammonia study to the Water Quality Control Division with a due date of November 30, 2003. The discharge permit expires May 31, 2004. In the County's 1041 permit hearing on the approval of this facility, the permittee agreed that the facility would meet an ammonia discharge level of no more than 15 mg/l total ammonia during the months of June, July and August.

Tabernash Meadows

Tabernash Meadows Water and Sanitation District and the community of Tabernash received site approval for a 0.2 MGD new wastewater treatment facility. Currently the facility is operating at 0.1 MGD capacity. The organic capacity of the facility has been rated at 209 pounds of BOD per day. The facility is a Sequencing Batch Reactor (SBR), with manual bar screens, two SBR basins, one clarifier, operating with ammonia removal and ultraviolet disinfection. Ammonia limits vary from 1.8 to 14.0 mg/l total ammonia (at a permitted capacity of 0.1 MGD). The permit expires July 31, 2005.

Snow Mountain Ranch Wastewater Treatment Facility

Snow Mountain Ranch, owned by the YMCA of the Rockies, has a permitted average

daily flow capacity of 0.22 MGD and 0.05 MGD annual average non-discharging land application wastewater treatment facility approximately five miles west of Tabernash. The organic capacity of the facility is rated at 500 pounds of BOD per day. The facility consists of three interconnected lagoon systems, including two aerated ponds, four un-aerated ponds, chlorination and a spray irrigation system for application to 8.9 acres. Sludge disposal is intermittent, due to the lagoon treatment. The discharge permit for this facility expired May 31, 1996. A Site Application was received by NWCCOG in January 1998 requesting expansion of the existing facilities to 0.22 MGD with continued land application. The new permit (issued January 13, 2000) is for an average daily flow of 220,000 gallons per day. An expanded area of 24 acres with 205 sprinkler heads is capable of receiving 300,000 gallons per day. The new permit expires on December 31, 2004.

Granby Sanitation District Wastewater Treatment Facility

The Granby wastewater treatment plant is a 0.995 MGD tertiary treatment rotating biological contactor (RBC) mechanical facility, discharging to the Fraser River (upper Colorado River Segment 10), about one mile above the confluence with the Colorado River. The organic capacity of the facility is rated at 1,700 pounds of BOD per day. The plant consists of a mechanical and manual bar screen, two aeration basins, three secondary clarifiers, four RBCs, four sand filters, and chlorination and dechlorination facilities. The facility has ammonia discharge limits. Infiltration/inflow is estimated at 0.2 MGD during May, June and July. Sludge disposal is accomplished by de-watering through the use of a belt press and disposal at the county sanitary landfill in Granby. In 2000 treatment plant capacity in use was 42% of the flows and 43% of the organic capacity as BOD. Granby Sanitation District's discharge permit expires July 31, 2005.

Town of Hot Sulphur Springs Wastewater Treatment Facility

Hot Sulphur Springs' wastewater treatment facility is a 0.09 MGD aerated lagoon that discharges to Segment 3 of the upper Colorado River (Colorado mainstem). The organic capacity of the facility is rated at 247 pounds of BOD per day. An ammonia wasteload allocation study was done to determine if a wasteload allocation was necessary for the Hot Sulphur Springs plant. The resulting calculated limits for ammonia were found to be much higher than expected effluent concentrations, thus no ammonia limits were required. Since this is an aerated lagoon, sludge removal takes place on a limited basis and is not a concern. At the time of the permit renewal in 1998, the Water Quality Control Division imposed a compliance schedule for studies regarding infiltration and inflow and ground water testing in the vicinity of the lagoon system. The facility's discharge permit expires July 31, 2003.

Kremmling Sanitation District Wastewater Treatment Facility

Kremmling Sanitation District's wastewater treatment facility is a 0.17 MGD un-aerated lagoon system, potentially discharging to Muddy Creek, segment 6a of the upper Colorado River. The organic capacity of the facility is rated at 425 pounds of BOD per day. The facility consists of one aerated and three un-aerated lagoons, with a chlorine contact tank that would be used if the facility were to discharge. Currently the facility uses evaporation and exfiltration of the effluent from the lagoons. I/I does not appear to be a problem. A number of conditions were placed upon the most recent permit (issued August 31, 1992). These conditions include: installation of an influent flow measuring

device and groundwater monitoring wells; and the collection of ammonia, pH, and temperature data. -The most recent discharge permit issuance occurred in 1998, with an expiration date of September 30, 2003.

Sanitation facilities below Kremmling
A number of ISDS systems are permitted through Eagle County, including Rancho Del Rio, State Bridge, and Burns. Little information exists on these systems. Dotsero Mobile Home Park is permitted through the Water Quality Control Division. This facility is a Rotating Biological Contactor plant which discharges to ground water.

Two Rivers Village

This project in Eagle County Dotsero area, just below the confluence with the Eagle River, has been granted site approval for a 0.15 MDG facility (1,500 population equivalents). The Colorado Water Quality Control Division has extended the site application permit for this facility to October 9, 2002. The proposed facility includes two lift stations, and an extended aeration activated sludge process ("Aeromod" System) followed by sand filtration and ultraviolet disinfection. [This facility is also mentioned in the Eagle River Water Quality Management Plan]

Below Glenwood Canyon, there is a sanitation district that currently has no collection or treatment facilities.

3.1.2 Population Statistics and Projections

Population statistics and projections for Grand County are listed in Table 22, below. For Grand County, the permanent population between 1980 and 1990 grew 6.6%, and between 1990 and 2000 grew 56.2%. For the other areas in the watershed, (small parts of Routt, Eagle, and Garfield Counties), the population is extremely dispersed, and accounts for probably less than 5% of the total population in the watershed.

Table 22. Grand County Population Statistics and Projections.

	Permanent Population[1]					
ENTITY	1980	1990	2000	2000 projected[2]	2010	2020
Grand County	7,475	7,966	12,442	8,412	15,035[3]	20,790[3]
Fraser	470	573	910	677		
Granby	963	966	1,525	1,143		
Grand Lake	382	259	447	299		
Hot Sulpr Spr	405	347	521	412		
Kremmling	1,296	1,166	1,578	1,318		
Winter Park	480	528	662	610		

[1]: US Census data, provided by Denver Post, Census 2000 Special Report, March 20, 2001
[2]: 1996 NWCCOG 208 Plan projections, based on the Department of Local Affairs, State Demographers Office, 1994 projections.
[3]: Population projections, based on State Department of Local Affairs State

Demographer's Office, October 2000 projections.
NOTE: Permanent population projections for the Towns are not available.

Peak Population

Permanent population estimates in the NWCCOG region only partially show the extent of development and growth in the region. Two additional variables also need to be considered regarding development and growth (and infrastructure needs) in the region. One variable is the "transient" visitor to the region who relies on infrastructure (e.g. hotels, motels, etc.), which is not part of the population estimate. The other variable is the second homeowner, who maintains a secondary residence in the region, but does not add to the population estimate. However, there is not adequate data on peak populations.

These two variables are extremely important considerations in growth and development in the region, and again, are not reflected in the population estimates and population growth projections in the watershed plans. For example, in 2001, second homes are estimated to represent 85% of the housing stock in Winter Park, and 70% in Grand Lake.

The major entities in this watershed that are affected by seasonal population fluxes are the Winter Park Water and Sanitation District, Grand County Water and Sanitation District #1, and the Three Lakes Sanitation District due to the seasonal nature of recreational activities in these areas.

3.1.3 Industrial Discharges

Industrial discharges in the Upper Colorado River watershed are generally related to mining activities. Discharge permit holders include Cyprus Climax Metals Company (Henderson Mine and Mill), and numerous gravel and aggregate mining operations. In general, water quality impacts from these dischargers are infrequent and have not been documented to be of significance. Earlier 208 documents (1988 and previous plans) cited water quality impacts from the Henderson Mine (1974 study and 1987 Colorado Nonpoint Source Assessment Report). As previously discussed, recent Denver Water Department water quality data collected in the Williams Fork, indicates excellent water quality. The data does not indicate water quality impacts from the Henderson site.

3.1.4 Point Source Issues - Summary

In summary, the current point source water quality issues in the upper Colorado River watershed are:

Un-ionized ammonia in the Fraser River.

Meeting the Recreation Class 1 fecal coliform standard for discharge issued prior to November 30, 1999 when the recreation class 2 standard was changed to Class 1.

3.2 Point Source Recommendations

NWCCOG has no recommendations at this time.

3.3 Nonpoint Source Issues

Nonpoint source water quality issues in the upper Colorado River watershed include: the loss of stream flows due to trans-basin diversions which reduces the amount of high quality water in the basin; impacts related to urban land uses (including roads and construction activities); water quality impacts associated with recreational activities including snow making, golf course irrigation, and increased visitor impacts; sediment and nutrient loads due to urban runoff and agricultural activities, including logging; and sediment loads associated with gravel mining operations.

3.3.1 Hydrologic Modification Activities

3.3.1.1 Trans-basin Diversion

In 1993, approximately 274,427 acre-feet of water were diverted from the Upper Colorado River watershed to the eastern plains (Denver Water letter to NWCCOG, March 13, 2002 from Chris Schuyler-Rossie). The major water diverters from this watershed are the Denver Water Department and the Northern Colorado Water Conservancy District. The ten-year average or these diversions is 313,854 acre-feet [State Engineer's Office, District V Engineer's Office, 1994]. The Denver Water records for the 1993 ten-year average for this same area indicate 313,185 acre-feet were diverted. The annual flow at the USGS gage above Gore Canyon for the 1993 water year (subtracting the Blue River flow) was 532,200 acre feet. This suggests that approximately one-third of the annual stream flow in the upper Colorado River watershed is diverted out of the drainage. This water use is 100% consumptive, i.e. none of it is returned to the stream system from which it came. The withdrawal of this amount of water from the streams in the watershed has impacts on water quality including: decreased dilution flows; decreased spring runoff "flushing flows" which move accumulated sediments and impact fish spawning habitat (particularly in the Fraser River); decreased aquatic life habitat; increased stream temperature and other water quality concerns associated with changes to channel morphology, and loss of high quality "headwaters" with low pollutant concentrations.

In water year 2000 (November – October), trans-basin diversions from the Upper Colorado River watershed were 321,725 acre-feet. This included 18,673 acre-feet from the Grand ditch, 245,602 from the Alva Adams Tunnel, and 57,450 acre-feet from the Moffat Tunnel. The 10-year average of diversions from the watershed for 2000 is 264,614 acre-feet [2000 Annual Report, Division 5 Water Resources, State Engineers Office].

Some of the reservoirs and structures in the upper Colorado River watershed, which are used to enable, and sometimes mitigate the consequences of trans-basin diversions (Wolford Mountain), include the following.

Granby Reservoir is the major Colorado-Big Thompson storage reservoir (owned by the Bureau of Reclamation and operated by the Northern Colorado Water Conservancy District). The reservoir inundates about 7,300 acres and has 539,760 acre-feet of

storage capacity. The active capacity is 465,600 acre-feet.

Shadow Mountain Reservoir is contiguous with Grand Lake at normal operating elevation. The two lakes have about 1,852 surface acres and 18,400 acre-feet of storage. Grand Lake's surface elevation fluctuation is limited to one foot by legislation. This limitation provides 1,839 acre-feet of regulation in both lakes [US Department of the Interior Water and Power Resource Service, Colorado-Big Thompson Windy Gap Projects Colorado Final Environmental Impact Statement, 1981]. Grand Lake has a surface area of 507 acres and a maximum depth of approximately 200 feet. Grand Lake, which is a natural lake, is used as a conduit as part of the Colorado-Big Thompson Project.

Willow Creek Dam and Reservoir total storage capacity of 10,550 acre-feet, and an active capacity of 9,067 acre-feet (300 surface acres).

Windy Gap and Willow Creek transfer systems are operated by Northern Colorado Water Conservancy District and divert approximately 50,000 acre feet of water annually to Lake Granby [Surface-Water Quality Evaluation Windy Gap Project 1994 Monitoring Program, Harlan & Associates, Inc. June 1995]. It should be noted that "since the entire Colorado-Big Thompson Project was designed and physically built to handle an average of 310,000 acre feet per year, and yields to date have averaged less than 245,000 acre feet per year..." [DOI, 1981], significantly more water could be diverted using the existing western slope system. Middle Park Water Conservancy District owns 3,000 acre-feet of Windy Gap water.

In the Fraser River drainage, Denver Water Department operates a diversion above Winter Park. This diversion structure takes water from the Williams Fork, Vasquez and Saint Louis Creek drainages as well as the Fraser River and sends it to the eastern slope (Gross Reservoir) via the Moffat Tunnel. The annual average diversion (1982-1993) through the Moffat tunnel is 62,325 acre-feet. The City of Thornton owns the Berthod Pass Ditch high on the Fraser River, which diverts an annual average of 614 acre-feet.

Williams Fork Reservoir is owned and operated by the Denver Water Department, and is used to meet downstream calls which could call out Denver's use of Blue River water.

Wolford Mountain Reservoir was constructed in 1994 and 1995 by the Colorado River Water Conservancy District on Muddy Creek. This Reservoir was constructed to hold 60,000 acre-feet and has a surface area of 1,447 acres. Of the 60,000 acre-feet, Denver Water Department owns 24,000 acre-feet (40%), and the remainder is available for lease by the Colorado River Water Conservancy District.

3.3.2 Urban and Construction Activities

The areas of most concentrated urban activities in the watershed occur in the upper Fraser River and in the Three Lakes area. Some of the urban and construction activities which can impact water quality include: increased road sanding and salting; increased nutrient loads from lawn irrigation; increased organic and metals loads due to increased traffic; pesticide and herbicide applications; increased sediment from construction sites and new roads; etc.

3.3.3 Recreational Activities

Recreational activities potentially impacting water quality include water diversions for snow making and golf course irrigation which can increase pollutants in runoff and increase consumptive water use. Riparian area disturbance due to fishing, boating, etc., can lead to increased sediment and nutrient loads to streams in the watershed.

3.3.4 Agricultural Activities

Most of the watershed is rural in nature with agricultural activities, mainly grazing and logging, as the predominant land use. Although this land use has not been documented to have impacts upon water quality in this watershed, due to the percentage of land use in this category, and due to the lower stream flows due to trans-basin diversions, it is appropriate to recommend Best Management Practices (BMPs) to minimize the nutrient and sediment loads to the streams in the watershed.

3.3.5 Nonpoint Source Issues - Summary

The major nonpoint source water quality problems of streams and lakes in the upper Colorado River watershed include:

Nutrients and suspended sediment which carry nutrients and cause "nuisance" algae and aquatic "weed" conditions in Grand Lake, Shadow Mountain Lake, and Lake Granby as a result of natural and man - induced runoff from the surrounding area.

Increases in sediment in the Fraser River as a result of erosion and traction sanding along State Highway 40 (Berthoud Pass), as well as other land use practices which increase sediment movement in to water bodies above natural conditions.

Increased nutrient inputs from land development activities in the Fraser River basin. This is exacerbated due to trans-basin diversion of high quality water in the headwaters of the watershed. Loss of high quality “dilution flows” results in increased in-stream nutrient concentrations lower in the Fraser River.

Excessive concentrations of total iron and suspended sediment in the Colorado River downstream from Troublesome Creek as a result of natural runoff from iron rich and easily eroded geologic formations.

Increased water development activities associated with the trans-basin diversion of water. These projects significantly modify the hydrology of the Fraser and Williams Fork Rivers. Modification of the hydrology downstream of point source discharges on the Fraser and upper Colorado Rivers increase the average concentration of pollutants, including concentrations of ammonia and chlorine downstream of municipal sources.

3.4 Nonpoint Source Recommendations

Implementation of Policies 1, 2, 3, 4, 5, and 6 of this Plan (see table of contents for Volume I for titles of policies).

4.0 WATERSHED IMPROVEMENT PROJECTS

4.1 Existing Projects

4.1.1 Clinton Reservoir Agreement

An agreement between the Denver Water Department and numerous "West Slope Parties" enables additional flows in the Fraser River using Clinton Reservoir, in the Tenmile drainage of the Blue River watershed. A maximum of 920 acre feet of "bypass" water has been made available by the Denver Water Department to Grand County users, available September 15 through May 15.

4.1.2 Berthoud Pass Sediment Control Projects

The Colorado Department of Transportation (CDOT) is working on a slope stabilization project adjacent to Zero Creek on the north side of Berthoud Pass. In addition, the Forest Service and CDOT cooperated in a project at the base of the pass, which prevents snow storage immediately adjacent to the Fraser River, and provided vegetative stabilization of the stream bank in the vicinity of the bottom switchback.

NWCCOG was the recipient of a 1997 EPA 319 Grant to coordinate and implement a project which is designed to reduce the sediment load in the upper Fraser River. The project intends to capture a portion of the sediment load during the post-runoff period of late summer and early fall when river flows are not sufficient to carry the sediment load through the system, by utilizing the detention area next to the Denver Water Board diversion structure for the Moffat tunnel.

4.1.3 Three Lakes Water Quality Monitoring Database

In 1993, a water quality database for the Three Lakes (Grand, Shadow Mountain and Granby) was developed by NWCCOG. The database includes data collected by the USGS, the Colorado Water Quality Control Division (including samples collected by the Upper Colorado Lakes Protection Association), and the Northern Colorado Water Conservancy District. The database is updated annually, and will be used by NWCCOG to produce annual summaries of water quality in the three lakes. This database was used to assist in the following project, and has been incorporated into the following effort.

4.1.4 Three Lakes Clean Lakes Watershed Assessment Grant

In 2000 Grand County was awarded an EPA 319 grant for $135,000 to perform a “Clean Lakes Assessment” of Grand Lake, Shadow Mountain and Granby Reservoirs. The project is designed to document trophic status, and define needed programs to restore or protect beneficial uses of the Three Lakes.

4.1.5 Sheephorn Creek Riparian Improvement Project

The goal of this 2001 project was to reduce stream bank cutting on a ¼ mile section of Sheephorn Creek and increase sub-surface water in a meadow area on Piney Peak Ranch in Grand County about 18 miles southwest of Kremmling. The project was funded by a $10,000 matching grant from the State Soil Conservation Board, and developed $30,000 worth of stream and stream bank improvements. Structures included several instream V-shaped rock weirs, "J- hooks", and embedded logs. The lower one-third of the project area was fenced to provide a buffer zone for comparison of grazing vs. non-grazing in a riparian habitat. Project coordinators were Mark Volt of the Natural Resources Conservation Service Middle Park Soil Conservation district conservationist, and Darcee Biekert.

4.1.5 Shadow Mountain Reservoir Delta Formation

In 1999 the Shadow Mountain Homeowners Association was awarded an EPA 319 grant to assess and provide direction regarding sediment deposition at the mouth of the Colorado River as it enters Shadow Mountain Reservoir. [Project section – Chapter 4]

4.2 Future Project Needs

4.2.1 Berthoud Pass Sediment Control Projects

Additional work to minimize sediment impacts to the Fraser River as a result of slope erosion and road sanding practices on Berthod Pass is necessary.

4.2.2 Instream Flow Improvement Projects

Projects designed to minimize or mitigate the impact of hydrologic modifications in the upper Colorado River watershed are needed.

4.2.3 Agricultural Best Management Practice Projects

Voluntary projects that minimize impacts or demonstrate new and innovative approaches to protecting water quality impacts from agricultural practices (including logging activities) are needed, especially in areas of high soil erodability.

4.2.4 Urban Runoff Water Quality Improvement Projects

Projects designed to improve water quality, especially sediment and nutrient reduction, from existing and future land development areas are encouraged in the Fraser Valley and Three Lakes area.

5.0 LAND USE REGULATIONS APPLICABLE TO WATER QUALITY PROTECTION AND IMPROVEMENT

Grand County's Planning Commission has adopted the 208 Plan as a guidance document and requests NWCCOG's comments on development proposals with respect to how the proposals comply with the 208 Plan. Grand County requires a 30 foot building setback from streams, intermittent streams, and lakes if the building is on central sewer. A 150 foot setback from waterbodies is required for septic systems.

Grand County has adopted "1041" regulations for permitting of new and expanded water and wastewater projects.

Beginning in 1996 Grand County and the towns within Grand County undertook a Growth Strategy project, which identified water quality protection as a key concern. The NWCCOG has provided Grand County with the model Water Quality Protection Standards (Appendix 10) as an example for a watershed wide water quality protection regulation.

6.0 WASTELOAD ALLOCATIONS

The Three Lakes Sanitation District has been conducting a Use Attainability study to determine appropriate water quality standards for the unnamed tributary of Willow Creek in which they discharge (upper Colorado River segment 6b), and the segment downstream of Willow Reservoir Road to the confluence with Willow Creek (Segment 6c). The Use Attainability Analysis was completed and a TMDL has been established for Segment 6c. The TMDL goal is the attainment of chronic and acute un-ionized ammonia standards at the top of segment 6c. The wasteload allocation for the Three Lakes wastewater treatment facility is:

Three Lakes Sanitation District @ 2.0 MGD (chronic limits):

January	7.5
February	7.0
March	6.0
April	8.0
May	7.0
June	9.5
July	8.5
August	11.0
Sept.	7.0
Oct.	6.0
Nov.	6.0
December	7.0

Wasteload allocations have been established for point source discharges in the Fraser River drainage. The East Grand Water Quality Board contracted with Regulatory Management, Inc. (RMI) to model the upper Fraser River drainage and estimate ammonia effluent limits for the wastewater treatment plant discharges to the upper Fraser River. RMI reported estimated ammonia effluent limits for effluent limits based on the Colorado Ammonia Model (CAM) adjusted with a wasteload allocation procedure that considered the relative impact of the CAM results on each discharger. A wasteload allocation agreement has been proposed between Winter Park W&SD, Grand County

W&SD No. 1, and Fraser SD which will limit Winter Park W&SD ammonia discharge to levels that will meet winter time concentrations at the downstream discharger's outfall(s) of 0.5, 0.5, 0.4, and 0.3 mg/L (January - April).

The CAM modeling and wasteload allocation analysis was performed for a number of alternative wastewater discharge flow rates for each wastewater plant and alternative locations for the dischargers. The final determination of the ammonia limits for each discharger will be based on wasteload allocation negotiations between the dischargers and the Water Quality Control Division.

A summary of the estimated ammonia effluent limits reported by RMI is presented below:

Point Sources:Allowable Ammonia Discharge (mg/L as N)

Winter Park Water and Sanitation District (based on a downstream consolidated facility at Fraser):

	@ 0.37 MGD	@0.45 MGD	@ 0.750 MGD
January	8.5	5.0	5.1
February	11.2	8.0	5.9
March	8.1	5.7	4.6
April	6.1	2.4	3.7
May	7.7	3.3	4.3
June	10.4	6.1	6.4
July	13.5	4.1	10.1
August	15.6	2.8	9.9
September	13.9	2.3	10.3
October	13.9	1.8	9.6
November	11.2	2.3	7.0
December	12.3	6.7	7.7

Grand County #1 and Fraser Sanitation District, based on a consolidated facility- if consolidation does not take place allocations are likely to be equal for each facility, and the effluent limits would be based on the sum of the two plant design flows.

	@ 2.0 MGD	@ 3.0 MGD	@ 4.0 MGD
January	10.1	7.7	6.5
February	9.8	7.4	6.3
March	11.7	8.9	7.4
April	3.1	2.5	2.2
May	2.8	1.9	1.5
June	2.8	1.9	1.6
July	3.1	2.5	2.1
August	2.4	1.9	1.7
September	2.5	1.9	1.6
October	2.0	1.5	1.2
November	1.5	1.2	1.0
December	11.2	8.4	7.0

Young Life Camp @ 0.034 MDG

August	20
September	20
October	20

Note: Young Life has agreed with Grand County in its 1041 permit to limits its ammonia discharge to 15 mg/L from June through August.

Tabernash Meadows Water and Sanitation District @ 0.1 MGD

January	Report
February	Report
March	Report
April	2.4
May	3.3
June	6.1
July	4.1
August	2.8
Sept.	2.3
Oct.	1.8
Nov.	2.3
December	14.0

Granby Sanitation District @ 0.995 MGD:

January	Report
February	Report
March	Report
April	19.1
May	19.7
June	9.5
July	8.8
August	7.5
Sept.	9.7
Oct.	12.7
Nov.	20.7
December	Report

7.0 WATER QUALITY MONITORING

7.1 Existing Monitoring Efforts

Existing ambient water quality monitoring efforts in the upper Colorado River watershed include:

USGS sampling of three sites in the Three Lakes area (paid for by Northern Colorado Water Conservancy District) and other sites - Hot Sulphur Springs, Muddy Creek, and below the Blue River confluence;

USGS sampling in Rocky Mountain National Park as part of National Water Quality Assessment Program;

Northern Colorado Water Conservancy District's Surface Water Quality Evaluation of the Windy Gap Project [Harlan and Associates];

Colorado River Water Conservation District's Wolford Mountain Reservoir monitoring program;

East Grand Water Quality Board's sponsored USGS monitoring of the Fraser River;

Denver Water Board monitoring of the Williams Fork and Fraser drainages;

Division of Wildlife's River Watch program (West Grand High School monitors two stations on Muddy Creek (and two on the lower Blue River);

Colorado Dept. of Public Health and Environment Water Quality Control Division - volunteer monitoring program on Grand Lake (Upper Colorado Lakes Protection Association).

Three Lakes 319 Clean Lakes Project

Additional information on specific water quality sampling locations and data is in Appendix 5.

7.2 Water Quality Monitoring Needs

There is a need for continued monitoring of phosphorus and other nutrient concentrations and associated phytoplankton counts in Grand Lake, Shadow Mountain Lake and Lake Granby. Although much of this work was conducted through the Three Lakes Clean Lakes study, continued monitoring would aid in establishing a long-term picture of the lakes' trophic status and cause and effect relationships.

Evaluation of the Fraser River downstream of Winter Park to establish water quality conditions important to the maintenance of the fishery would be helpful to establish quality criteria necessary for protection of this resource. In particular, there is a concern with regard to the effect of diminished stream flows over the stability of the stream channel and the ability of the stream to flush out accumulated sediment with a diminished frequency of bank full conditions. Field evaluation of channel cross sections would assist in a determination of criteria important to the maintenance of channel stability.

Locating sources of and monitoring concentrations of total iron and suspended sediment entering the Colorado River, principally from Troublesome Creek and downstream of State Bridge, would aid in determining if remedial measures to control runoff from iron rich and easily eroded geologic formations can be achieved. Analyses of iron in bed and suspended sediment samples need to be made to determine how much iron is transported with the sediment.

8.0 WATER QUALITY STANDARDS

8.1 Existing Classification and Standards

Streams in the Fraser River Basin are classified for protection of cold water aquatic life (Class I), primary and secondary contact recreation, water supply and agricultural uses. The Williams Fork River and tributaries are classified for primary contact recreation, cold water aquatic life (Class I), water supply and agriculture. Streams in Rocky Mountain National Park are designated as "Outstanding Waters" and receive special protection under Colorado Water Quality standards (no degradation is allowed). Streams in the Indian Peaks Wilderness Area currently have higher quality water than the numeric criteria necessary to protect the designated uses included in state standards are reviewable under the state's antidegradation rule.

Grand Lake, Shadow Mountain Reservoir and Granby Reservoir have previously been classified as threatened segments because of concern for a downward trend in water quality measured by an increased concentration of phosphorus and other nutrients increases in chlorophyll a concentrations, and a decreasing level of water clarity. However, the provision of a regional wastewater treatment system serving the area has eliminated this trend and the segment is no longer classified as threatened.

Streams in the lower portion of the watershed are classified for the protection of aquatic life, primary and secondary contact recreation, water supply, and agriculture uses. All waters in this area are reviewable under antidegradation regulations except for the un-named tributary to Willow Creek (Segments 6b and 6c of the upper Colorado River).

8.1.1 Designated Use Impairment Stream Segments

The state has listed one stream segment in the Upper Colorado River watershed as "Use Impaired" in the 305(b) report. That segment, as well as the identified constituent is listed in Table 22. This list indicates stream segments in which water quality is, or may be a concern.

Segment 6c, Tributary to Willow Creek is impacted by un-ionized ammonia.

8.1.2 303(d) List

The Clean Water Act requires the state to list those stream segments or waterbodies that require Total Maximum Daily Load (TMDL) allocations in order for the segment to attain or maintain water quality standards. The state's 1994 304(b) report lists the current 303(d) list (Table 23). In the upper Colorado River watershed, one stream segment is identified, Segment 6c, tributary to Willow Creek. A TMDL has been completed for this section, and once the Three Lakes Water and Sanitation District facility is operational, it is expected that this segment will be in compliance with standards and will be deleted from the State's 303(d) list.

Table 23. 303(d) Listed Segment in the Upper Colorado River Basin

Segment	Description	Status	Impairment	Priority

COUCUC06c	Un-named tributary to Willow Creek	Partially supporting	Ammonia	L (TMDL completed)
COUCUC08	Williams Fork, source to the mouth	Partially supporting	Mn	

A TMDL is the estimated assimilative capacity of a waterbody, which estimates how much of a pollutant may enter a water body without affecting its designated uses. The TMDL represents the sum of the point sources, the nonpoint sources, and a margin of safety (which can include anticipated future pollutant loadings).

NWCCOG has recommended deletion of the Williams Fork segment from the 1998 303(d) list. This segment is meeting standards and designated uses.

A number of segments in the Upper Colorado River watershed have been included in the State's 303(d) list appendix for monitoring and evaluation. These segments, potentially impacted by sediment, have been identified by the Forest Service, and include: Corral Creek, Gore Creek, Upper Rock Creek watershed, Little Rock Creek, Smith Ditch, Red Dirt Creek watershed, and Muddy Creek.

NWCCOG recommends the addition of the Fraser River from Berthoud Pass to Winter Park to the State's 303(d) List Appendix - monitoring and evaluation list.

8.2 Recommendations on Standards

8.2.1 Support of Existing Classifications and Standards

Water quality standards (including use designations and criteria) for the upper Colorado River watershed are generally adequate to protect the existing uses under current conditions.

NWCCOG is supportive of the State's antidegradation provision and protection of high quality waters. NWCCOG is concerned, however that currently classified Recreation Class 2 waters will be reclassified as Recreation Class 1a unless a Use Attainability Analysis (UAA) is completed. It is likely that Recreation Class 2 is the appropriate classification for some of these segments. It is also unlikely that UAAs will be completed for these segments, due to financial and time constraints. In the Upper Colorado River watershed these waters are:

Segment 6a – All tributaries to the Colorado from L. Granby to the Blue not on National Forest lands

Segment 7 – All tributaries to the Colorado from the Blue to the Roaring Fork

There are permitted discharges to these segments.

8.2.2 Outstanding Water Designation

Designation of the following stream segments as "Outstanding Waters" under the system established by the Water Quality Control Commission:

NWCCOG does not currently recommend any additional waterbodies to the list of

"Outstanding Waters" designation. If Congress approves new wilderness areas within the watershed, NWCCOG recommends investigations of waterbodies within those areas for appropriate ness of "outstanding waters" designation.

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