Chapter 2.1 Executive Summary

2.1.0 Introduction

Utah's surface water resources include 14,250 miles of rivers and streams, nearly 3,000 lakes and reservoirs. Utah is the second driest state in the country and these waters play a major role in the private, commercial and industrial development of the state. They are sources of drinking water, provide enormous recreational opportunities, sustain a wide variety of wildlife, and provide water for agricultural production. Utah's beneficial use classifications for waters of the state are listed in Table 2.1.1.

Utah assesses the quality of its surface water resources to protect it for drinking, fishing, boating, irrigation, stock watering, and supporting aquatic wildlife. Data are compared against State water quality standards to determine beneficial use support (DWQ, 2005). Assessments are also made using biological and habitat data. Various reports are written and disseminated to project sponsors, local and state officials, government and private entities and the public to expand the awareness of the need to protect and enhance the water quality of Utah's rivers, streams, lakes and reservoirs. In addition, water quality data are used to identify impaired Assessment Units and establish water quality goals for implementing projects to restore or protect water quality. Water quality data are also collected to do Total Maximum Daily Load analyses for discharge permits and to assure that permit requirements under the Utah Pollution Discharge Elimination System (UPDES) program are being met. The effectiveness of nonpoint source projects, and TMDL implementation activities are evaluated.

2.1.1 Stream Monitoring

Utah has adopted a basin rotation type of monitoring for its rivers and streams. This allows the State to assess a greater portion of its rivers and streams. The State is divided into five monitoring regions and there are ten watershed management regions.

The stream monitoring program consists of basin intensive and long-term ambient water quality monitoring stations. The fixed-station monitoring network consists of 64 stations. These stations will be used to evaluate long-term water quality trends. Samples are collected every six weeks (eight times per year).

The data collected and analyzed provide essential river, stream, lake and reservoir water quality assessment data to identify and quantify water quality problems that may exist and provide background information for the development of possible solutions to those problems. They also allow water quality programs to be focused on critical areas, and allow the Division of Water Quality to prioritize its management plans. The data are used to determine the effectiveness of the Division's water quality management plans and to assist individuals and agencies involved in protecting the quality of the State's waters.

2.1.2 Rivers / Streams Assessment

Data collected during two intensive monitoring surveys were combined with assessments done in the 2006 Integrated Report (IR) to provide a comprehensive evaluation of the state. Data collected since the 2006 IR from other watershed management units were also included in the

assessment. These data were obtained through the Division's cooperative monitoring program and from long term monitoring sites. Data from the U.S Geological Survey's projects and work they have done for other entities were also used along with data from Salt Lake City and Salt Lake County.

Maps showing the assessment of the watershed management units are included in this report. Utah assessed approximately 10,901 miles of perennial streams. Of the 10,901 stream miles assessed for at least one beneficial use class, 7,502 miles (68.9 %) were rated as fully supporting at least one assessed beneficial use and 3,399.0 (31.1%) were rated as not supporting one or more of their designated beneficial uses (Figure 2.1.1).

Table 2.1.1. Designated Beneficial Uses for Rivers, Streams, Lakes, and Reservoirs.

Class	Definition
1	Protected for use as a raw water source for domestic water systems.
1C	Protected for domestic purposes with prior treatment by treatment processes as required by the Utah Division of Drinking Water.
2	Protected for recreational use and aesthetics.
2A	Protected for primary contact recreation such as swimming.
2B	Protected for secondary contact recreation such as boating, wading, or similar uses.
3	Protected for use by aquatic wildlife.
3A	Protected for cold water species of game fish and other cold water aquatic life, including the necessary aquatic organisms in their food chain.
3B	Protected for warm water species of game fish and other warm water aquatic life, including the necessary aquatic organisms in their food chain.
3C	Protected for nongame fish and other aquatic life, including he necessary aquatic organisms in their food chain.
3D	Protected for waterfowl, shore birds and other water-oriented wildlife not included in Classes 3A, 3B, or 3C, including the necessary aquatic organisms in their food chain.
3E	Severely habitat-limited waters. Narrative standards will be applied to protect these waters for aquatic wildlife.
4	Protected for agricultural uses including irrigation of crops and stock watering.
5	The Great Salt Lake. Protected for primary and secondary contact recreation, aquatic wildlife, and mineral extraction.

The major causes of water quality impairment are habitat alterations, temperature, metals, nutrients, and total dissolved solids, nutrients, sediments, and stream habitat alterations. Stream habitat alterations include riparian habitat and in-stream habitat.

The major sources of pollutants are agriculture, habitat modification, hydrological modification, and habitat modification. About 4% percent of the stream miles are affected by point source discharges. Agricultural practices, such as grazing and irrigation, cause increased nutrient and sediment loading into streams. Point sources are also responsible for nutrient input into streams, while natural sources contributed metals, total dissolved solids and sediments to streams.

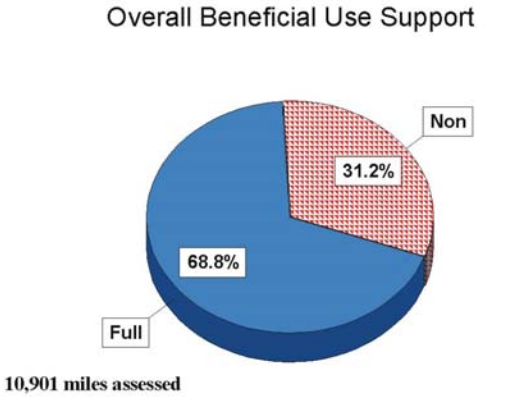

Figure 2.1.1. Overall Beneficial Use Support -Statewide.

Resource extraction and associated practices such as road construction contributed significantly to impairment of water quality also. Individual beneficial use assessment is listed in Table 2.1.2.

The river and stream assessment units (AUs) were also assessed and placed into the five assessment categories that the U.S. EPA has adopted for the Integrated Report. (Table 2.1.3). These categories provide more information on the waters of the state. They identify those assessment units that all beneficial uses were assessed and found fully supporting them (Category 1). Those where one or more beneficial uses were assessed, but not all were assessed and those assessed were fully supporting their beneficial uses (Category 2) and those that were not assessed because of insufficient or no data available to make an assessment (Category 3).

Category 4A includes those AUs for which a TMDL has been completed and approved by the U.S. Environmental Agency, but is still not meeting water quality standards or supporting beneficial use assessments. Waters that are impaired by pollution, such as habitat impairment, are placed in Category 4C, no TMDL required. For these waters, Best Management Practices (BMPs) need to be implemented so the waters support their beneficial uses. Those waters identified as not supporting their beneficial use because of a pollutant requiring a TMDL are placed in Category 5. An AU can be placed in multiple categories.

Utah's proposed 303(d) list for streams includes 64 Assessment Units. Because multiple causes affected some of the segments, 85 parameters were listed for TMDL analysis.

Table 2.1.2. Individual Use Support Summary.

Use	Size Assessed	Size Fully Supporting	Size Fully Supporting but Threatened	Size Not Supporting	Size Not Attainable
Aquatic Life	10,878.0	7,937.5	0.0	2,941.1	0.0
Fish Consumption	0.0	0.0	0.0	0.0	0.0
Swimming	668.8	112.2	0.0	557.3	0.0
Secondary Contact	668.9	112.2	0.0	557.3	0.0
Drinking Water	4,339.5	4,154.5	0.0	184.9	0.0
Agricultural	9,967.1	8,580.3	0.0	1,386.7	0.0
Total	10,901.4	7,502.0	0.0	3,399.4	0.0
Use					
Aquatic Life		73.0%		27.0%	
Fish Consumption		0.0%		0.0%	
Swimming		16.8%		83.3%	
Secondary Contact		16.8%		83.3%	
Drinking Water		95.7%		4.3%	
Agricultural		86.1%		13.9%	
Total		68.9%		31.1%	

Table 2.1.3 Stream Miles By Assessment Category – Statewide Assessment - 2008		
Category	**Category Definition**	**Stream Miles**
1	All beneficial uses fully supported.	42.0
2	Beneficial uses assessed are fully supported.	7,529.0
3A	No data or insufficient data to make an assessment.	2,410.5
3B	Lakes that are not supported for one cycle only.	0.0
3C	Insufficient data to assess but an assessment plan is in place.	0.0
4A	Approved TMDL	1,372.6
4B	Pollution control requirements are expected to result in full beneficial use support in near future.	0.0
4C	Impaired by pollution, no TMDL required.	1,159.8
5	Impaired by pollutant, TMDL required.	1,566.4

2.1.3 Lakes / Reservoirs

The 132 lakes assessed during this reporting cycle account for 97.1% (467,787 acres) of the total lake acreage in the state. When accounting by acreage, 68.5% were found supporting their designated uses and 31.5% were not supporting at least one designated beneficial use (Figure 2.1.2). Of the 132 lakes surveyed, 82 (62 %) were fully supporting and 50 (38 %) were not supporting.

The causes of impairment in lakes and reservoirs continue to be nutrients, siltation, low dissolved oxygen, suspended solids, organic enrichment, and noxious aquatic plants.

The major sources of pollutants causing impairments are nonpoint sources, agricultural practices, industrial and municipal point sources, and habitat modification (draw-down of reservoirs).

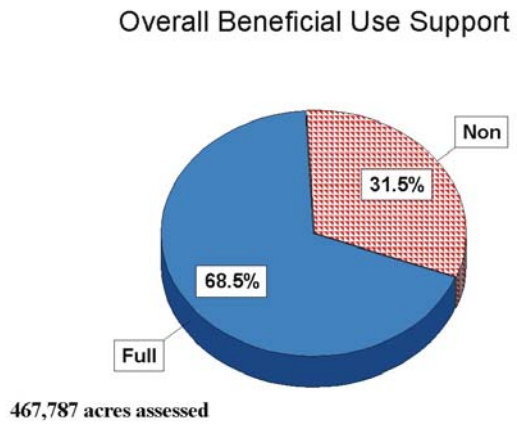

Figure 2.1.2. Overall Beneficial Use Support -Statewide.

Twenty-three lakes are on the 303(d) list. The Division of Water Quality created a new category for lakes that are assessed as fully supporting in one of the two most recent assessment cycles and are not supporting in the other. The category is 3B. For these waters to be listed on the 303(d) list, they need to be assessed as not supporting their beneficial use for two

consecutive monitoring cycles. Several lakes remain under additional stress due to continuing drought conditions.

Table 2.1.4. Lake Beneficial Use Assessment By Category – Lake Acreage.		
Category	**Category Definitions**	**Lake Acreage**
1	All beneficial uses fully supported.	162,700
2	Beneficial uses assessed are fully supported.	156,919
3A	No data or insufficient data to make an assessment.	336.6
3B	Lakes that are not supported for one cycle only.	0.0
3C	Insufficient data to assess but an assessment plan is in place.	1,088,000
4A	Approved TMDL	28,814
4B	Pollution control requirements are expected to result in full beneficial use support in near future.	0.0
4C	Impaired by pollution, no TMDL required.	0.0
5	Impaired by pollutant, TMDL required.	121,149

The causes of impairment in lakes and reservoirs continue to be nutrients, siltation, low dissolved oxygen, suspended solids, organic enrichment, and noxious aquatic plants.

The major sources of pollutants causing impairments are nonpoint sources, agricultural practices, industrial and municipal point sources, and habitat modification (draw-down of reservoirs).

Twenty-three lakes are on the 303(d) list. Lakes or reservoirs which were assessed as fully supporting in one of the two most recent assessment cycles and not supporting in the other are listed in a new category, 3B. For these waters to be listed on the 303(d) list, they need to be assessed as not supporting their beneficial use for two consecutive monitoring cycles. Several lakes remain under additional stress due to continuing drought conditions.

Chapter 2.2 Overview of Division of Water Quality's Water Quality Programs

2.2.1 Introduction

The Utah Division of Utah (DWQ) is responsible for a variety of programs that monitor, assess, and protect the surface and ground waters of the state. To meet its responsibilities the Division has seven sections that deal with point sources, nonpoint sources, waste water plant construction, ground water protection, and monitoring. These sections and their attendant responsibilities form the State's water pollution control program

2.2.2 Water Pollution Control Programs

2.2.2.1 Watershed Approach - 305(b) Program

The DWQ uses a 5-year rotating monitoring process to assess the rivers and streams within the state. The state has been divided into 10 watershed management units and these have been aggregated into five monitoring regions that are designed to cover the state every five years.

In addition, the DWQ has cooperative monitoring programs with the United States Forest Service, United State Bureau of Land Management, National Park Service, and the Provo River Watershed Management Group to assist those groups and to enhance its water quality assessment program.

Every year, usually in February, the DWQ has a work meeting with individuals from each of the National Forest and Regional Offices of the BLM to evaluate their needs and to determine what they have planned related to water quality in the coming year.

After their requests are submitted, the 305(b) Coordinator, the watershed coordinators in the Total Maximum Daily Load (TMDL) Section, and the Monitoring Section review each one to determine if their request meets the needs of the Division and to determine the needed laboratory capacity for the upcoming monitoring year. The monitoring year is based upon the State's fiscal year which runs from July 1st through June 30th of the next year.

After receiving their requests, Division personnel in the 319 NonPoint Source Program, the 314 Clean Lakes Program, the Total Maximum Daily Load TMDL Program (TMDL), the 305(b) Program, and the 303(d) Program determine what sites will be monitored during the current rotating intensive monitoring and other sites that are needed statewide to meet their needs. Once the review is complete, the monitoring needs are included in the yearly water quality monitoring document. This document identifies each of the sites that are to be monitored and what parameters are to be obtained in the field and analyzed for in the laboratory. The ground water monitoring is also included in this document.

2.2.2.2 Clean Lakes Program - 314 Program

The DWQ continues to monitor and assess its priority lakes on an odd/even year basis. Approximately, half of the lakes are monitored during the odd and even number years. However, if additional data are required to develop a Total Maximum Daily Load (TMDL) analysis for a lake or reservoir, the monitoring frequency and additional sites are incorporated into the monitoring scheme to obtain more data.

2.2.2.3. Nonpoint Source Program Overview -319 Program

The mission of the Utah Nonpoint Source Pollution Management Program is to support the environmental protection goals of the state as described in the Utah Administrative Code R317-2 in part to: 1) to conserve the waters of the state; 2) to protect, maintain, and improve the quality of the waters of the state for public water supplies, species protection and propagation and for other designated uses; and 3) to provide for the prevention, abatement and control of new or existing sources of polluted runoff. The Utah NPS Management Program works to achieve these goals by working in concert with numerous local, state and federal agencies and private parties to perform the objectives and tasks identified in the NPS Pollution Management Plan.

Nonpoint source pollution generally originates from sources rather than from a discrete point such as a pipe. Sources include land runoff, percolation, precipitation or atmospheric deposition. Rain and other forms of precipitation wash pollutants from the air and land and into our streams, lakes, reservoirs and groundwater. Such pollutants can include sediment, nutrients, pathogens (bacteria and viruses), toxic chemicals, pesticides, oil, grease, salt and heavy metals. In Utah our most common problems are sediment, nutrients, metals, salts and pathogens. These pollutants alter the chemical, physical and biological quality of the water and can impair their designated uses.

Some common sources of NPS pollution include various agricultural activities, natural sources, runoff from parking lots and streets and residential areas, mining and forestry operations, recreational activities, underground wastewater treatment systems, construction and stream/riparian habitat degradation and other forms of hydrologic modification.

Fiscal year 2007 (FY-07) ended with six new projects contracted to the UDAF for some $521,900. On-the-ground implementation projects are continuing in such watersheds as Upper Sevier River, Middle Sevier River, San Pitch River, Fremont River, Bear River, and West Colorado River. Several new information and education outreach projects were funded in FY-07 including the Bear River Information and Education Outreach program to support the Bear River Task Force, the Bear Lake Regional Commission and Jordan River Watershed Council for work related to water quality. Funds were provided to educate entities involved in oil and gas drilling in the Uinta Basin about erosion control. Projects were also funded at Utah State University to assess and improve the treatment and handling of septage wastes and to continue the excellent statewide NPS education and outreach program conducted through Extension Service and the College of Natural Resources. Seven watershed TMDL

implementation projects were funded including new a new project with Salt Lake County to re-build the Alta Fen to decrease heavy metal loading, principally zinc, to Little Cottonwood Creek. Funding was also provided to the Utah Division of Wildlife Resources to utilize to restore riparian and stream bank ecosystems and promote and (or) acquire riparian conservation easement.

The NPS Task Force with assistance primarily from the Utah Department of Agriculture and Food joined forces with the Bear River Commission as the lead entity, together with Utah State University and the Eccles Conference Center and USU to sponsor the 2007 Bear River Symposium and NPS Water Quality Conference held September 5, 6 and 7th in Logan Utah. The Symposium began on the 5th with tours of water conservation related projects northern Cache Valley and water quality improvement projects along the Bear River. Numerous technical sessions and two general sessions were held on September 6 and 7th dealing with topic focused on the Bear River Targeted Watershed Grant studies of pollution trading and the Bear River Watershed Information System. Other topics ranged from water quality modeling, sediment transport, fishery evaluations, TMDL development for Cutler Reservoir and the Middle Bear River, biological assessment and analytical methods, monitoring for the evaluation of BMP implementation, Tri-state Bear River monitoring and sociological study of cooperator behavior in the Little Bear River.

Much effort has gone into the continued enhancement of statewide watershed planning groups at the local level. Some thirty local watershed committees are actively assisting and promoting TMDL development and implementation of watershed projects. The Utah Watershed Coordinating Council continues to meet 2 or 3 times per year to exchange information, provide training and promote the local ownership and development of TMDLs and watershed restoration plans. Fifteen to twenty watershed coordinators, including the occasional private chairpersons of local committees and a few agency support staff regularly attend the Council meetings. This year the DWQ and the Council became part of the grant proposal by Trees, Water and People to EPA and is receiving $100,000 of two years for several activities geared to strengthening the Council and respective local watershed coordinators and local watershed committees.

Significant resources from 319, EQIP and Congressional “earmark” funds continue to support the implementation of the Utah AFO/CAFO Strategy by the Utah Department of Agriculture and Food, the UACD, Utah Farm Bureau Federation, agriculture commodity groups and other state and federal partners.

The Utah Department of Environmental Quality and Utah Department of Agriculture & Food are working together in a partnership with commodity groups and farm organizations in the development of an Air Quality Strategy similar to the AFO/CAFO strategy developed for water quality. DEQ has signed an MOU with EPA which establishes a collaborative working relationship to develop and implement the Utah Animal Feeding Operation Air Quality Strategy. The purposes of the strategy are to gather air emissions information from AFOs and implement programs to reduce emissions.

The NPS staff and Task Force partnership will continue to support TMDL development and implementation through the watershed approach in dealing with the NPS challenges in Utah. This program will continue to utilize the local delivery system of the Utah Conservation Districts and other entities such as counties, water conservancy districts to assist with planning and implementation of best management practices to meet Total Maximum Daily Loads contained in their respective TMDL Plans and watershed-based implementation plans. This is being carried out through the establishment of more local watershed coordinators in priority watersheds where TMDLs have been approved by EPA and are being implemented.

A new local watershed coordinator position was established in the Lower Weber River via agreement/contract between USU Extension Service and DWQ. A new coordinator was also hired in the Uinta Basin on contract with the Duchesne Conservation District. The primary purpose of the nine local watershed coordinators is to facilitate, coordinate and report on the implementation of TMDL/watershed plans. They track and report progress to the UDAF on 319 projects in their watersheds.

The coming year resources and efforts focused to provide technical and financial assistance to potential CAFOs to correct unacceptable conditions will continue.. The Division of Water Quality in cooperation with the Utah AFO/CAFO Committee and EPA is working to revise and extend the original AFO/CAFO Strategy through December 2012 from its current end date of December 2008. Additional funding to continue implementations may be sought. Planning and implementation efforts are ongoing and coordinated by UACD and UFBF staff supported in part by 'congressional earmark' funding thru NRCS and CWA 319 funds. Assistance to permitted operations (CAFOs) via a general permit from DEQ will continue through increased compliance activities. In late 2007 or 2008, pursuant to new federal regulations and state rules, CAFOs will receive a new general permit with site-specific nutrient management plans. The AFO inventory and assessment was completed in April 2003. The inventory currently identifies 398 'Potential CAFOs' which have been the focus of intensive technical and financial support to correct unacceptable conditions through implementation of CNMPs and facility specific nutrient management plans. As of December 31, 2006, some 258 'Potential CAFOs' (65%) have completed implementation of their plans.

The DEQ and UDAF has and will continue in 2008 to improve program reporting especially relating to timely receipt, review and approval of 319 project final reports. Increased emphasis will be devoted toward working with project sponsors to secure environmental results information in mid-year, annual and final project reports. Efforts in FY-2008 will be focused on gathering all final project reports and closing the FY-99 and the FY-2000 Nonpoint Source Project Grants (Cooperative Agreements). The FY-97 and FY-98 Grant Agreements were closed in June and August 2007, respectively. Several NPS 319 Project Grants including FY-2001 thru FY-2004 are due to terminate on September 30, 2008. DEQ and UDAF are hopeful to close some of these in FY-2009.

DWQ NPS staff will continue working on updates to the NPS Program Management Plan related to urban/storm water and hydrologic modifications. These plans will not be completed until late 2008 and 2009 respectively because of other work assignments and priorities. Efforts are also underway to prepare an abandoned/inactive mine component to the Plan to be completed by May 2008.

The DWQ is increasing its emphasis on riparian and stream channel protection and enhancement through improved coordination with NRCS EQIP funds, Watershed Initiative Funds with DNR and perhaps with UDAF's new Grazing Improvement Program. Negotiations are ongoing with Division of Wildlife Resources regarding land acquisition and easements for the improvement of water quality and enhancement of fish habitat on Weber River and Scofield Reservoir or other priority areas jointly determined by DWQ and Division of Wildlife Resources (DWR). In 2007 nearly $950,000 was put in contract with DWR for implementation of such riparian stream restorations and conservation easements.

2.2.2.4 Water Quality Standards Program

In 2007, the triennial review was initiated. The process included the creation of a Water Quality Standards Work Group composed of interested agencies and the public to provide input to the Division. The areas of major concern were total dissolved solids (TDS), *E. coli*, redefinition of the recreational use classifications, antidegradation, and the triennial review process in rule. It is expected that these changes will go to the Utah Water Quality Board in early 2008 and become rule by mid-year.

2.2.2.5 Point Source Control Program

The Utah Division of Utah (DWQ) is responsible for a variety of programs that monitor, assess, and protect the surface and ground waters of the state. To meet its responsibilities the Division has seven sections that deal with point sources, nonpoint sources, waste water plant construction, ground water protection, and monitoring. These sections and their attendant responsibilities form the State's water pollution control program

Point source discharges, both municipal and industrial, are regulated through the Utah Pollutant Discharge Elimination System Program (UPDES). Regulatory authority was delegated to the State in July of 1987, and includes permit, compliance, and enforcement authority. In addition to municipal and industrial discharge regulation, program authority was granted for general permits, federal facilities and industrial pretreatment programs. Program authority to issue biosolids (sludge) permits was delegated to Utah in 1996.

Permits are issued for up to five years and reflect both technology-based controls, and where appropriate, water quality based controls using wasteload analyses, current water quality standards and final TMDL results. Water quality parameters for which effluent limitations have been developed to protect the waters of the State include ammonia, total dissolved solids; DO, total residual chlorine, BOD, temperature, various nutrients and toxics.

Fifty-four (54) industrial and sixty-five (65) municipal facilities are currently regulated under the UPDES program. These include eight (8) major industrial and twenty-five (25) major municipal dischargers. The State of Utah has begun consolidating permits to contain all pertinent requirements. For example a consolidated municipal permit will contain limits for the discharge, biosolids, pretreatment, storm water and whole effluent toxicity. Eventually all the municipal permits will be consolidated. The same is being done for the industrial permits, which would include limits for the discharge, storm water, and whole effluent toxicity. The idea is to combine different permits that would be issued to a facility into one permit. Many of the facilities have multiple discharge points that are regulated under a single permit. Major industrial dischargers include mining and manufacturing facilities, such as Kennecott Copper and Thiokol, while the major municipal dischargers are sewage treatment facilities that may or may not receive pretreated wastewaters from industries. Of the twenty-five (25) major municipal discharges, eighteen (18) have State approved pretreatment industrial programs which are used to regulate industries that would not otherwise be subject to UPDES permits because they discharge to a municipal sewer system rather than directly to the waters of the State. Because municipal treatment plants are designed primarily to treat domestic wastes, not industrial wastes, the pretreatment of industrial wastewaters ensures that toxic metals and toxic organic pollutants do not pass through the treatment plants untreated and enter the receiving streams. Without pretreatment, these pollutants could also severely impact the treatment capability of the municipal plants by killing beneficial bacteria that are essential for the decomposition of wastes.

To date, there also are approximately 2900 storm water discharge general permits throughout the state, that regulate, control and thereby reduce the discharge of pollutants from construction sites, industrial sites and municipalities. In addition, there were eighty-one (81) general industrial permits in effect that regulate such activities as construction dewatering and concentrated aquatic animal production. Table 4 provides a summary of these permits and the activities they regulate.

Table 2.2.1 General UPDES Permits

Type	Number
Mining	16
Construction Dewatering	13
Concentrated Aquatic Animal Production	13
Drinking Water Treatment Plants	37
Treated Ground Water Contaminated with Petroleum	2

Upon issuance of a discharge permit, the monitoring phase of the State's UPDES program is initiated to ensure that all conditions of a permit are being met. This includes compliance monitoring. Compliance monitoring requires self-monitoring by the permittee as well as State monitoring to determine if effluent violations are occurring. Self-monitoring results are reported to the State and to EPA in a Discharge Monitoring Report (DMR) that is sent to the State and EPA as required by the permit. Additionally, all UPDES facilities are inspected on a regular basis to determine if they are meeting the conditions of their permit and are being operated in the prescribed manner necessary to

ensure that effluents do not cause violation of State water quality standards for receiving water.

The permittee may also be required to implement biomonitoring as part of their discharge permit. Specific rules and guidelines are published in the Division of Water Quality's *Enforcement Guidance Document for Whole Effluent Toxicity Control Manual (Utah DWQ, 1991).* In general the following standards in conjunction with the volume of the discharge are used in determining whether biomonitoring is required or not: (1) there is a reasonable potential to discharge toxics, and/or (2) the receiving water has a low flow dilution greater than 20; 1, and/or (3) the discharge is intermittent, and/or (4) the receiving water has a use-classification of 3A, 3B, 3C, 3E, or 4.

Eighteen (18) industrial and twenty-three (23) municipal dischargers were required to conduct acute or acute/chronic bioassays during the current 305(b) reporting cycle. The majority of toxicity tests indicate an absence of toxic pollutants; however some facilities have had violations and were required to do additional testing. Eventually the permitted would be required to complete a toxicity reduction evaluation (TRE) whose purpose is to identify the toxicant and provide a way to eliminate it from the system (pretreatment) or modify the system to treat the identified toxicant.

All permits, new or renewal of a permit must go through waste load allocation analysis and review before they are issued. Based upon the results of the waste load allocation analysis, stricter effluent limitations may be placed on the permittee to ensure that state water quality standards are not violated.

The Utah Pollutant Discharge Elimination System (UPDES) Storm Water Permitting Program requires individual permits or general permit coverages for storm water discharges from: 1. Construction activities; 2. Industrial sites and; 3. Municipal separate storm sewer systems, which meet certain criteria. A brief discussion of the three discharge types is below:

2.2.2.5.1 Construction Activities

Storm water runoff from construction activities can have a significant impact on water quality. Construction activities can remove vegetation, disturb and compact soils, and largely replace absorbent soils with impermeable roofs, pavements, or shallow sods.

As storm water flows over a construction site, it can pickup sediment, debris, chemicals, thermal and other pollutants. Polluted storm water runoff can harm or kill fish and other wildlife, and can increase costs to use the water for municipal, irrigation, or other beneficial uses. Sedimentation from construction activities can destroy aquatic habitat, degrade stream aesthetics, and high intensity runoff can significantly increase stream bank erosion.

The UPDES Storm water program requires operators of construction sites of one acre or larger (including smaller sites that are part of a larger common plan of

development) to obtain a permit coverage under the UPDES General Storm Water Permit for Construction Activities. To obtain the required UPDES permit, the operator of construction sites, or of parcels within a larger common plan, must first develop a stormwater pollution prevention plan (SWPPP) and submit a "notice of intent (NOI)" to the Division of Water Quality to obtain the permit coverage. The NOI has been automated and is available for electronic submission on the Internet.

The development and implementation of storm water pollution prevention plans (SWPPP's) is the focus of UPDES storm water permits for regulated construction activities. DWQ, municipalities, and counties evaluate SWPPP's and their implementation through onsite inspections.

2.2.2.5.2 Industrial Activities

Activities that take place at industrial facilities, such as material handling and storage, are often exposed to the weather. As runoff from rain or snowmelt comes into contact with these materials, it picks up pollutants and transports them to nearby storm sewer systems, rivers, lakes, or coastal waters.

In order to minimize the impact of stormwater discharges from industrial facilities, the UPDES program includes an industrial stormwater permitting component. Operators of industrial facilities included in one of the 11 categories of stormwater discharges associated with industrial activity that discharge or have the potential to discharge stormwater to a municipal separate storm sewer system (MS4) or directly to waters of the State require authorization under a the UPDES Storm Water Multi-Sector General Permit, DWQ also includes storm water requirements at many of the facilities with an individual UPDES permit for wastewater discharge. (Construction activity is one of the 11 categories, but because of the nature of its operations, it's discussed separately from the other 10 categories, and is permitted separately.)

The focus is again on the implementation of an SWPPP for the facility. DWQ reviews SWPPP's at the industrial facility.

2.2.2.5.3 Municipal Separate Storm Sewer Systems

Under the UPDES storm water program, operators of Medium and regulated small municipal separate storm sewer systems (MS4s) (There are no Large MS4's in Utah) require authorization to discharge pollutants under a UPDES permit.

Medium MS4 operators include Salt Lake County, Salt Lake City and UDOT. They were required to submit comprehensive permit applications and were issued individual permits.

Regulated small MS4 operators have the option of choosing to be covered by an individual permit, a general permit, or a modification of an existing Phase I MS4's

individual permit. In the case of the municipalities within Salt Lake County, they chose to be co-permitted with the county. Small MS4's outside of the county chose to obtain general permit coverages.

The MS4 permits require the development and implementation of a Storm Water Management Program (SWMP). These programs must be implemented to address the six minimum controls measures in the permit. The six control measures are as follows:

1. Public Education

2. Public Outreach

3. Illicit Discharge Detection and Elimination

4. Post Construction and Redevelopment Controls

5. Good Housekeeping for Municipal Operations

The MS4 SWMP's are reviewed by DWQ through audits.

2.2.2.6 Total Maximum Daily Load (TMDL) Program

The State of Utah's Total Maximum Daily Load (TMDL) and Watershed Planning Program is focused on restoring the beneficial uses of all of the State's impaired Assessment Units. It is responsible for developing TMDLs for assessment units that are listed on the state's 303(d) list of impaired waters. Through the TMDLs process, the sources of the pollutants of concern are identified and the allowable loads are allocated amongst the various point, non-point, and natural sources. The Section is then responsible for developing implementation plans to reduce pollutant loadings and improve water quality.

A key element in restoring the beneficial uses in a watershed is soliciting the involvement and leadership of local stewards through the formation and support of watershed stakeholder groups. TMDL Coordinators are assigned primary coordination responsibilities for one or more of the ten watershed management units within the State. At the initiation of a TMDL water quality study local stakeholders, representatives from the regulated community and relevant partner agencies are invited to participate throughout the entire process, from preliminary data review to implementation plan development. Once the TMDL/Watershed plan is complete the TMDL Coordinators are responsible for ensuring that appropriate limits are incorporated into discharge permits and to assist in obtaining funding to address non-point sources of pollutants. During the implementation phase the TMDL Coordinators are also responsible for tracking and reporting progress towards achieving water quality goals.

There are currently over 30 local watershed groups throughout the State of Utah in various phases of plan development or implementation. These groups are supported by the Utah Watershed Coordinating Council, initiated by the Division of Water Quality to disseminate information, training opportunities and guidance on successful watershed planning and implementation efforts. The Support Team for the Watershed Council is made up of agency representatives from the Utah Association of Conservation Districts, Utah State University Extension Service, Utah Department of Agriculture and Food, and the Natural Resources Conservation Service. In addition, through the support of EPA Section 319 funds nine local watershed coordinators have been hired by local watershed groups to help facilitate the planning and implementation of best management practices in their high priority watershed.

To date, there have been 129 TMDLs completed and approved by EPA.

2.2.2.7 Ground Water Protection Program

Utah's Water Quality Board has been dedicated to providing a sound ground water anti-degradation policy for the State of Utah. As a result of this commitment, *Administrative Rules for Ground Water Quality Protection (UAC R317-6)* were promulgated in 1989 for the protection of Utah's ground water resources. These rules form the basis for a formal program to protect the present and probable future beneficial uses of ground water throughout the state. The intent of the rules is to require a permit for a facility or activity that, during normal operations or activities of the facility, may have a discharge that will affect ground water quality. The Ground Water Protection Section within the Utah Division of Water Quality administers the ground water permitting program. Currently, there are 35 active ground water discharge permits regulating approximately 90 facilities. The majority of these permits are for activities and operations primarily associated with agriculture and mineral extraction. Since 1989, the *Ground Water Quality Protection Rules (UAC R317-6)* have been revised three times, primarily to update Federal Drinking Water Standards established by EPA, which serve as the basis for Utah's ground water quality standards and permit-specific protection levels. In February 2007, the Water Quality Board approved a rulemaking action to adopt a set of agricultural liner criteria tables into the *Ground Water Quality Protection Rules (UAC R317-6).* These liner criteria tables are the product of an agricultural stakeholder best available technology (BAT) work group formed in response to stakeholder feedback regarding more stringent liner requirements for animal wastewater lagoons. The BAT work group was comprised of agricultural stakeholders from Farm Bureau Federation, Utah State University Cooperative Extension Service, Natural Resources Conservation Service, Division of Water Quality, Department of Agriculture and Food, Utah Dairyman Association, and several agricultural producers. The liner criteria tables determine what type of liner is appropriate for any site based on the site-specific risk and vulnerability of contamination to waters of the state, including ground water.

The Ground Water Protection Section conducts annual permit site inspections, reviews quarterly and semi-annual compliance monitoring reports, and if necessary, implements enforcement activities for permit non-compliances. Additionally, the Section was

actively involved in the finalization of two multi-million dollar ground water contamination Consent Agreements and associated Natural Resource Damage Claims. Ground Water Classification for Aquifers is a valuable part of the Ground Water Protection Program, and as of September 14, 2007, 10 aquifers have been classified within the State. Since the inception of the program in 1989, the Section has conducted outreach efforts to encourage local governments to institute ground water protection measures. The Section has been instrumental in coordinating the passage of a Salt Lake County-wide ground water protection ordinance that has been nationally recognized. In conjunction with the Utah League of Cities and Towns, the Section has successfully held its 13th Annual Statewide Water Planning Conference for professional planners and local Planning and Zoning Commissions. The Section has also been effective in implementing over one million dollars in non-point source projects for ground water protection. Ground water quality protection priorities include: the administration of a Statewide Ground Water Protection Program; the annual assessment of ground water quality statewide; the integration of ground water protection measures into local planning; development of new partnerships to protect ground water quality statewide; and the continued commitment in establishing consistent ground water protection measures.

The second primary program administered within the Ground Water Protection Section is the federally-mandated 1422 Underground Injection Control (UIC) Program. The Utah UIC Program regulates underground injection of Class I, III, IV, and V injection wells by prohibiting injection activity which would allow movement of fluid containing any contaminant into underground sources of drinking water (USDWs) if the presence of that contaminant may cause a violation of any primary drinking water regulation (40 CFR Part 141 and Utah Primary Drinking Water Standards R309-200-5), or which may adversely affect the health of persons. Underground Injection means the subsurface emplacement of fluids through a bored, drilled, or driven shaft or a dug hole whose depth is greater than the largest surface dimension, or an improved sinkhole or a subsurface fluid distribution system consisting of an assemblage of perforated pipes, drain tiles, or other similar mechanisms intended to distribute fluids below the surface of the ground (UAC R317-7-2 and 40CFR 144.3).

An Underground Source of Drinking Water or USDW means an aquifer or portion thereof which:

(a) (1) Supplies any public water system; or

(2) Contains a sufficient quantity of ground water to supply a public water system; and

(i) Currently supplies drinking water for human consumption; or

(ii) Contains fewer than 10,000 mg/l total dissolved solids (TDS); and

(b) Is not an exempted aquifer as designated according to the procedures in 40 CFR 144.7.

Currently, the Utah 1422 UIC Program is reviewing a Class I permit application; oversees an area permit for seven active Class III wells at a potash solution mining operation; coordinates with the Utah Division of Solid and Hazardous Waste and the Division of Environmental Response and Remediation in the use of exempt Class IV injection wells for RCRA and CERCLA-related aquifer remediation, and manages over 5,500 Class V injections wells. Class V injection wells represent, by far, the greatest number of wells in Utah and the greatest diversity of industry sectors with 30 well subclasses ranging from storm water drainage wells to a deep underground hydrocarbon storage facility.

As land development continues to increase in Utah, the potential for ground water contamination also increases from storm water drainage wells and from UIC-regulated on-site domestic wastewater disposal systems in communities without sanitary sewer or storm water drainage systems, respectively. Utah is also experiencing an increased interest in and application for subsurface disposal of industrial wastewater brought on by the restrictions in surface discharge through implementation of TMDLs and the Colorado Salinity Forum as well as prohibitions to surface discharge by the US Forest Service. The Utah 1422 UIC Program coordinates with the Utah Source Water Protection Program administered by the Division of Drinking Water by prioritizing its inspection and permitting activity for UIC regulated facilities that lie within ground waster based source water protection zones.

Expansion of the areas of regulatory oversight for the 1422 UIC Program has occurred with the recent funding by DOE for a pilot carbon sequestration project located east of Wellington. Furthermore, Senate Bill 202 (2008 General Legislative session) includes provisions for the development of administrative rules to address carbon capture and geological sequestration. It is anticipated that these rules (if the bill passes) will be developed concurrently with those being developed by the USEPA for carbon sequestration.

2.2.2.8 Wetlands Assessment Program

The DWQ initiated its wetlands assessment program in 2004 with focus on whether the beneficial use, support for waterfowl and shorebirds and the aquatic life in their food chain, is being fully supported in Great Salt Lake wetlands. The Primary objective is to establish appropriate nutrient criteria for Farmington Bay wetlands. The wetlands program is also developing a rapid assessment method with the anticipation of providing a protocol to be used for 404 permits for use by the US Corps of Engineers and Utah Department of Transportation. This method is currently being developed in the Great Salt Lake basin but its utility will eventually be expanded to statewide use and for 305(b) assessments.

2.2.2.9 Cost/Benefit Assessment

2.2.2.9.1 Point Source

Since 1972 some 410 wastewater projects have received financial assistance from EPA Construction Grants, the State Revolving Fund (SRF), or the Utah Wastewater Project Assistance Program (UWPAP), which includes the Utah Wastewater Loan Program and the Utah Hardship Grant Fund. To date, assistance on these projects totals more than $594 million with total project costs estimated to exceed one billion dollars (assuming that Construction Grant funding represents 50% of eligible project costs).

The EPA grants program was phased out in 1991. Since then, the SRF and WQPAP have provided the majority of funding. However, in 1996, the Utah Water Quality Board implemented a grant program to assist small communities which are limited in their ability to afford a water quality project. Since its implementation, a number of communities have been given grant assistance for planning, design and construction activities. Typically, advances given to communities for planning and design are repaid to the Hardship Grant program with proceeds from the long-term funding provided by the Utah Water Quality Board. All funding to projects in Utah have been given to a body politic. Although a majority of the projects have been for the planning, design and construction of wastewater collection and treat facilities in communities, many of the projects have provided water quality protection to recreational and environmentally sensitive areas. A few examples are the projects that were constructed along the shores of Bear Lake, at Scofield Reservoir, communities along the Weber and Bear Rivers, Jordanelle Reservoir and several projects in the upper reaches of watersheds which include recreational areas. Most all of Utah has, at one time, utilized cesspools or individual septic tank/drain field systems to meet their wastewater treatment needs.

The construction of centralized wastewater collection and treatment facilities provides water quality protection for both surface and ground water quality. Presently, there are only 5 cities and towns in Utah with population over 1,000 that do not have a centralized wastewater collection and treatment system.

Table 2.2.2. Funding Amounts For Wastewater and Treatment Facilities

Fund Source	Amount (millions)
State Revolving Fund (SRF)	$270
Utah Wastewater Loan Program (UWLP)	$78
Construction Grants	$211
Hardship Grant Fund	$35

Other benefits derived from the funding of wastewater projects include:

1. Public Education about the need for water quality and environmental protection

2. Prevention of water quality degradation in surface and ground water sources

3. Protection of fisheries in discharge receiving streams

4. Education of State Legislators on the need for funding of water quality projects

5. Protection of Public health

6. Beneficial reuse of biosolids resulting from wastewater treatment.

Communities have established operations and maintenance procedures for their wastewater collection and treatment systems. This ensures proper operations and helps to prevent damage to the environment.

Most recently, an increased interest in reusing treated effluent for irrigation purposes.

It may be hard to quantify the benefits that have been derived from the capital expenditures since 1972, yet it is easy to see that if the projects were not constructed, water quality in general would have degraded in the state of Utah. It is believed that the benefits of such funding and water quality programs far out-weigh the costs involved.

2.2.2.9.2 Nonpoint Source

The DWQ has received over 26 million dollars in funding under the EPA NPS 319 Program (F). Funding was used for planning, monitoring, assessment, technical support, and enforcement. Other funds were used for implementation programs under the Utah Department of Environmental Quality and the Utah Department of Agriculture and Food.

The funding distribution for the various components of the NPS 319 program is illustrated in Figure II-3. Funding was used for administration, watershed demonstration projects, information and education, monitoring, assessment, TMDL development, enforcement and planning.

It is very difficult to determine the cost/benefits for nonpoint source projects because it may take 5 or more years to see any improvements in a watershed. The assessment becomes more difficult when only a portion of the stakeholders in a watershed are participating in the implementation program.Since the inception of the program, the DWQ has removed on watershed from Utah's 303(d) list that was impacted by only nonpoint sources of pollution. The Mill Creek watershed was on the list for sedimentation, habitat alteration and bacteria.

Several areas of the stream channel were reconstructed and the recreational facilities were moved away from the stream to lessen human impact on the riparian habitat. A program was implemented by Salt Lake City that required animal owners to remove feces that there dogs excreted. The DWQ assessed the results and the bacteria standard was being met, and the riparian habitat had recovered significantly.

A segment of another watershed on the Little Bear River was removed from the 303(d) list also. This segment was impacted by point and nonpoint sources. The implementation of best management practices within this watershed played a significant role in reducing nutrient input to the stream which was the cause of the impairment.

The formation of watershed management committees to review, provide input and to assist in implementing projects with watersheds has been very successful. It has made people more aware of what the water quality issues are and they have begun to take pride in their watersheds. The funding for part-time watershed coordinators has also been very important. These individuals live in the watersheds and are able to communicate on a more regular basis with people that live in there. It has contributed to a more open dialogue on water quality issues and how they can be approached on a cooperative basis instead of being fearful of the process.

Table 2.2.3. Nonpoint Source 319 Funding FY-90 Through FY-05.

Department of Environmental Quality		Utah Department of Agriculture and Food	
Monitoring, Planning, Assessment, Technical Support, Enforcement	$4,260,810 (16%)	Program Implementation	$13,833,740 (83%)
Project Contracts (Implementation)	$5,327,800 (20%)	Program Management and Technical Support	$2,800,742 (17%)
UDAF – Ag NPS Program Management and Implementation	$16,634,486 (63%)		

Table 2.2.4. Nonpoint Source Funding Distribution: 1990-2007.

Category	Amount	Percent
Administration	$718,090	3%
Management Technical Support, Enforcement	$5,082,845	19%
Watershed Demonstration Projects	$12,538,720	48%
Information and Education	$2,911,625	11%
Ground Water Studies	$1,407,100	5%

Monitoring, Assessment and TMDL Development	$3,564,730	14%

Chapter 2.3 Statewide River and Stream Water Quality Assessment

2.3.1 Introduction

Water quality monitoring conducted as part of the Section 305(b) report form the basis of the Division of Water Quality's assessment work. As part of this assessment, the State uses a five-year rotating monitoring program to collect data and to assess the beneficial use support of its rivers and streams. The State has been divided into ten watershed management units (Figure 3.2.1) and aggregated into five monitoring regions (Table 2.3.1). Each region is monitored on an intensive basis once every five years.

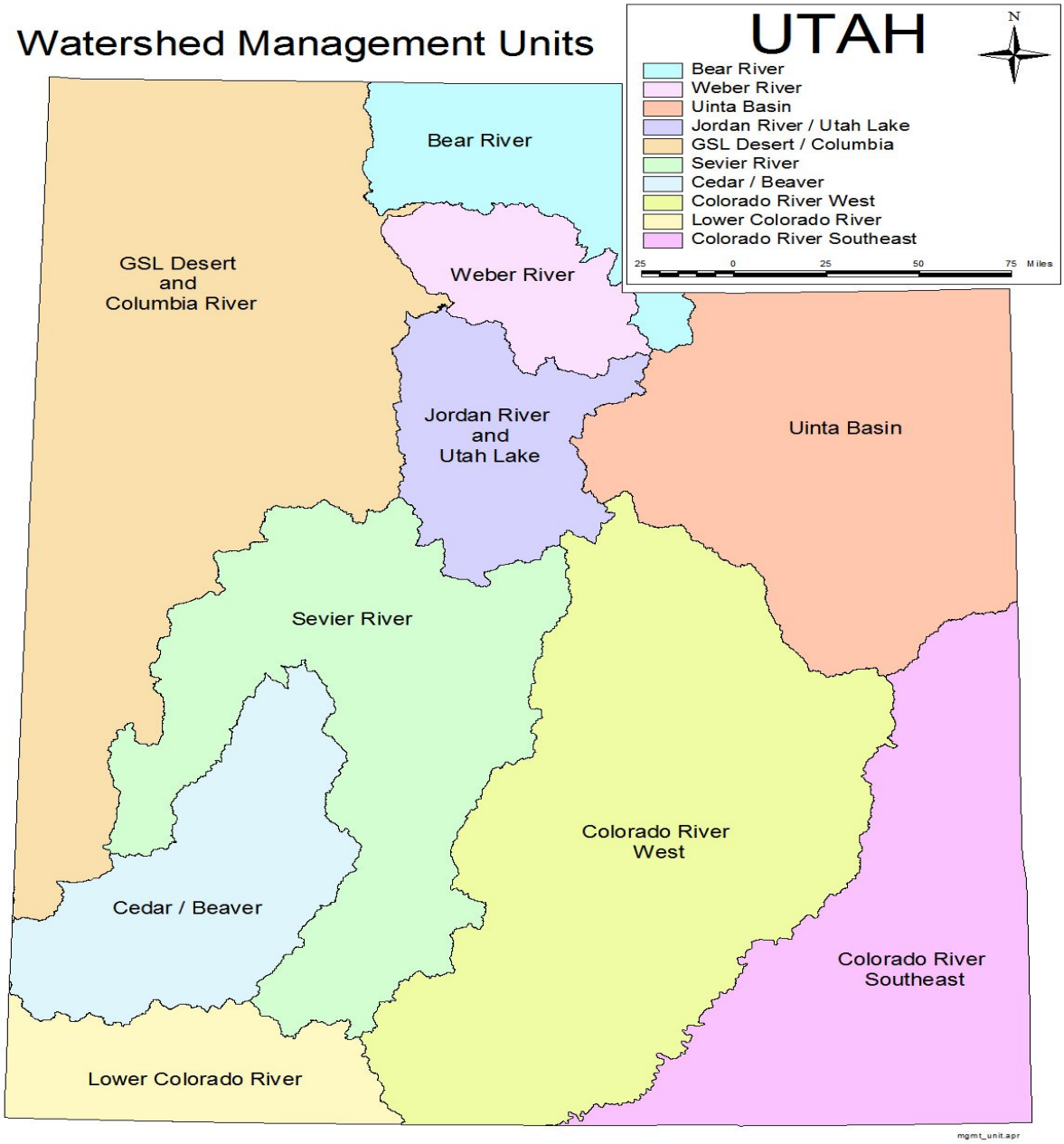

Figure 2.3.1. Watershed Management Units.

Table 2.3.1. Water Quality Monitoring Regions.	
Region	**Management Units**
1	Bear River, Weber River, Great Salt Lake Desert/Columbia (northern portion of the GSL Desert)
2	Jordan River, Great Salt Lake Desert (southern portion of Great Salt Lake)
3	Uinta
4	Sevier River, Cedar/Beaver, Lower Colorado
5	Colorado River West, Colorado River Southeast

For this assessment cycle, the statewide assessment consists of the summary evaluations of the intensive monitoring surveys for three watershed management units. These watersheds were the Sevier River, Cedar / Beaver and Lower Colorado Watershed Management Units.

These watershed assessments were combined with the results of the intensive watershed assessments of the Bear River, Weber River, Uinta, Lower Colorado), Colorado River West and the Colorado River Southeast, and the Jordan. A major portion of the Jordan/Utah Lake Watershed Management is monitored on a yearly basis because of the different entities monitoring in this watershed. Evaluation of data collected at sites within any of the watershed assessment units since the 2006 Integrated Report was also done. Intensive monitoring occurs from July 1 a year until June 30 of the next year. No samples are collected during December.

Use support of beneficial uses was arrived at using chemical, physical, biological data and other information collected by the DWQ, Cooperating Agencies, and other entities involved in collecting data related to water quality. Federal and other public agencies involved with cooperative monitoring agreements or providing information used during this cycle to assess beneficial use support are listed below:

1. United States Forest Service
2. United States Bureau of Land Management
3. Salt Lake City
4. United States National Park Service
5. Central Utah Water Conservancy District.
6. United States Geological Survey
7. Salt Lake County
8. Provo River Watershed Council

Bacteriological data collected by Salt Lake City were used to assess streams in the Jordan River watershed. Bacteriological data provided by Salt Lake County were used to assess Emigration Creek and the Jordan River.

2.3.2 Statewide Assessment Results

2.3.2.1. Assessment For Mercury In Fish Tissue.
Fish consumption advisories were placed on four Assessment Units (Table 2.3.3). These AUs were not listed on the 303(d) list as being impaired for mercury. They exceeded the Environmental Protection Agency's level of 3 mg/kg, or 0.3 ug/g, but none of the concentrations exceeded the United States Food and Drug Administration (FDA) value of 1.0 mg/kg. If any fish consumption advisory exceeds the FDA's standard, the AU will be listed on the 303(d) list.

Table 2.3.2. Stream Assessment Units That Have Fish Consumption Advisories.

Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Beneficial Use Class	Common Name Of Fish
UT14070005-007	Calf Creek	Calf Creek from confluence w/Escalante River to headwaters	3A	Brown Trout
UT16020102-022	Weber River-6	Weber River between East Canyon Creek confluence and Lost Creek confluence	3A	Brown Trout
UT14060005-009	Green River-3	Green River from HUC unit boundary (Price River confluence to Duchesne River confluence.	3B	Channel Catfish
UT14030005-005	Mill Creek-1	Mill Creek and tributaries from confluence with Colorado River to U.S.F.S. boundary	3A	Brown Trout

Statewide assessment of streams for at least one beneficial use came to 10,901 miles for this 305(b) reporting period. This was 76.5% of the perennial stream miles in the state.

2.3.2.2 Assessment By Category–Table 2.3.3 lists the number of stream miles assigned to the various assessment categories: Category 1, 2, 3A, 3B, 3C, 4A, 4B, 4C, and 5. The statewide beneficial use assessment by category is mapped in Figure 2.3.5. The stream miles assigned to each assessment category are graphed in Figure 2.3.6. Assessment Units assigned to each assessment category are listed in the tables in Appendix 2.1.

Table 2.3.3. Stream Miles By Assessment Category – State Wide

Category	Category Definitions	Stream Miles
1	All beneficial uses fully supported.	42.0
2	Beneficial uses assessed are fully supported.	7,460.0

Table 2.3.3. Stream Miles By Assessment Category – State Wide		
Category	**Category Definitions**	**Stream Miles**
3A	No data or insufficient data to make an assessment.	2,410.0
3B	Lakes that are not supported for one cycle only.	0.0
3C	Insufficient data to assess but an assessment plan is in place.	0.0
4A	Approved TMDL	1,372.6
4B	Pollution control requirements are expected to result in full beneficial use support in near future.	0.0
4C	Impaired by pollution, no TMDL required.	1,159.8
5	Impaired by pollutant, TMDL required.	1,566.4

2.3.2.3.Overall Use Support--Of the 10,901 stream miles assessed, 7,502 miles (68.8 %) were rated as fully supporting and 3,399 miles (31.2%) were rated as not supporting one or more of their designated beneficial uses (Figure 2.3.4). For the majority of streams, the Class 2B (protected for contact recreation) was not assessed because bacteriological data were not available. Waters with this classification were only considered assessed if bacteriological data were collected unless there was physical or chemical impairment such as pH.

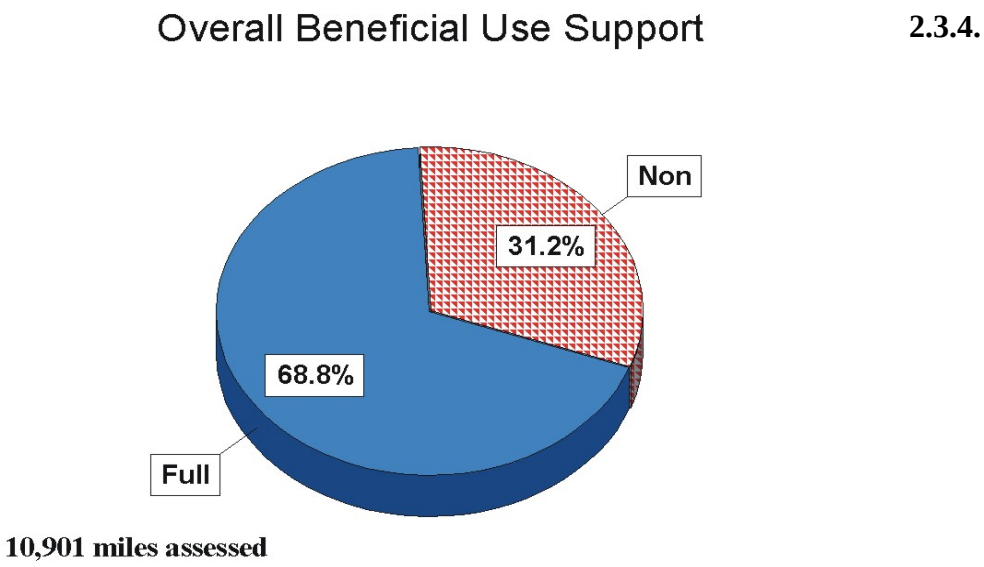

Figure 2.3.2. Statewide use support for rivers and streams.

Individual Beneficial Use Support --Use support by individual beneficial use designations is summarized in Table 2.3.3 The drinking water use was assessed on 4339.5 miles of streams. Of these stream miles, 4,154.5 (95.7%) about 25 miles were assessed as supporting this beneficial use. The stream mileage assessed as not support this beneficial use was 184.9 (4.3%) assessed. The assessment results for primary and

secondary recreation were 688.8 miles were assessed. Of these 112.1 were assessed as fully supporting (16.8%) and 557.3 (83.3%) miles were not supported. The majority of these were listed because pH violations.

Streams classified for agricultural use had 8,580.3 miles (66.8 %) that were rated as fully supporting, and 1,386.7 miles (13.9%) as not supporting agricultural usage.

The aquatic life use was assessed on 10,878.0 stream miles. Full use support was assessed for 7,937.5 miles (73.0%) and not supporting was given to 2,941.1 miles (27.0%).

2.3.2.4. Causes of Less Than Supporting--Stream miles impacted by specific cause categories are summarized in Table 2.2-7. Stream segments may have been impacted by multiple causes. The primary causes of impairment were metals (8.1%), nutrients (7.1%), sediment (5.6%), temperature (9.3%), habitat alterations (8.0%) and total dissolved solids (4.9%) The percent stream miles affected by sources are graphed in Figure 2.3.7 and the relative percent contribution of each cause is shown in Figure 2.3.8.

2.3.2.5. Sources of Less Than Fully Supporting--The sources of stream water quality impairment are summarized in Table 2.3.6. Like causes, stream segments may have been impacted by multiple sources. The primary sources of impairment were agricultural practices (15.2%), natural sources (8.3%) hydrological modification (9.0%), and habitat modification (9.4%%) (Figure 2.3.9). The relative percent contribution of each source to the impairment of streams is shown in Figure 2.3.10.

Table 2.3.4. Individual Use Support Summary.

Use	Size Assessed	Size Fully Supporting	Size Fully Supporting but Threatened	Size Not Supporting	Size Not Attainable
Aquatic Life	10,878.0	7,937.5	0.0	2,941.1	0.0
Fish Consumption	0.0	0.0	0.0	0.0	0.0
Swimming	668.8	112.2	0.0	557.3	0.0
Secondary Contact	668.9	112.2	0.0	557.3	0.0
Drinking Water	4,339.5	4,154.5	0.0	184.9	0.0
Agricultural	9,967.1	8,580.3	0.0	1,386.7	0.0
Total	10,901.4	7,502.0	0.0	3,399.4	0.0
Use					
Aquatic Life		73.0%		27.0%	
Fish Consumption		0.0%		0.0%	
Swimming		16.8%		83.3%	
Secondary Contact		16.8%		83.3%	
Drinking Water		95.7%		4.3%	
Agricultural		86.1%		13.9%	
Total		68.8%		31.2%	

Table 2.3.4 lists the percentages of streams that were assessed using only chemical/physical data and those that were assessed using chemical/physical, habitat and biological data to determine aquatic life uses.

Table 2.3.5. Categories of Data Used In ALUS Assessments for Wadable Streams and Rivers

Degree of ALUS	Miles Assessed Based on B/H Data Only	Miles Assessed Based on P/C Data Only	Miles Assessed Based on B/H and P/C Data	Total Miles Assessed for ALUS
Fully Supporting	-	8,322.4	183.9	8,506.3
Fully Supporting but Threatened	-	-	-	-
Partially Supporting	-	1,240.3	252.9	1,4 94.2
Not Supporting	-	445.7	0.0	445.7

Table 2.3.6. Total Waters Impaired by Various Cause Categories (Stream Miles)	
Cause Category	**Miles Impacted**
Cause unknown	0.0
Unknown toxicity	0.0
Pesticides	-
Priority organics	-
Nonpriority organics	-
Metals	883.5
Ammonia	
Chlorine	0.0
Other inorganics	0.0
Nutrients	76i9.3
pH	156.5
Siltation/Sediments	538.4
Organic enrichment/low DO	206.0
Salinity/TDS/Chlorides	685.8
Thermal modifications	1,013.1
Flow alterations	217.4
Other habitat alterations	873.0
Pathogen Indicators	21.9
Radiation	21.8
Oil and grease	-
Taste and odor	0.0
Noxious aquatic plants	0.0
Total toxics	-
Turbidity	-
Exotic Species	-

Table 2.3.7. Total Waters Impaired by Various Source Categories (Steam Miles)	
Source Category	**Miles**
	Impacted
Industrial Point Sources	109.1
Municipal Point Sources	143.8
Combined Sewer Overflow	0.0
Agriculture	16i57
Silviculture	0.0
Construction	47.6
Urban Runoff/Storm Sewers	156.8
Resource Extraction	201.6
Land Disposal	0.0
Hydromodification	980.2
Habitat Modification	1,115.8
Marinas	0.0
Atmospheric Deposition	0.0
Contaminated Sediments	0.0
Unknown Source	978.2
Natural Sources	907.0
Source Outside State	136.2

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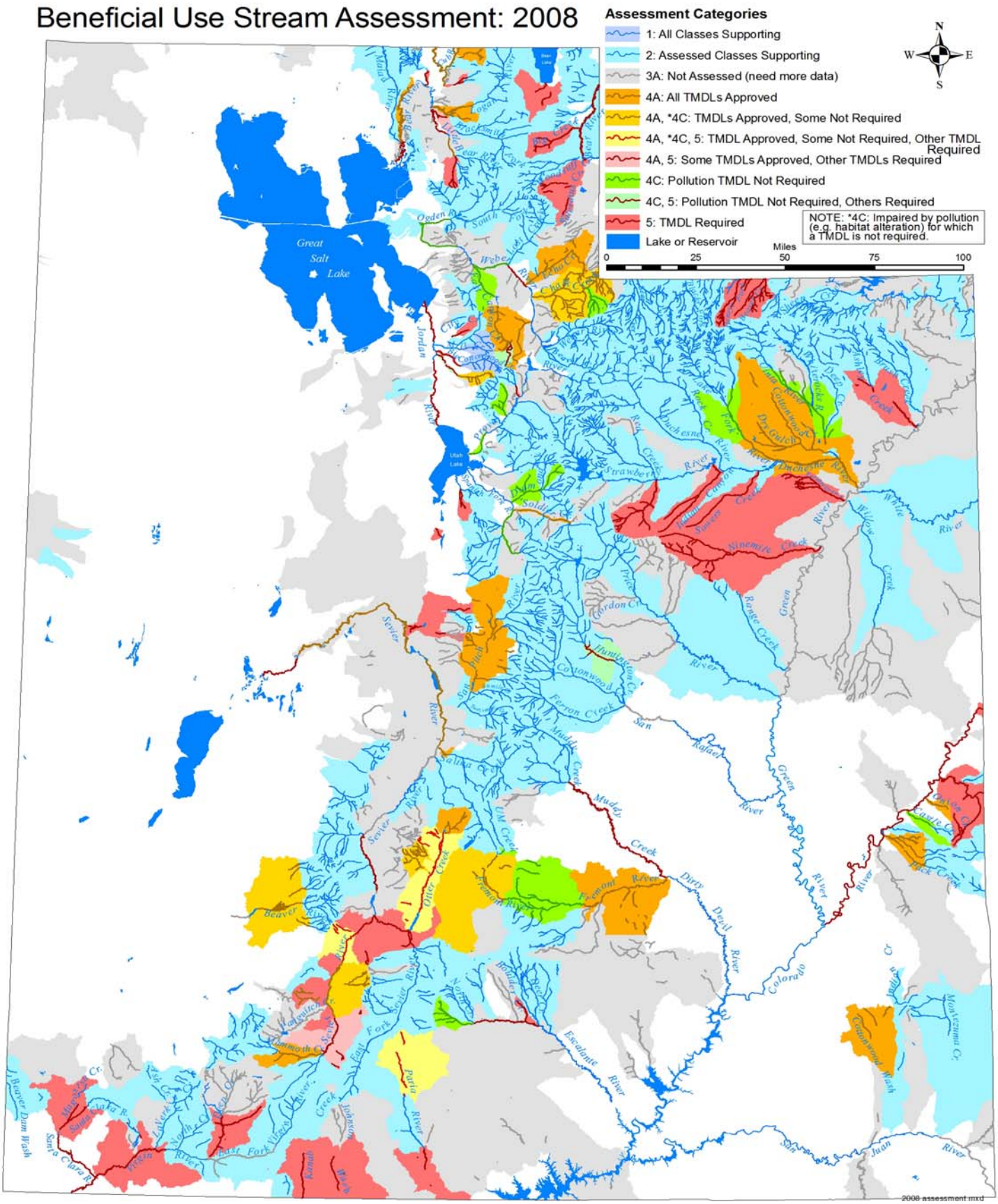


Figure 2.3.2. Overall stream beneficial use support – 2008 Integrated Report.

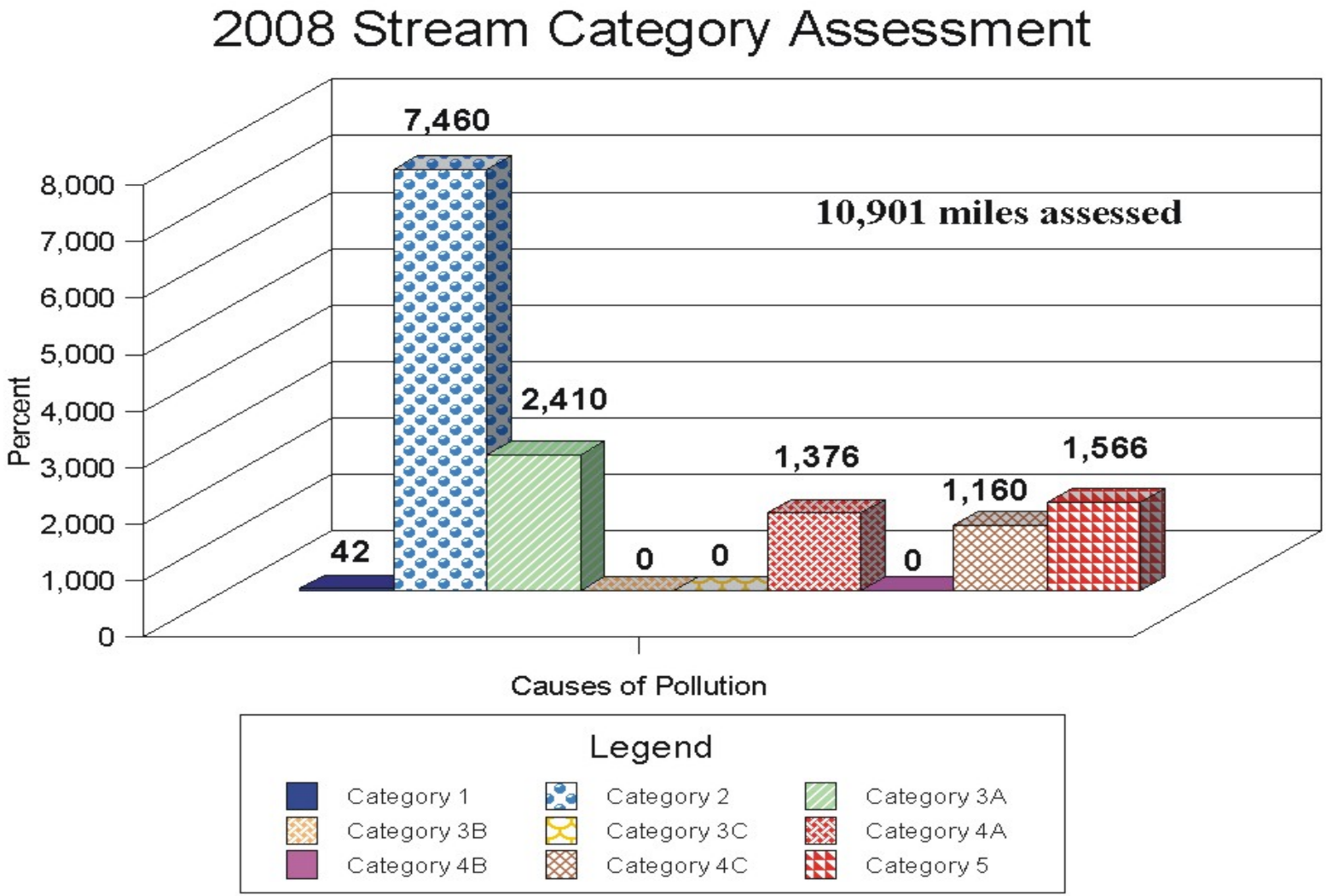


Figure 2.3.3 Statewide Assessed Stream Miles By Assessment Category – 2008 Integrated Report

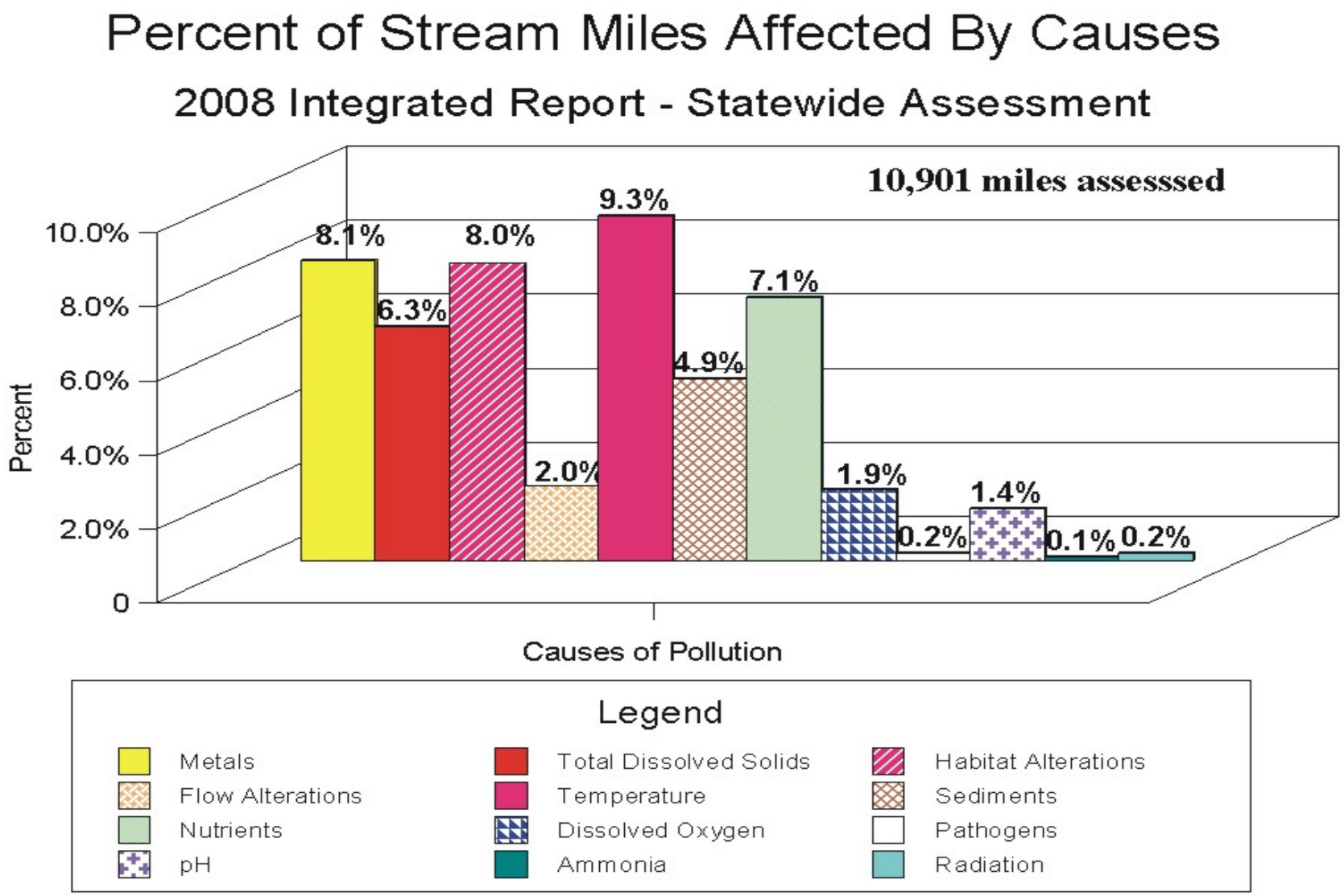


Figure 2.3.4. Percent of assessed stream miles impacted by various causes – Statewide Assessment.

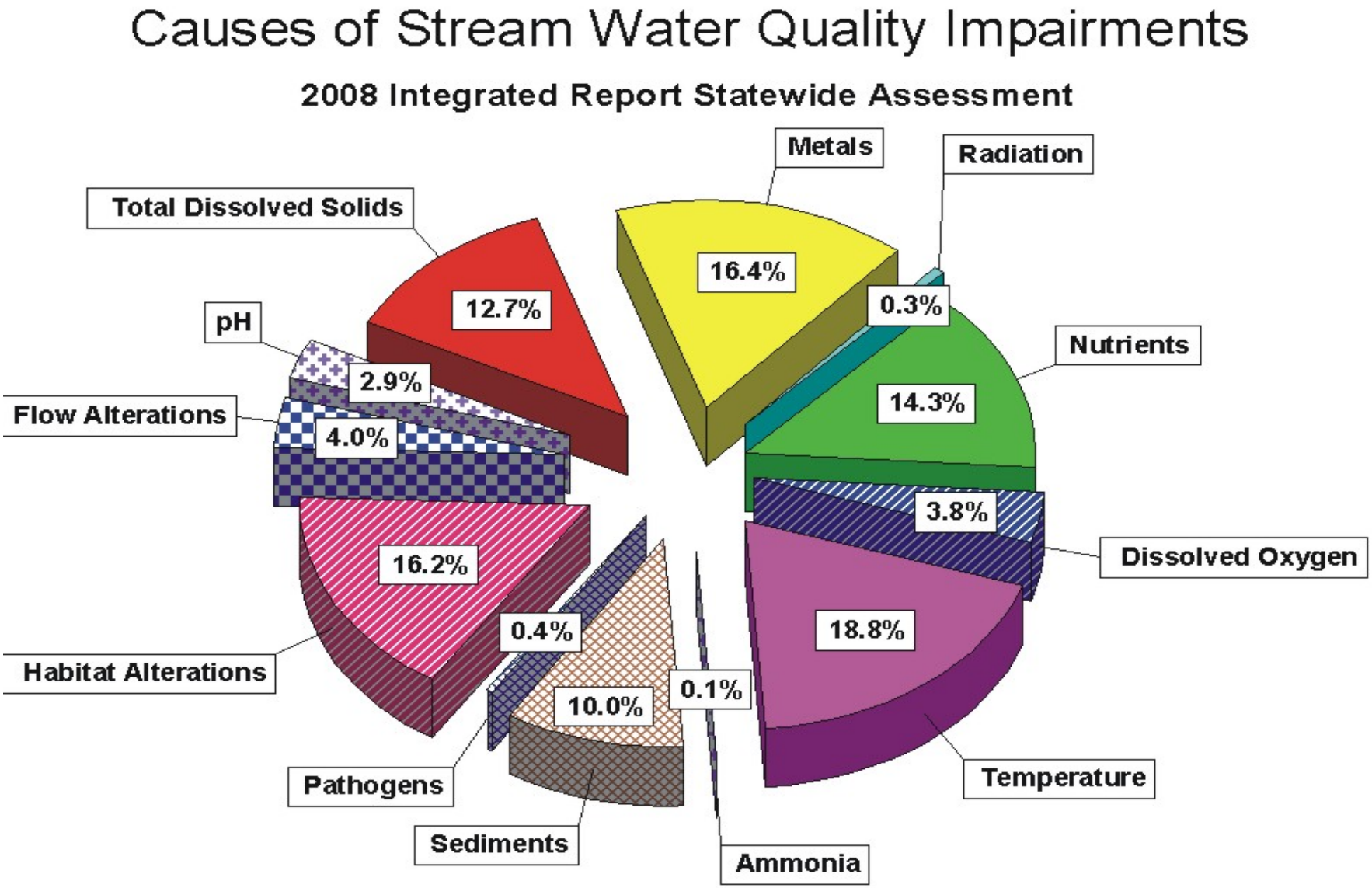
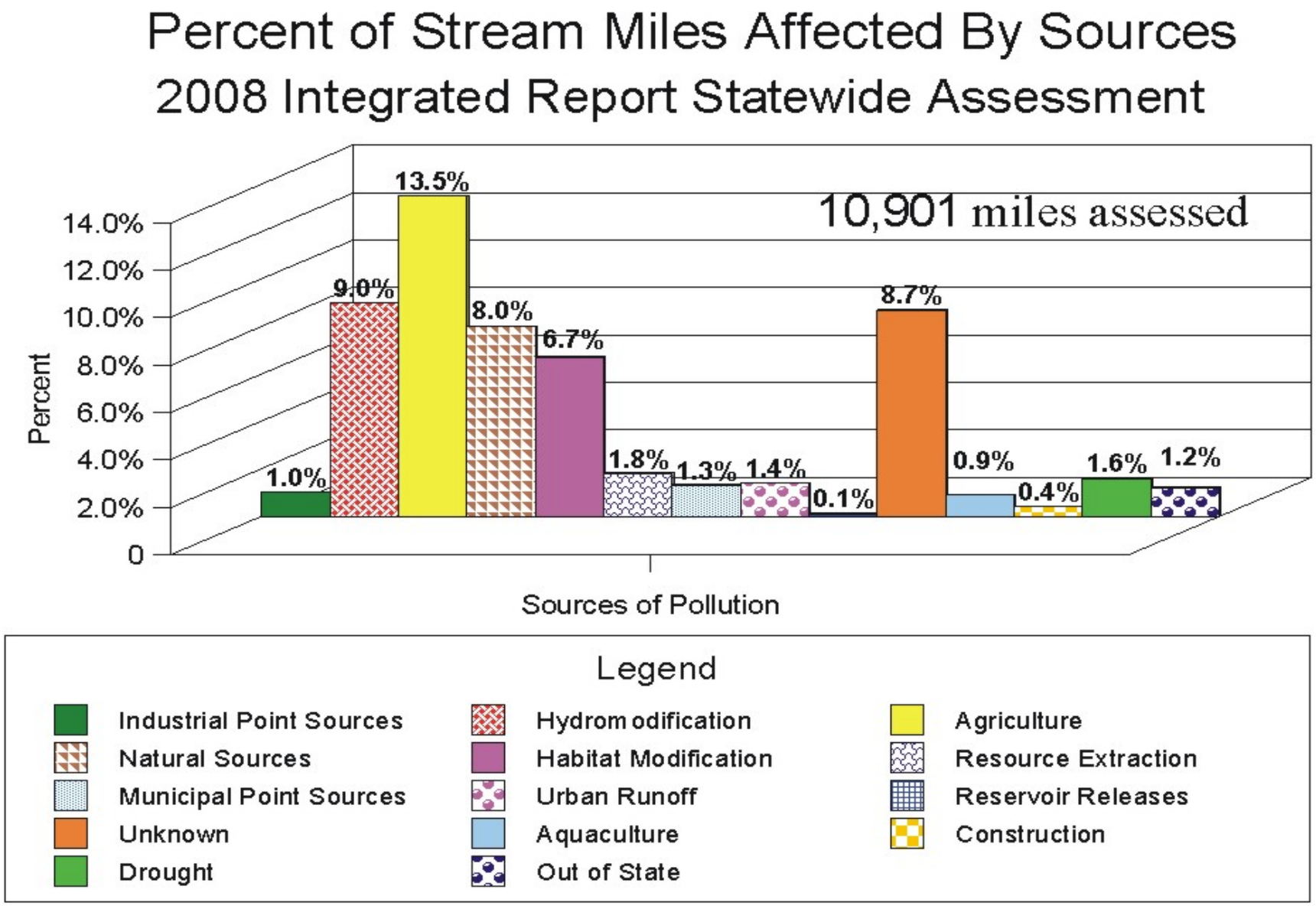


Figure 2.3.5. Relative percent contribution of causes on stream water quality – 2008 Integrated Report.



2.3.6. Percent impact by sources on stream water quality – 2008 Integrated Report.

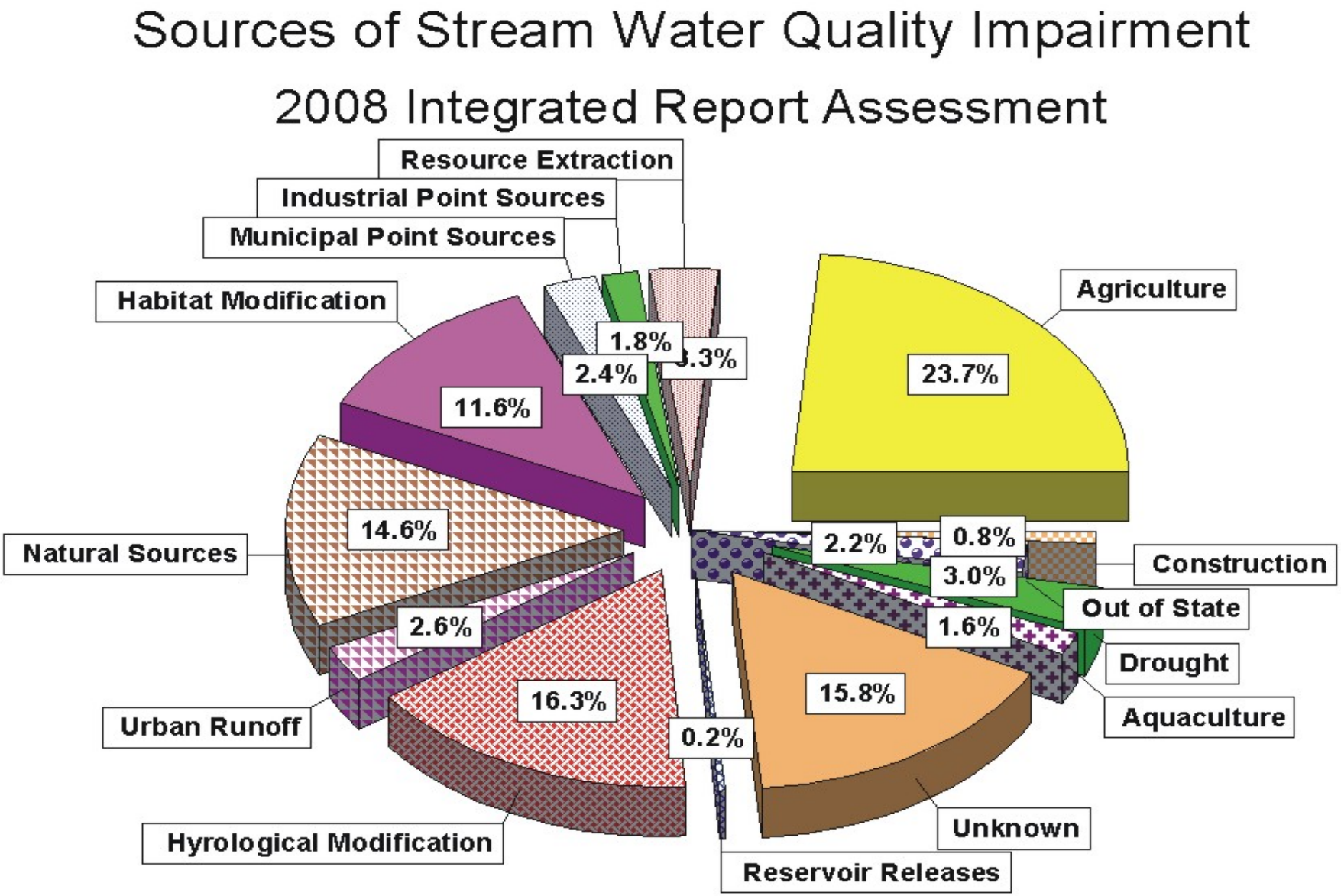


Figure 2.3.7. Relative percent contribution of sources on stream water quality.

Chapter 2.4. Bear River Watershed Management Unit

2.4.1 Introduction

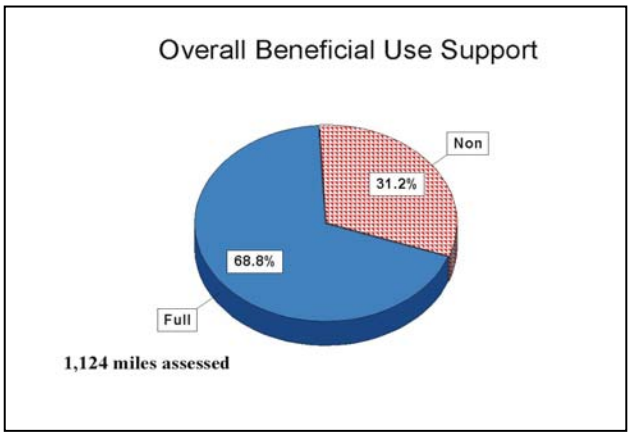
The Bear River Basin is part of the Great Basin Hydrologic region, and is comprised of the U.S.G.S. Hydrological Units (HUCs) listed in Table 2.4.1. The Bear River is the principal stream within this drainage area. It flows north out of Utah into Wyoming, then back into Utah, returns to Wyoming, then crosses into Idaho, then flows southwest into Utah and empties into the Great Salt Lake. The Bear River is the longest river (approximately 500 miles long) in the United States whose waters do not eventually empty into an ocean. Originally the Bear River did not flow into Bear Lake, but since the early 1900's, it has been diverted into Bear Lake at Stewart Dam. Water flows form Bear Lake into the Bear River via a canal. Other streams of interest include the Logan, Blacksmith Fork, Cub River and the Little Bear Rivers.

Table 2.4.1. U.S.G.S. Hydrological Units in the Bear River Watershed Management Unit.

Hydrological Unit Code	Hydrological Unit Name
16010101	Upper Bear
16010102	Central Bear
16010201	Bear Lake
16010202	Middle Bear
16010203	Little Bear - Logan
16010204	Lower Bear - Malad

2.4.2 Water Quality Assessment Results

The 2006 305(b) assessment forms the majority of the assessment in this watershed for the 2008 cycle. Additional data used to assess water quality were collected at long term a5 nonpoint source sites . Benthic macroinvertebrate data were collected at several monitoring sites (Chapter xx) and were used to assess aquatic life beneficial uses under the State's narrative standard. Water quality data were compared against standards established for each of the designated beneficial uses that can be assigned to rivers and streams within the state to determine beneficial use support. The designated beneficial use classes assigned to rivers and streams in the Bear River Watershed Management Unit are mapped in Figure 2.4.1.



2.4.1.1 Overall Beneficial Use Support --An assessment of beneficial use support was made for 1 088.0 miles. Based upon at least one beneficial use being assessed, 701.3 miles (64.5%) were assessed as fully supporting and 386.6 miles (35.5%) as not supporting (Figure 2.4.1).

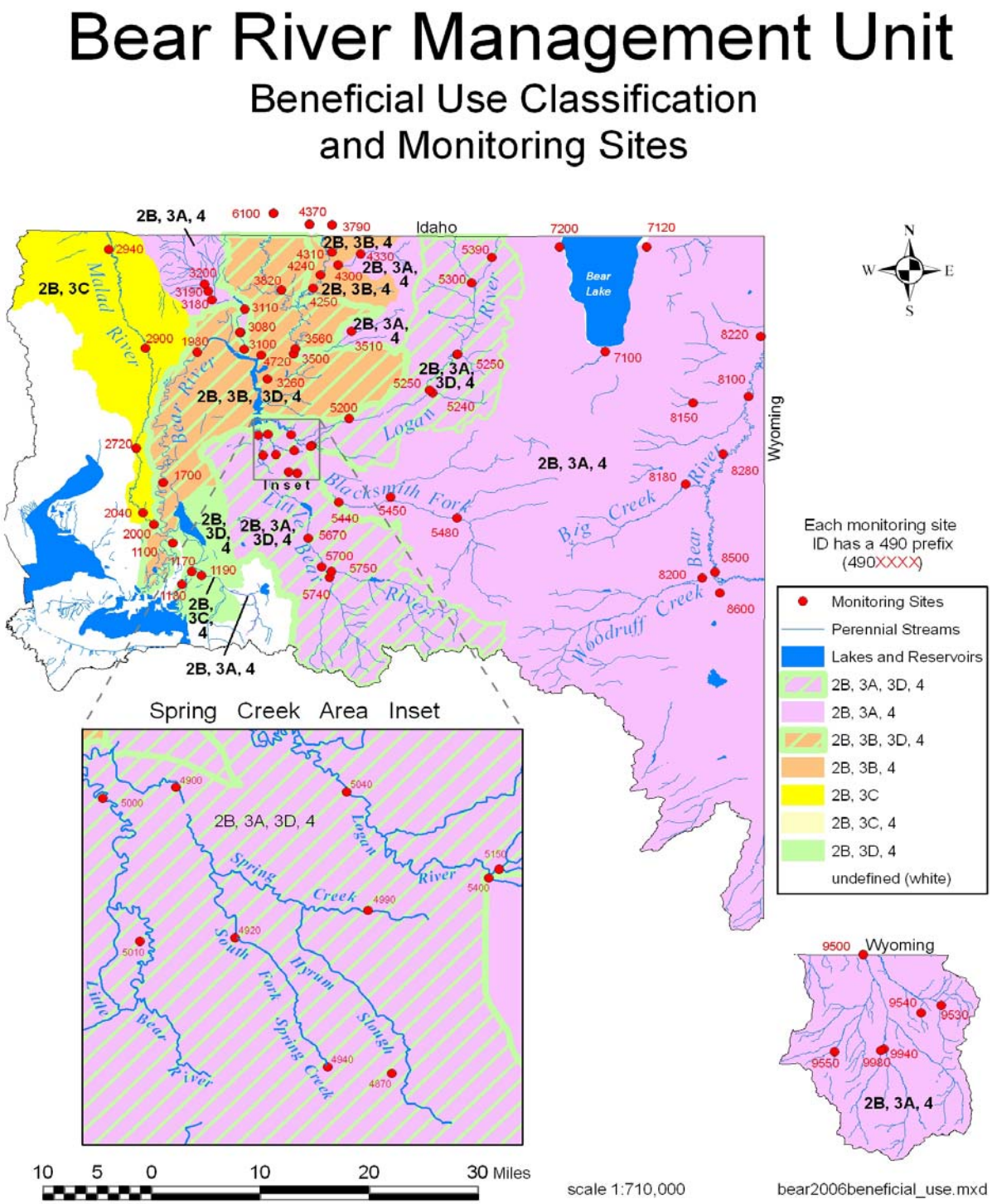


Figure 2.4.2. River and stream beneficial us classes – Bear River Watershed Management Unit.

2.4.1.2 Assessment by Categories – Table 2.4.2 is a list of streams miles assigned to the various beneficial use categories during the assessment. Figure 2.5.3 is a map of the stream miles that were assessed during this cycle.

Table 2.4.2. Stream Miles By Assessment Category - Bear River Watershed Management Unit

Category	Category Definition	Stream Miles
1	All beneficial uses fully supported.	0.0
2	Beneficial uses assessed are fully supported.	701.3
3A	No data or insufficient data to make an assessment.	150.0
3B	Lakes that are not supported for one cycle only.	0.0
3C	Insufficient data to assess but an assessment plan is in place.	0.0
4A	Approved TMDL	168.5
4B	Pollution control requirements are expected to result in full beneficial use support in near future.	0.0
4C	Impaired by pollution, no TMDL required.	0.0
5	Impaired by pollutant, TMDL required.	200.8

2.4.1.3 Individual Beneficial Use Support – Use support by individual beneficial use designations is summarized in Table 2.4.3. For aquatic life, 1124.8 miles were assessed. Of these, 742.2 miles (65.7%), were assessed as supporting aquatic life beneficial uses. This was 65.9% of the stream miles assessed. There were 382.6 miles assessed (34.0%) as not supporting aquatic life. Of the 991.9 miles assessed for agricultural use, 874 miles (88.1%) were fully supporting and 117.2 miles (11.9%) not supporting this beneficial use. Of the stream miles assessed for swimming and secondary contact recreation, all were assessed as not supporting this beneficial use. They were impaired by pH and pathogens.

Table 2.4.3. Individual Use Support Summary – Bear River Watershed Management Unit.

Use	Size Assessed	Size Fully Supporting	Size Fully Supporting but Threatened	Size Not Supporting	Size Not Attainable
Aquatic Life	1,088.0	701.3	0.0	386.6	0.0
Fish Consumption	0.0	0.0	0.0	0.0	0.0
Swimming	34.2	0.0	0.0	34.2	0.0
Secondary Contact	34.2	0.0	0.0	34.2	0.0
Drinking Water	0.0	0.0	0.0	0.0	0.0
Agricultural	991.9	874.0	0.0	117.9	0.0
Total	1,125.1	738.5	0.0	386.6	0.0
Use					
Aquatic Life		64.5%		35.5%	
Fish Consumption		0.0%		0.0%	
Swimming		0.0%		100.0%	
Secondary Contact		0.0%		100.0%	
Drinking Water		0.0%		0.0%	
Agricultural		88.1%		11.9%	

Total		65.6%		34.4%	

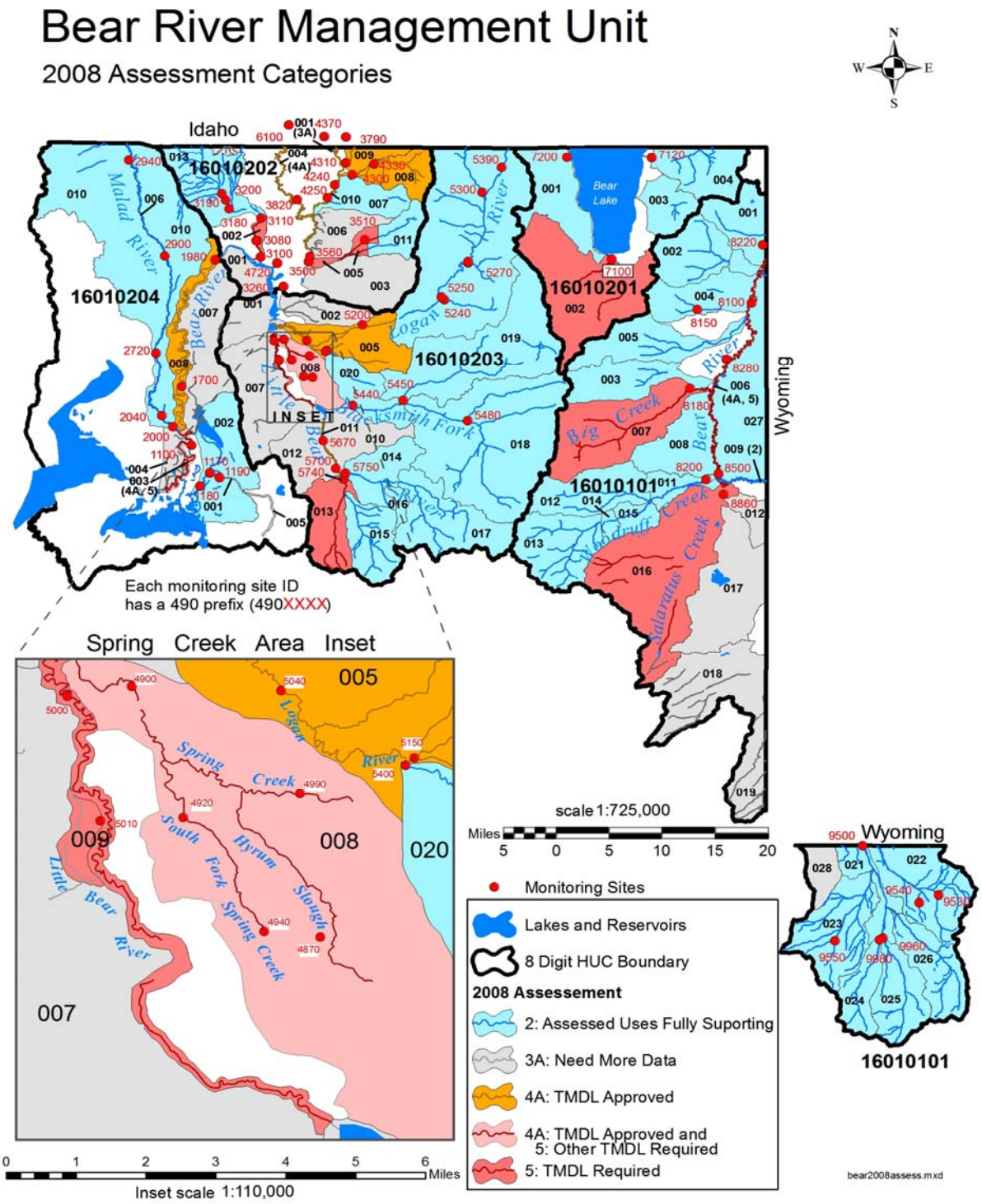


Figure 2.4.2. River and stream designated beneficial uses – Bear River Watershed Management Unit.

2.4.1.4 Total l Waters Impaired by Various Causes - Table 2.4.4 is a list of the stream miles affected by the various causes categories identified as generally affecting water quality. The major cause of water quality impairment was total phosphorus, a nutrient (Figure.2.4.5). Other factors affecting beneficial uses were temperature, dissolved oxygen, pH and temperature. The relative percent impact by causes is shown in Figure 2.4.6.

2.4.1.5 Total Waters Impaired by Various Sources - Table 2.4.6 is a list of the stream miles affected by various sources categories. The major sources of impairment were agricultural activities. A significant number of sources of impairment were unknown. It is estimated that 17.6% of the stream miles were affected by agricultural practices and 14.9% sources were unknown. The percent of the stream miles affected by sources is in Figure 2.4.6. The relative percent impacts by sources are shown in Figure 2.4.7.

2.4.1.5 Impaired Assessment Units - Table 2.4.4 is a list of the impaired waters in the Bear River Watershed Management Unit. It includes the Assessment Unit ID, assessment category, AU description, the cause of impairment, and stream miles.

Table 2.4.4 Total Waters Impaired by Various Cause Categories (Stream Miles) - Bear River Watershed Management Unit	
Cause Category	**Stream Miles**
Cause unknown	0.0
Unknown toxicity	0.0
Pesticides	0.0
Priority organics	0.0
Nonpriority organics	0.0
Metals	0.0
Ammonia	7.4
Chlorine	0.0
Other inorganics	0.0
Nutrients	168.5
pH	26.8
Siltation/Sediments	0.0
Organic enrichment/low DO	92.1
Salinity/TDS/Chlorides	53.9
Thermal modifications	113.9
Flow alterations	0.0
Other habitat alterations	0.0
Pathogen Indicators	7.5
Radiation	0.0
Oil and grease	0.0
Taste and odor	0.0
Noxious aquatic plants	0.0
Total toxics	0.0
Turbidity	0.0
Exotic species	0.0
Other (specify)	0.0

Table 2.4.5. Total Waters Impaired by Various Source Categories (Stream Miles) – Bear River Watershed Management Unit.	
Source Category	**Total Miles Affected**
Industrial Point Sources	66.4
Municipal Point Sources	66.4
Combined Sewer Overflow	0.0
Agriculture	197.5
Silviculture	
Construction	
Urban Runoff/Storm Sewers	32.2
Resource Extraction	
Land Disposal	
Hydromodification	12.0
Habitat Modification	14.3
Marinas	
Atmospheric Deposition	
Contaminated Sediments	
Unknown Source	162.9
Natural Sources	46.6
Reservoir Releases	
Recreation	
Aquaculture	
Extreme Drought	

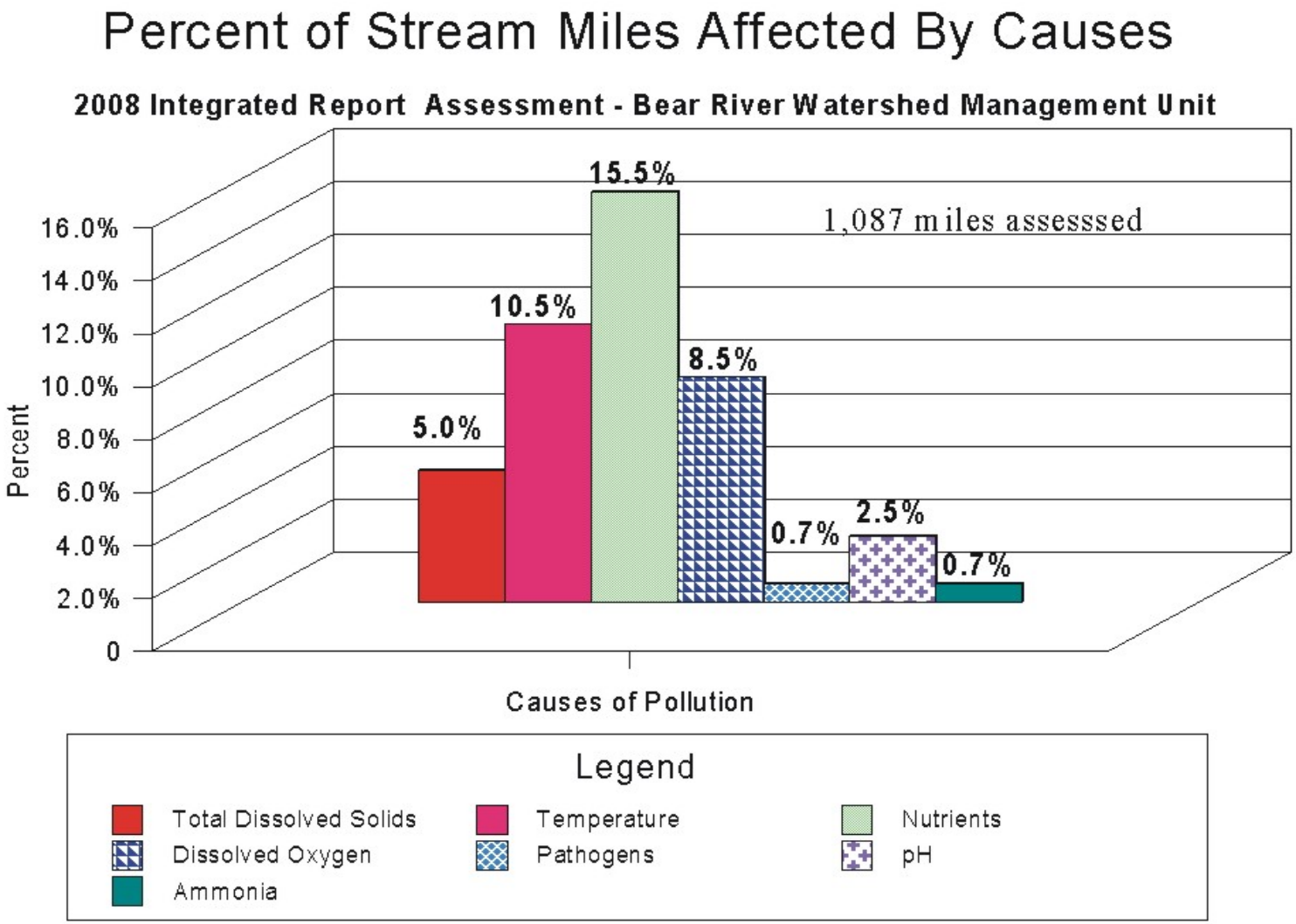


Figure 2.4.4. Percent of assessed stream miles impacted by various causes – Bear River Watershed Assessment Unit.

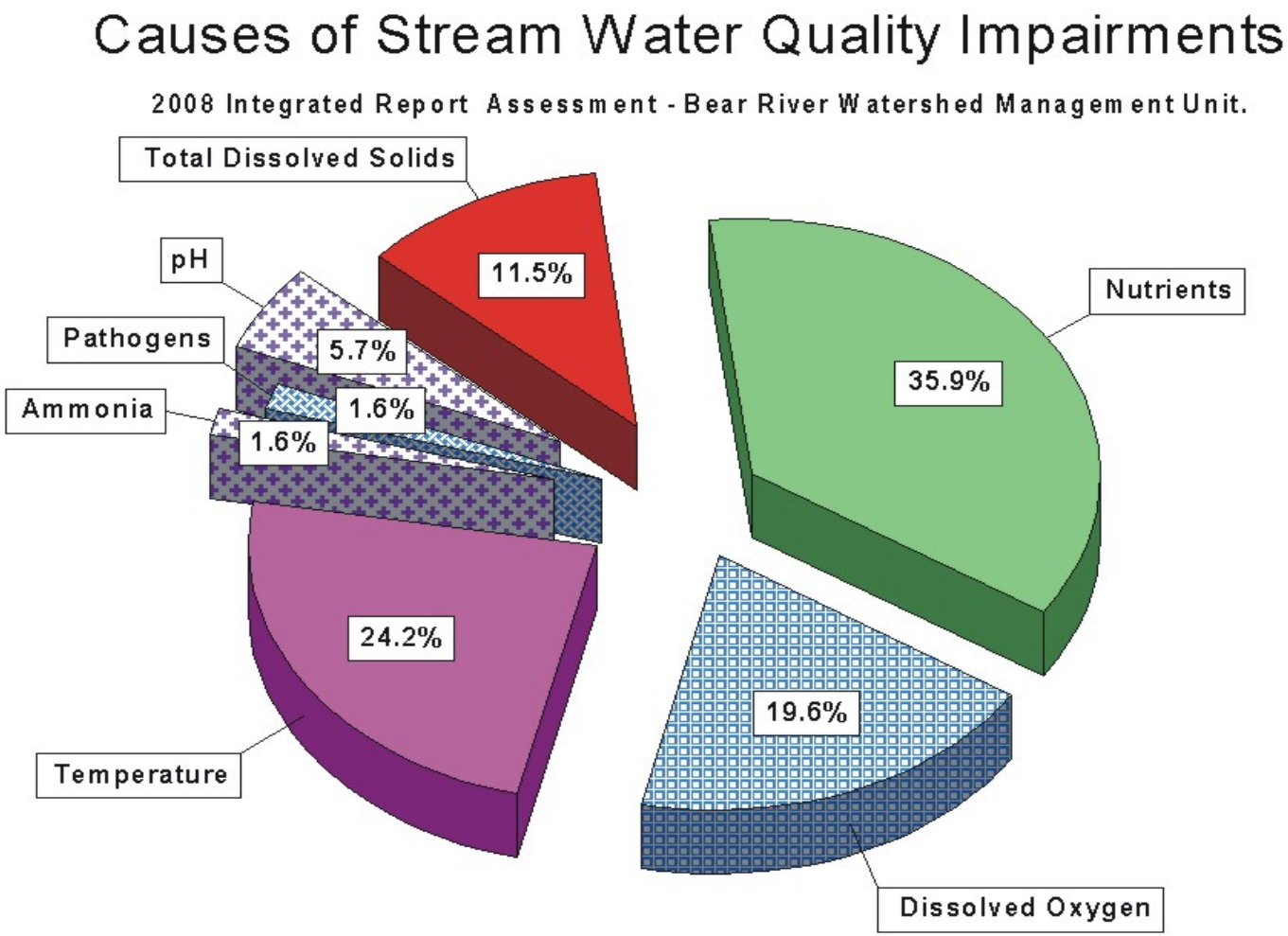


Figure 2.5.5. Relative percent impact by causes on water quality – Bear River Watershed Management Unit.

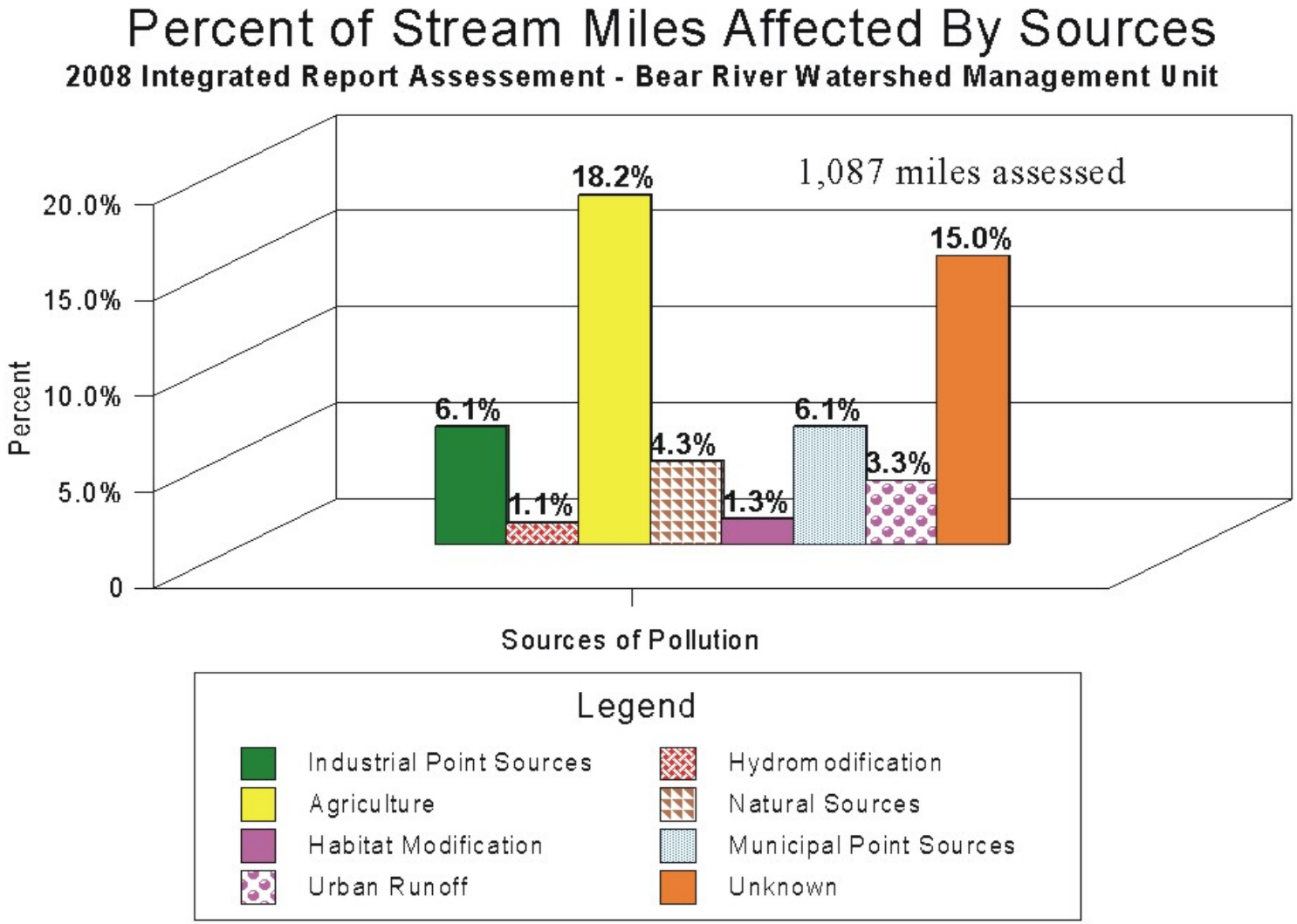


Figure 5.2.6. Percent of stream miles impacted by various sources – Bear River Watershed Management Unit.

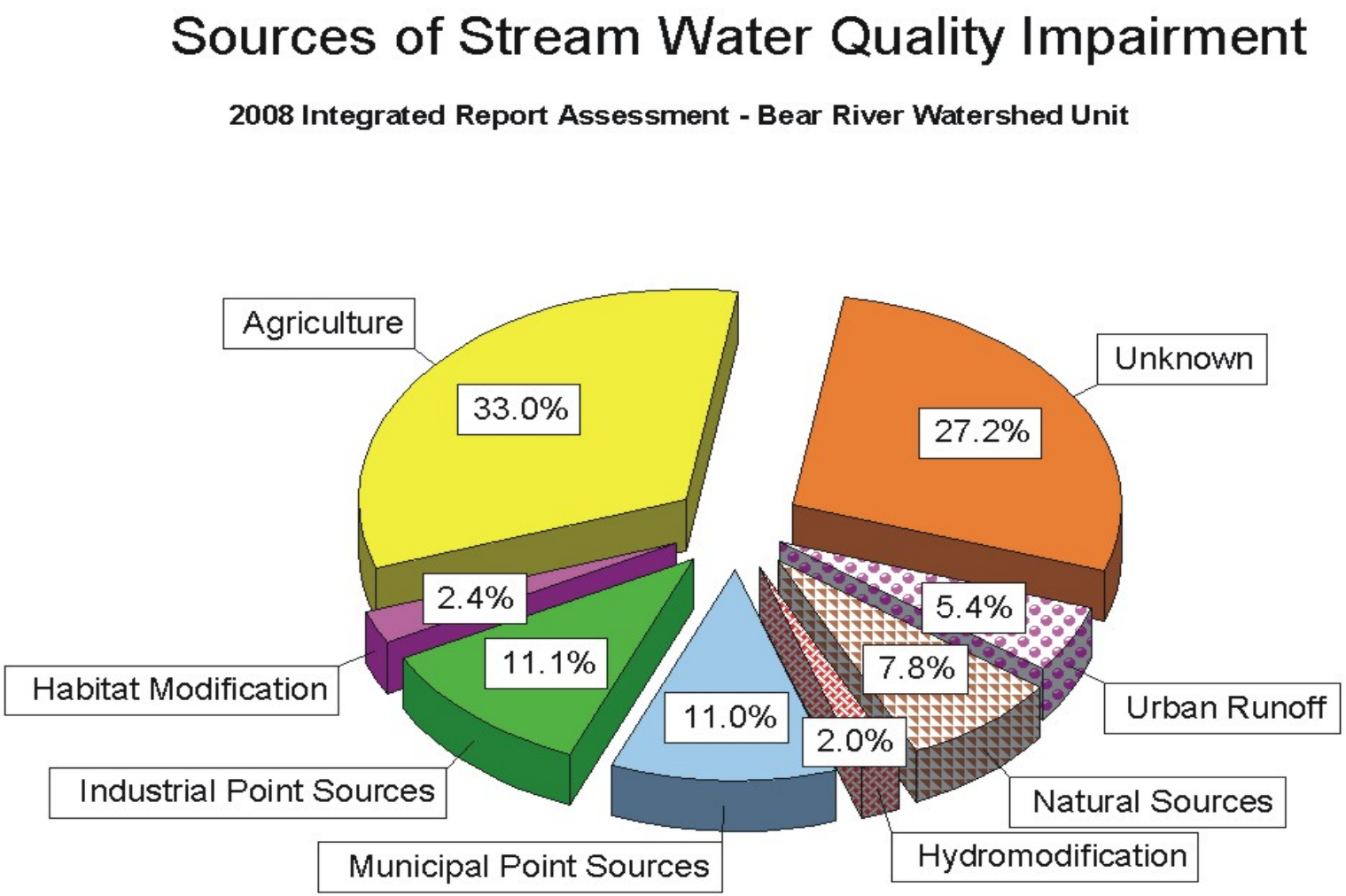


Figure 2.5.7. Relative percent impact by sources on stream water quality – Bear River Watershed Management Unit.

Table 2.4..6. Impaired Assessment Units In The Bear River Watershed Management Unit.								
Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Beneficial Use Class Impaired	Beneficial Use Support	Support Category	Pollutant Or Pollution	Source	Stream Miles
UT16010101-006	Bear River-4	Bear River from Woodruff Creek north to Sage Creek Junction	3A	NS	4A	Dissolved Oxygen	-	55.67
UT16010101-006	Bear River-4	Bear River from Woodruff Creek north to Sage Creek Junction	3A	NS	5	Thermal Modification	-	55.67
UT16010101-007	Big Creek	Big Creek and tributaries from Bear River to headwaters	2B	NS	5	pH	-	26.84
UT16010101-007	Big Creek	Big Creek and tributaries from Bear River to headwaters	3A	NS	5	pH	-	26.84
UT16010101-007	Big Creek	Big Creek and tributaries from Bear River to headwaters	4	NS	5	pH	-	26.84
UT16010101-016	Saleratus Creek	Saleratus Creek and tributaries from confluence with Woodruff Creek to headwaters	3A	NS	5	Dissolved Oxygen	-	29.05
UT16010101-016	Saleratus Creek	Saleratus Creek and tributaries from confluence with Woodruff Creek to headwaters	4	NS	5	Salinity/TDS/Chlorides	-	29.05
UT16010201-002	Laketown	Laketown & Big Creek & other tribs from Bear Lake to headwaters	3A	NS	5	Thermal Modification	-	11.5
UT16010202-002	Newton Creek	Newton Creek from confluence w/Cutler Reservoir to Newton Reservoir	3A	NS	5	Thermal Modification	-	
UT16010202-002	Newton Creek	Newton Creek from confluence w/Cutler Reservoir to Newton Reservoir	3B	NS	4A	Nutrients	-	5.16
UT16010202-004	Bear River-3	Bear River from Cutler Reservoir to Idaho Stateline	3B	NS	4A	Nutrients	-	27.84
UT16010202-005	Summit Creek Lower	Summit Creek and tributaries from confluence with Bear River to U. S. Forest Service Boundary	3A	NS	5	Thermal Modification	-	6.8
UT16010202-008	High Creek Lower	High Creek and tributaries from confluence w/ Cub River to U.S. Forest Service Boundary	3A	NS	4A	Nutrients	-	3.1
UT16010202-009	Spring Creek Lewiston	Spring Creek (Lewiston) and tributaries from confluence to Utah Idaho border	3B	NS	4A	Nutrients	-	2.96
UT16010202-010	Cub River	Cub River and tributaries from confluence w/ Bear River to Utah-Idaho Stateline	3B	NS	4A	Nutrients	-	14.31
UT16010203-005	Logan River-1	Logan River and tributaries, except Blacksmith Fork drainage, from Cutler Reservoir to Third Dam	3B	NS	4A	Nutrients	-	32.19

Table 2.4..6. Impaired Assessment Units In The Bear River Watershed Management Unit.								
Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Beneficial Use Class Impaired	Beneficial Use Support	Support Category	Pollutant Or Pollution	Source	Stream Miles
UT16010203-008	Spring Creek	Spring Creek and tributaries from confluence w/ Little Bear River to headwaters	2B	NS	5	Pathogens	-	7.36
UT16010203-008	Spring Creek	Spring Creek and tributaries from confluence w/ Little Bear River to headwaters	3A	NS	5	Dissolved Oxygen	-	7.36
UT16010203-008	Spring Creek	Spring Creek and tributaries from confluence w/ Little Bear River to headwaters	3A	NS	4A	Nutrients	-	7.36
UT16010203-008	Spring Creek	Spring Creek and tributaries from confluence w/ Little Bear River to headwaters	3A	NS	4A	Thermal Modification	-	7.36
UT16010203-008	Spring Creek	Spring Creek and tributaries from confluence w/ Little Bear River to headwaters	3A	NS	5	Unionized Ammonia	-	7.36
UT16010203-008	Spring Creek	Spring Creek and tributaries from confluence w/ Little Bear River to headwaters	4	NS	5	Total Dissolved Solids	-	7.36
UT16010203-009	Little Bear River-1	Little Bear River from Cutler Reservoir to Hyrum Reservoir	3A	NS	4A	Nutrients	-	16.52
UT16010203-009	Little Bear River-1	Little Bear River from Cutler Reservoir to Hyrum Reservoir	3A	NS	5	Thermal Modification	-	16.52
UT16010203-013	South Fork Little Bear	South Fork Little Bear and tributaries from confluence with Little Bear River to headwaters, except Davenport Creek	3A	NS	5	Thermal Modification	-	16
UT16010204-003	Bear River-1	Bear River from Great Salt Lake to Malad River confluence	3B	NS	4A	Nutrients	-	17.51
UT16010204-003	Bear River-1	Bear River from Great Salt Lake to Malad River confluence	4	NS	5	Total Dissolved Solids	-	17.51
UT16010204-008	Bear River-2	Bear River from Malad River confluence to Cutler Reservoir	3B	NS	4A	Nutrients	-	41.5

Chapter 2.5. Weber River Watershed Management Unit Assessment

2.5.1 Introduction

The Weber River rises in Summit County near Reids Peak (11,708 ft), then flows west to Oakley, Utah; then turns and flows in a north westerly direction to the Great Salt Lake (4,200 ft). The Weber River is approximately 125 miles long; one-half of which lies in Summit County, 25 miles flow in Morgan County and 30 miles in Weber County. The Ogden River, the major tributary to the Weber River, lies within Weber County and enters the Weber River about 12 miles upstream from its mouth. The other major tributaries to the Weber River are East Canyon Creek, Lost Creek, Chalk Creek, and Beaver Creek. Two smaller tributaries that can affect the water quality of the Weber River are Echo Creek and Silver Creek.

Table 2.5.1. U.S.G.S. Hydrological Units in the Weber River Watershed Management Unit.

Hydrological Unit Code	Hydrological Unit Name
16020101	Upper Weber
16020102	Lower Weber

2.5.2 Water Quality Assessment Results

The 2006 305(b) assessment was used as the basis for assessing the rivers and streams in this watershed management unit. Data collected since the 2006 assessment were used to assess any changes. Data collected at the long-term and point source sites were also used in the assessment. Benthic macroinvertebrate data were used to assess aquatic beneficial use at sites the data were collected at. The designated beneficial use classes assigned to rivers and streams are mapped in Figure 2.5.1. Water chemistry and field data were compared against state standards to determine beneficial use support. Benthic macroinvertebrate data were used to assess beneficial use support under the narrative standard (Chapter 17). The beneficial uses assigned to rivers and streams are mapped in figure 2.5.1.

2.5.2.1 Overall Beneficial Use Support -- An assessment of beneficial use support was made for 866.4 miles. Based upon at least one beneficial use being assessed, 464.5 miles (53.6%) were assessed as fully supporting and 401.8 miles (46.4%) as not supporting (Figure 2.5.2).

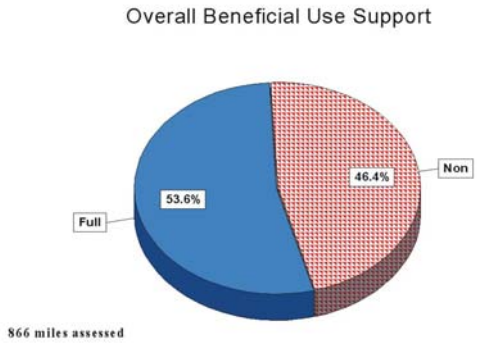


Figure 2.5.1. Overall Beneficial Use Support

2.5.1.2 Assessment by Categories – Table 2.5.2 is a list of streams miles assigned to the various beneficial use categories during the assessment. Figure 2.5.3 is a map of the beneficial use support by categories.

2.5.1.3 Individual Beneficial Use Support - Table 2.5.3. lists the beneficial use support by individual beneficial use classes. Four-hundred sixty-four (464) were assessed as

supporting their aquatic life beneficial uses. This was 53.6% of the stream miles assessed. There were 401.8 miles (46.4%) assessed as not supporting aquatic life. Of the 812.5 miles assessed for agricultural use, all were assessed as fully supporting. As a source of drinking water, 744.9 miles (97.2%) were assessed as fully supported and 21.3 miles as not supporting. Silver Creek is the stream that does not meet drinking water standards.

Table. 2.5.2. Stream Miles By Assessment Category – Weber River Watershed Management Unit.

Category	Category Definition	Stream Miles
1	All beneficial uses fully supported.	0.0
2	Beneficial uses assessed are fully supported.	464.5
3A	No data or insufficient data to make an assessment.	186.9
3B	Lakes that are not supported for one cycle only.	0.0
3C	Insufficient data to assess but an assessment plan is in place.	0.0
4A	Approved TMDL	250.2
4B	Pollution control requirements are expected to result in full beneficial use support in near future.	0.0
4C	Impaired by pollution, no TMDL required.	393.7
5	Impaired by pollutant, TMDL required.	10.5

Table 2.5.3. Individual Use Support Summary – Weber River Watershed Management Unit.

Use	Size Assessed	Size Fully Supporting	Size Fully Supporting but Threatened	Size Not Supporting	Size Not Attainable
Aquatic Life	866.3	464.5	0.0	401.8	0.0
Fish Consumption	0.0	0.0	0.0	0.0	0.0
Swimming	0.0	0.0	0.0	0.0	0.0
Secondary Contact	0.0	0.0	0.0	0.0	0.0
Drinking Water	766.2	744.9	0.0	21.3	0.0
Agricultural	812.5	812.5	0.0	0.0	0.0
Total	866.3	464.5	0.0	401.8	0.0
Use					
Aquatic Life		53.6%		46.4%	
Fish Consumption		0.0%		0.0%	
Swimming		0.0%		0.0%	
Secondary Contact		0.0%		0.0%	
Drinking Water		97.2%		2.8%	

Table 2.5.3. Individual Use Support Summary – Weber River Watershed Management Unit.					
			Size Fully		
	Size	Size Fully	Supporting	Size Not	Size Not
	Assessed	Supporting	but	Supporting	Attainable
Use			Threatened		
Agricultural		100.0%		0.0%	
Total		53.6%		46.4%	

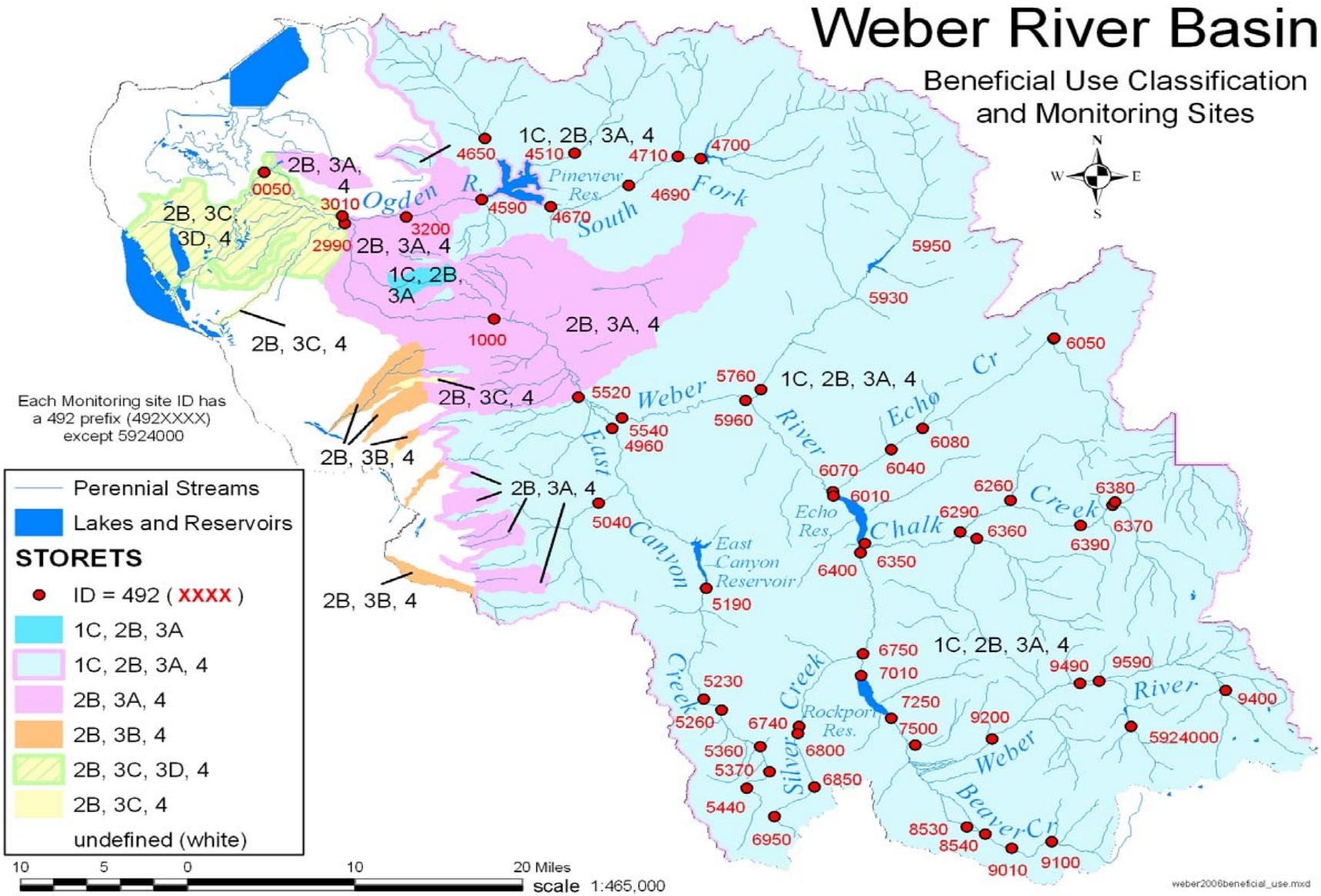


Figure 2.5.2. Weber River Watershed Management Unit beneficial use classifications.

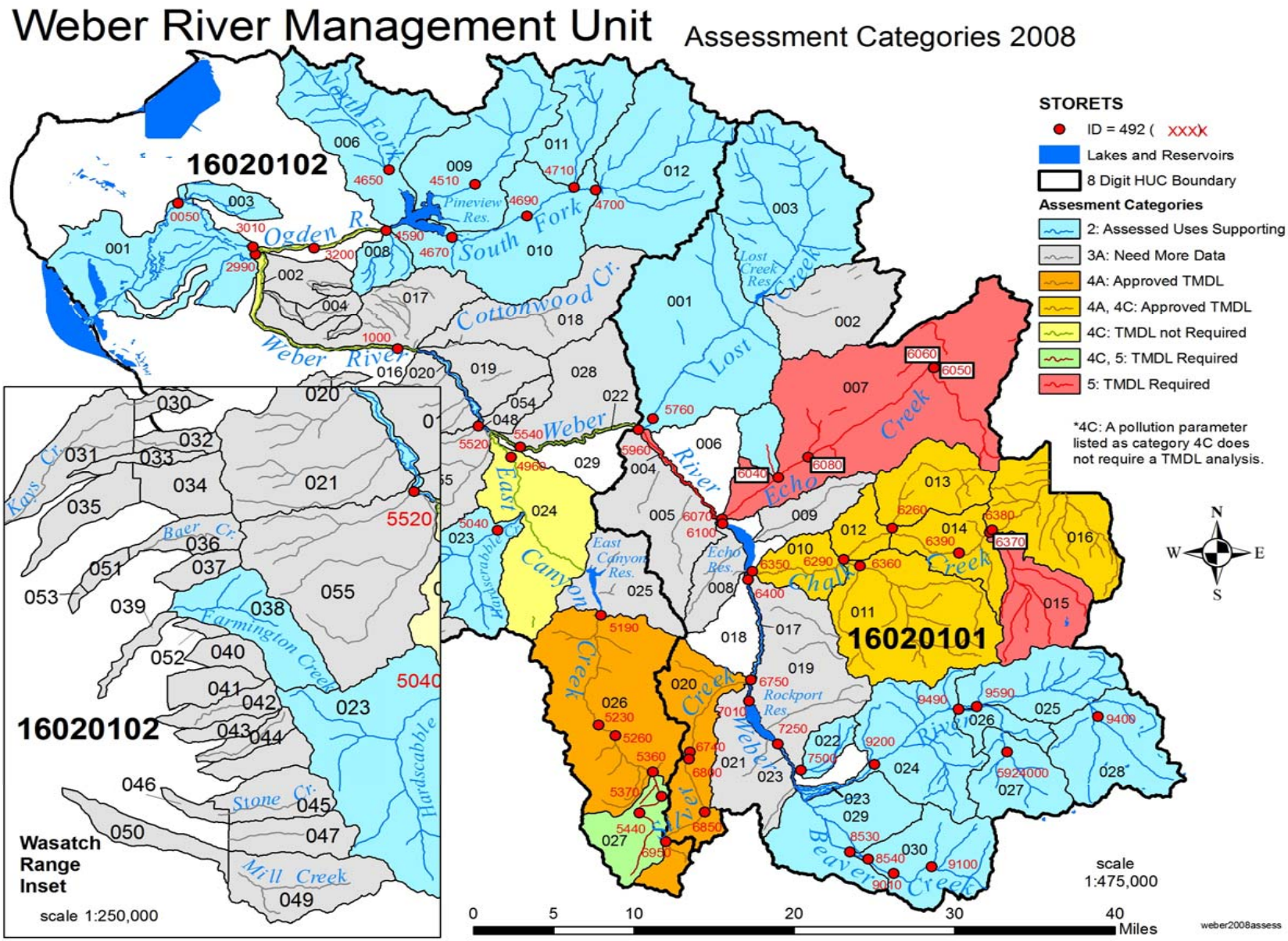


Figure 1.5.3. Weber River Watershed Management Unit assessment by categories.

2.5.6

2.5.1.4 Total Waters Impaired by Various Causes –Table 2.5.4 is a list of stream files affected by the various causes of pollution. The major cause of water quality impairments were sediment (Siltation/Sediment), total phosphorus, and habitat alterations such as loss of riparian habitat and in-stream structure and function. (Figure 2.5.4). The metals; arsenic, zinc, and cadmium; are the causes of impairment in Silver Creek. Historical mining practices and tailings are the source of the contamination. The relative percent impact by causes is shown in Figure 2.5.5.

2.5.1.4 Total Waters Impaired by Various Sources –Table 2.5.5 contains a list sources that caused stream impairments. The major sources of impairment were agricultural activities, habitat modification, resource extraction, and natural sources. The percent of stream miles impaired by these sources are found in Figure 2.5.6. The relative percent impacts by sources are shown in Figure 2.5.7.

2.5.8

Table 2.5.4. Total Waters Impaired by Various Cause Categories – Weber Watershed Management Unit.	
Cause Category	**Stream Miles**
Cause unknown	0.0
Unknown toxicity	0.0
Pesticides	-
Priority organics	-
Nonpriority organics	-
Metals	21.4
Ammonia	0.0
Chlorine	0.0
Other inorganics	0.0
Nutrients	195.2
pH	0.0
Siltation/Sediment	181.1
Organic enrichment/low DO	34.7
Salinity/TDS/Chlorides	0.0
Thermal modifications	0.0
Flow alterations	110.5
Other habitat alterations	293.7
Pathogen Indicators	0.0
Radiation	-
Oil and grease	-
Taste and odor	0.0
Noxious aquatic plants	0.0
Total toxics	0.0
Turbidity	-
Exotic Species	-

Table 2.5.5. Total Waters Impaired by Various Source Categories – Weber Watershed Management Unit.	
Source Category	**Stream Miles**
Industrial Point Sources	0.0
Municipal Point Sources	34/7
Combined Sewer Overflow	0.0
Agriculture	254.8
Silviculture	-
Construction	0.0
Urban Runoff/Storm Sewers	57.6
Resource Extraction	158.3
Land Disposal	0.0
Hydromodification	288.4
Habitat Modification	159.2
Marinas	*
Atmospheric Deposition	-
Contaminated Sediments	-
Unknown Source	44.2
Natural Sources	142.3
Reservoir Releases	0.0
Recreation	0.0

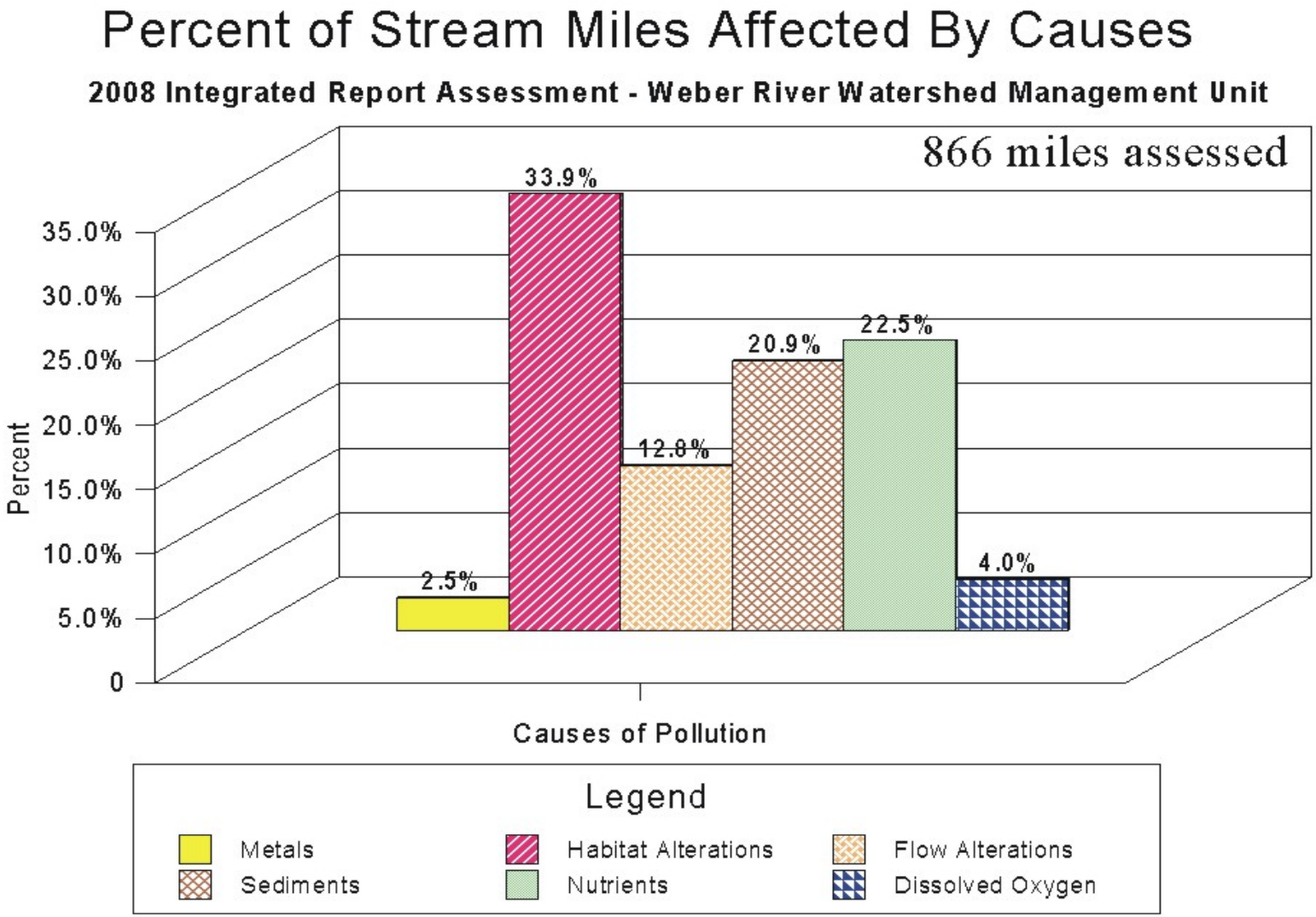


Figure 2.5.4. Percent impact by causes on stream water quality – Weber River Watershed Management Unit.

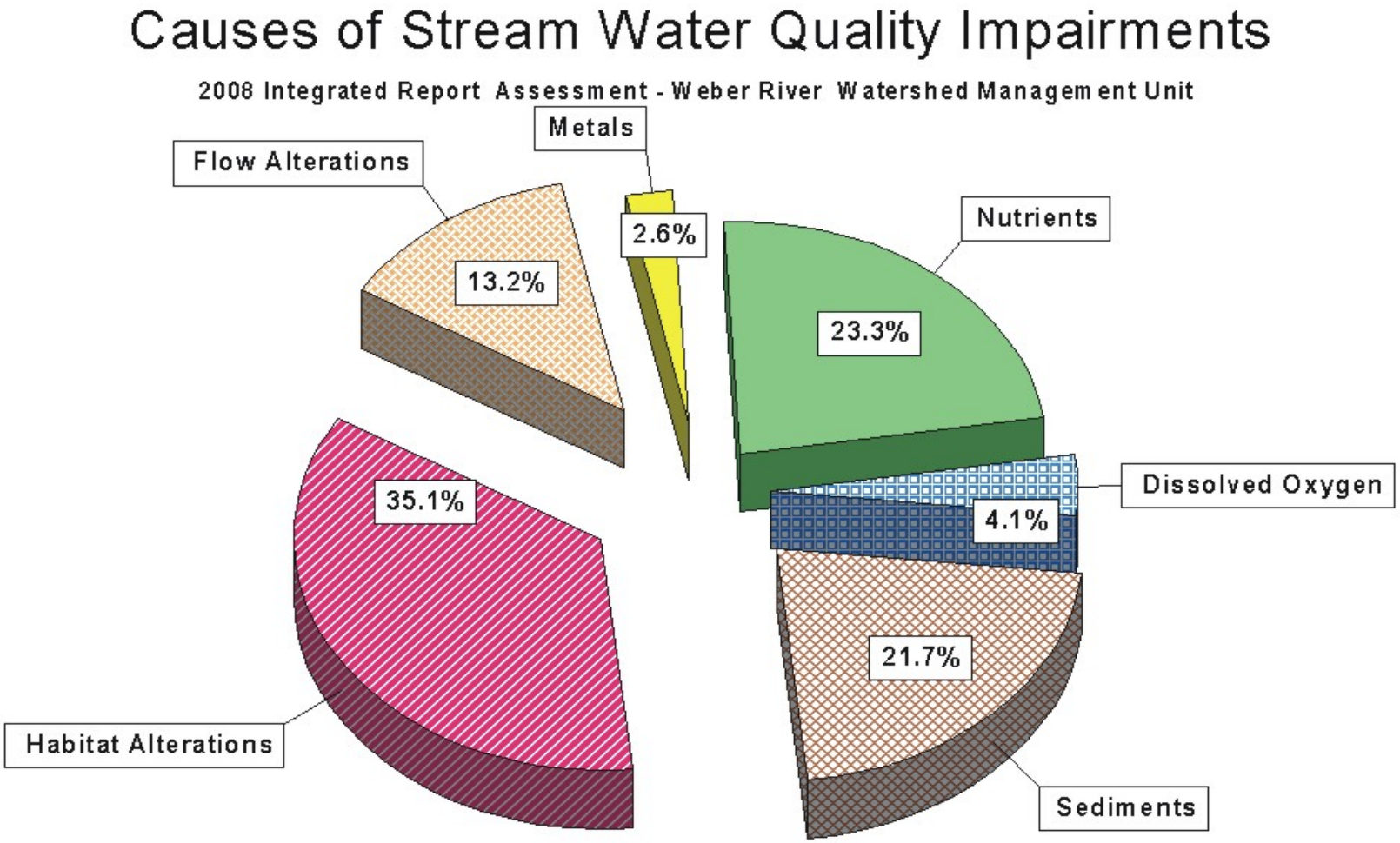


Figure 2.5.5. Relative percent contribution of causes on stream water quality – Weber River Watershed Management Unit.

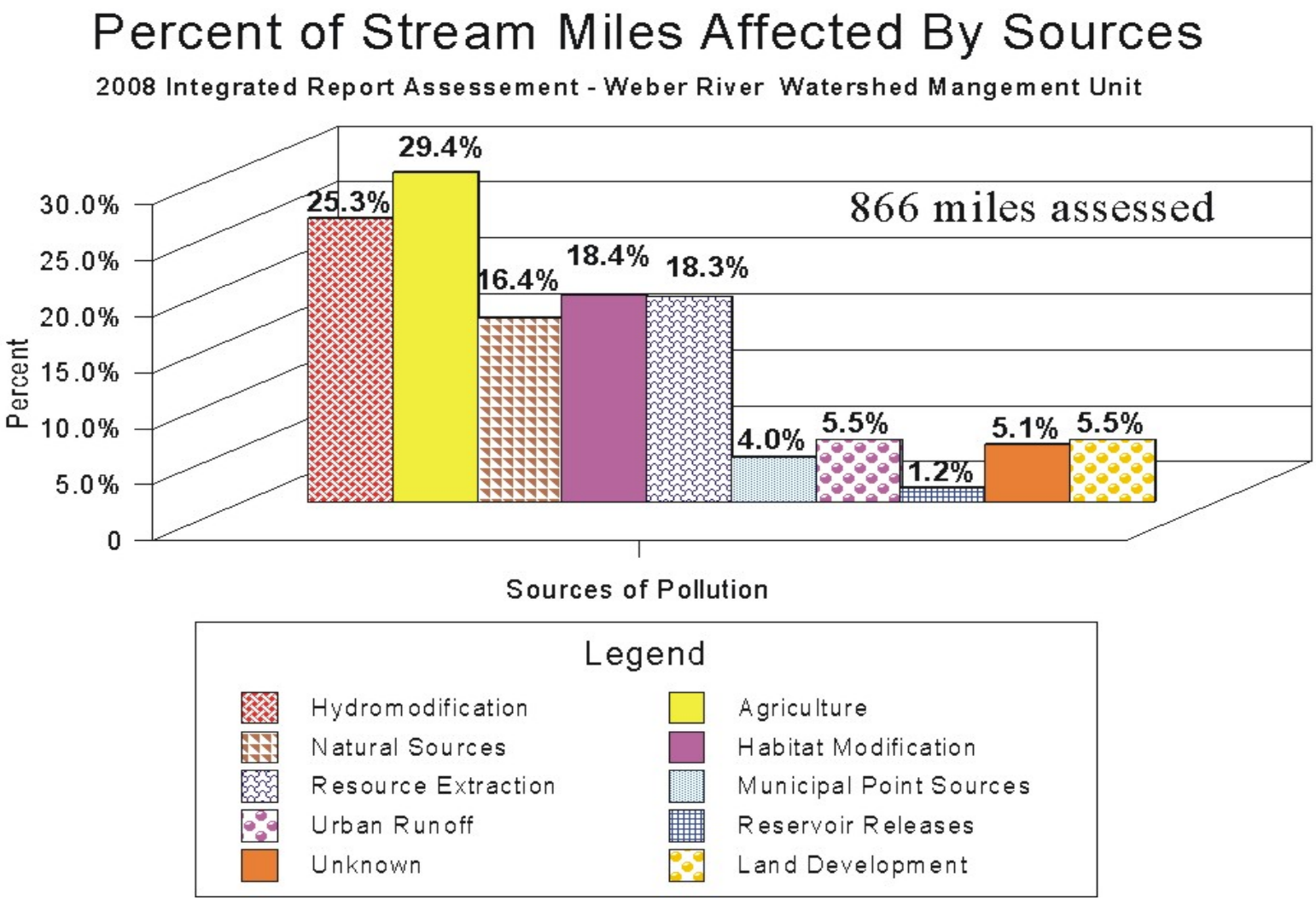


Figure 2.5.6. Percent of assessed stream miles impacted by various sources – Weber River Watershed Management Unit.

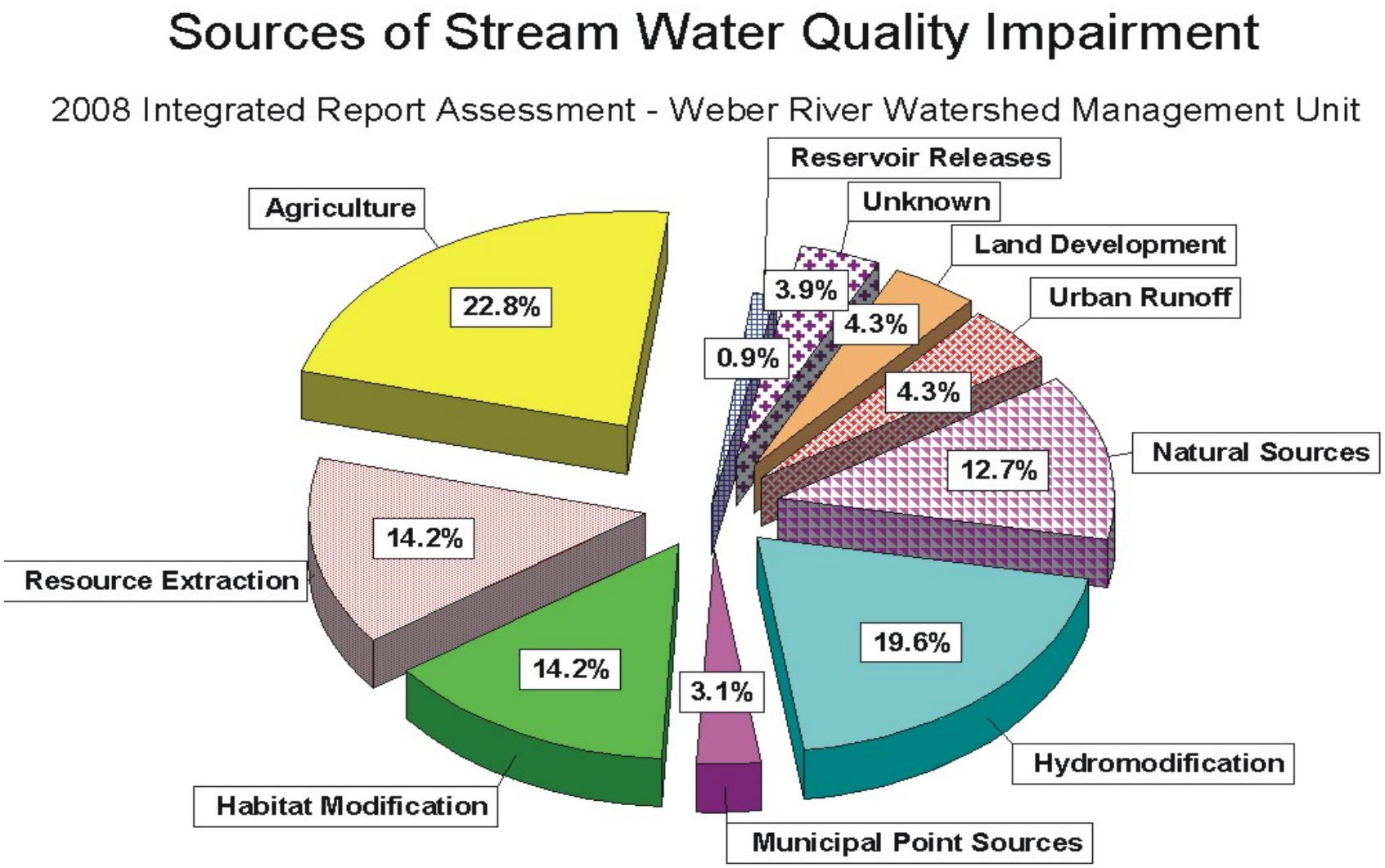


Figure 2.5.7. Relative percent impact by causes on water quality – Weber River Watershed Management Unit.

Table 2.5.6. Impaired Assessment Units In The Weber River Watershed Management Unit.								
Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Beneficial Use Class Impaired	Beneficial Use Support	Support Category	Pollutant Or Pollution	Source	Stream Miles
UT16020101-004	Weber River-7	Weber River segment between confluence Lost Creek and Echo Reservoir	3A	NS	5	Total Phosphorus	-	10.57
UT16020102-002	Weber River-1	Great Salt Lake to Slaterville Diversion	3C	NS	4C	Other habitat alteration	-	60.15
UT16020102-002	Weber River-1	Great Salt Lake to Slaterville Diversion	3C	NS	4C	Flow alteration	-	60.15
UT16020101-007	Echo Creek	Echo Creek and tributaries except Sawmill Creek from confluence w/ Weber River to headwaters	3A	NS	4A	Siltation/Sediment	-	44.15
UT16020101-010	Chalk Creek-1	Chalk Creek and tributaries from confluence w/ Weber River to South Fork confluence	3A	NS	4C	Other habitat alterations	-	7.67
UT16020101-010	Chalk Creek-1	Chalk Creek and tributaries from confluence w/ Weber River to South Fork confluence	3A	NS	4A	Total Phosphorus	-	7.67
UT16020101-010	Chalk Creek-1	Chalk Creek and tributaries from confluence w/ Weber River to South Fork confluence	3A	NS	4A	Siltation/Sediment	-	7.67
UT16020101-011	South Fork Chalk Creek	South Fork Chalk Creek and tributaries from confluence w/ Chalk Creek to headwaters	3A	NS	4C	Other habitat alterations	-	47.4
UT16020101-011	South Fork Chalk Creek	South Fork Chalk Creek and tributaries from confluence w/ Chalk Creek to headwaters	3A	NS	4A	Total Phosphorus	-	47.4
UT16020101-011	South Fork Chalk Creek	South Fork Chalk Creek and tributaries from confluence w/ Chalk Creek to headwaters	3A	NS	4A	Siltation/Sediment	-	47.4
UT16020101-012	Chalk Creek-2	Chalk Creek and tributaries from South Fork confluence to Huff Creek confluence	3A	NS	4C	Other habitat alterations	-	4.49
UT16020101-012	Chalk Creek-2	Chalk Creek and tributaries from South Fork confluence to Huff Creek confluence	3A	NS	4A	Phosphorus	-	4.49
UT16020101-012	Chalk Creek-2	Chalk Creek and tributaries from South Fork confluence to Huff Creek confluence	3A	NS	4A	Siltation/Sediment	-	4.49
UT16020101-013	Huff Creek	Huff Creek and tributaries from confluence w/ Chalk Creek to headwaters	3A	NS	4C	Other habitat alterations	-	16.39

Table 2.5.6. Impaired Assessment Units In The Weber River Watershed Management Unit.								
Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Beneficial Use Class Impaired	Beneficial Use Support	Support Category	Pollutant Or Pollution	Source	Stream Miles
UT16020101-013	Huff Creek	Huff Creek and tributaries from confluence w/ Chalk Creek to headwaters	3A	NS	4A	Total Phosphorus	-	16.39
UT16020101-013	Huff Creek	Huff Creek and tributaries from confluence w/ Chalk Creek to headwaters	3A	NS	4A	Siltation/Sediment	-	16.39
UT16020101-014	Chalk Creek-3	Chalk Creek and tributaries from Huff Creek confluence to East Fork confluence	3A	NS	4C	Other habitat alterations	-	13.73
UT16020101-014	Chalk Creek-3	Chalk Creek and tributaries from Huff Creek confluence to East Fork confluence	3A	NS	4A	Total Phosphorus	-	13.73
UT16020101-014	Chalk Creek-3	Chalk Creek and tributaries from Huff Creek confluence to East Fork confluence	3A	NS	4A	Siltation/Sediment	-	13.73
UT16020101-015	East Fork Chalk Creek	East Fork Chalk Creek and tributaries from confluence w/ Chalk Creek to headwaters	3A	NS	4C	Other Habitat Alterations	-	28.42
UT16020101-016	Chalk Creek-4	Chalk Creek and tributaries from East Fork Chalk Creek confluence to headwaters	3A	NS	4C	Other habitat alterations	-	47.29
UT16020101-016	Chalk Creek-4	Chalk Creek and tributaries from East Fork Chalk Creek confluence to headwaters	3A	NS	4A	Total Phosphorus	-	47.29
UT16020101-016	Chalk Creek-4	Chalk Creek and tributaries from East Fork Chalk Creek confluence to headwaters	3A	NS	4A	Siltation/Sediment	-	47.29
UT16020101-020	Silver Creek	Silver Creek and tributaries from confluence w/Weber River to headwaters	1C	NS	4A	Metals	-	21.37
UT16020102-002	Weber River-3	Weber River from Ogden River confluence to Cottonwood Creek confluence	3A	NS	4C	Other Habitat Alterations	-	17.86
UT16020102-005	Ogden River-1	Ogden River from confluence w/ Weber River to Pineview Reservoir	3A	NS	4C	Flow Alteration	-	9.66
UT16020102-005	Ogden River-1	Ogden River from confluence w/ Weber River to Pineview Reservoir	3A	NS	4C	Other Habitat Alterations	-	9.66
UT16020102-022	Weber River-6	Weber River between East Canyon Creek confluence and Lost Creek confluence	3A	NS	4C	Flow Alteration	-	12.37
UT16020102-022	Weber River-6	Weber River between East Canyon Creek confluence and Lost Creek confluence	3A	NS	4C	Other Habitat Alterations	-	12.37
UT16020102-024	East Canyon Creek -1	East Canyon Creek from confluence w/ Weber River to East Canyon Dam	3A	NS	4C	Flow Alteration	-	15.27
UT16020102-024	East Canyon Creek -1	East Canyon Creek from confluence w/ Weber River to East Canyon Dam	3A	NS	4C	Other Habitat Alterations	-	15.27
UT16020102-026	East Canyon Creek-2	East Canyon Creek and tributaries from East Canyon Reservoir to headwaters	3A	NS	4A	Organic enrichment/Low	-	34.66

Table 2.5.6. Impaired Assessment Units In The Weber River Watershed Management Unit.								
Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Beneficial Use Class Impaired	Beneficial Use Support	Support Category	Pollutant Or Pollution	Source	Stream Miles
						DO		
UT16020102-026	East Canyon Creek-2	East Canyon Creek and tributaries from East Canyon Reservoir to headwaters	3A	NS	4A	Total Phosphorus	-	34.66
UT16020102-027	Kimball Creek	Kimball Creek and tributaries from East Canyon Creek confluence to headwaters, including McLeod Creek	3A	NS	4C	Flow Alteration	-	12.97
UT16020102-027	Kimball Creek	Kimball Creek and tributaries from East Canyon Creek confluence to headwaters, including McLeod Creek	3A	NS	4C	Other Habitat Alterations	-	12.97
UT16020102-027	Kimball Creek	Kimball Creek and tributaries from East Canyon Creek confluence to headwaters, including McLeod Creek	3A	NS	5	Total Phosphorus	-	12.97

Chapter 2.6 Utah Lake-Jordan River Watershed Management Unit Assessment

2.6.1 Introduction

The Utah Lake-Jordan River Watershed Management Unit lies in north-central Utah and includes those streams that drain into Utah Lake and the Jordan River and its tributaries from Utah Lake to the Great Salt Lake. Utah Lake receives water from the Provo and Spanish Fork Rivers, and numerous tributaries that drain the Wasatch Mountains around it. In addition, the Duchesne Tunnel and Weber River diversions empty into the Provo River and a third diversion carries Strawberry Reservoir water into the lake via Diamond Fork and Spanish Fork Rivers. There are numerous streams that drain the Wasatch and Oquirrh Mountain ranges that flow into the Jordan River. Some of these streams are Little Cottonwood Creek, Big Cottonwood Creek, and Bingham Canyon Creek.

This management unit includes all streams located in the U.S.G.S Hydrological Units (HUCs) listed in Table 2.6.11 and is located in the north central part of the state.

Table 2.6.1. Hydrological Unit Codes and Names

Hydrological Unit Code	Hydrological Unit Name
16020201	Utah Lake
16020202	Spanish Fork
16020203	Provo
16020204	Jordan

2.6.2 Water Quality Assessment Results

Assessments were made using the 2006 305(b) report and data collected after the 2006 assessment. The majority of the Jordan River / Utah Lake Watershed is monitored annually. the DWQ, Salt Lake City, Salt Lake County, United States Geological Survey and the Utah Water Conservancy's collect data annually for a variety of reasons. These data are compared to the State standards to determine beneficial use support. The designated beneficial use for rivers and streams are mapped in Figure 2.6.1. In addition, benthic macroinvertebrate data are used to assess the aquatic life beneficial use classification (Chapter 14).

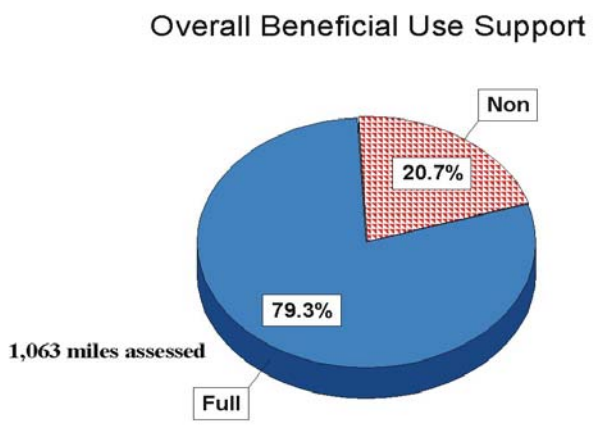


Figure 2.6.1. Overall Beneficial Use Support

2.6.2.1 Overall Beneficial Use Support --There are an estimated 1,314 perennial stream

miles within the Utah Lake-Jordan River Watershed Management Unit. Of the 1,063.4 miles assessed, 841,1 (81.4%) miles were assessed as fully supporting their beneficial uses, 220.4 (20.7%) miles were assessed as not supporting at least one designated beneficial use (Figure 2.5).

2.6.2.2 Beneficial Use Assessment By Categories-A list of the categories and the stream miles included in each of the assessment categories is in Table 2.6.2. Figure 2.6.3 is a map of the beneficial use assessment for the rivers and streams.

Table 2.6.2. Stream Miles By Assessment Category – Jordan River/Utah Lake Watershed Management Unit.

Category	Category Definition	Stream Miles
1	All beneficial uses fully supported.	42.0
2	Beneficial uses assessed are fully supported.	799.1
3A	No data or insufficient data to make an assessment.	118.2
3B	Lakes that are not supported for one cycle only.	0.0
3C	Insufficient data to assess but an assessment plan is in place.	0.0
4A	Approved TMDL	60.0
4B	Pollution control requirements are expected to result in full beneficial use support in near future.	0.0
4C	Impaired by pollution, no TMDL required.	138.8
5	Impaired by pollutant, TMDL required.	87.6

2.6.2.3 Individual Use Support --Of the streams assessed for aquatic life, 863.6 miles (81.4%) were assessed as fully supporting and 197.8 miles (18.6%) were identified as being non supporting.

Of the 1,032.8 stream miles assessed for agricultural use, 923.4 miles (89.4%) were assessed as fully supporting and 109.4 miles (10.6 %) were assessed not supporting their agricultural beneficial use classification.

Those stream segments that were determined not to be supporting at least one of their designated beneficial uses are called ‘water quality limited segments’ and can be placed on a list called the ‘303(d) list of impaired waters’. This list is submitted to EPA every two years and identifies those waters that are not meeting water quality standards or are assessed as not fully supporting one or more of their designated beneficial uses.

Table 2.6.3 Individual Beneficial Use Support Summary Jordan River / Utah Lake Watershed Management Unit (Stream Miles)

Use	Size Assessed	Size Fully Supporting	Size Fully Supporting but Threatened	Size Not Supporting	Size Not Attainable

Table 2.6.3 Individual Beneficial Use Support Summary Jordan River / Utah Lake Watershed Management Unit (Stream Miles)					
			Size Fully		
	Size	Size Fully	Supporting	Size Not	Size Not
	Assessed	Supporting	but	Supporting	Attainable
Use			**Threatened**		
Aquatic Life	1,061.4	863.6.2	0.0	197.18	0.0
Fish Consumption	0.0	0.0	0.0	0.0	0.0
Swimming	138.2	112.2	0.0	26.88	0.0
Secondary Contact	138.2	112.2	0.0	26.88	0.0
Drinking Water	474.6	470.5	0.0	4.1	0.0
Agricultural	1,032.8	923.4	0.0	109.4	0.0
Total	1,063.4	841.1	212.2	220.4	0.0
Use					
Aquatic Life		81.4%		18.6%	
Fish Consumption		0.0%		0.0%	
Swimming		81.2%		19.3%	
Secondary Contact		81.2%		19.3%	
Drinking Water		99.1%		0.9%	
Agricultural		89.4%		10.6%	
Total		79.5%		20.7%	

2.6.2.4 Total Waters Impaired by Various Causes The causes of impairment are listed in Table 2.6.3. The major causes of impairment were temperature, habitat alterations, flow alterations and metals. The percent of miles impacted are shown in Figure 2.6.4. The relative contribution of each cause to water quality impairment is shown in Figure 2.6.5.

2.6.2.5 Total Waters Impaired by Various Sources-- The major sources of impairment were resource extraction, habitat modification, hydromodification, and agricultural activities as shown in Figure 2.6.6. They affected 5.0, 4.3, 3.8, and 3.8 percent respectively of the stream miles assessed. The relative percent impairment by sources is illustrated in Figure 2.6.7.

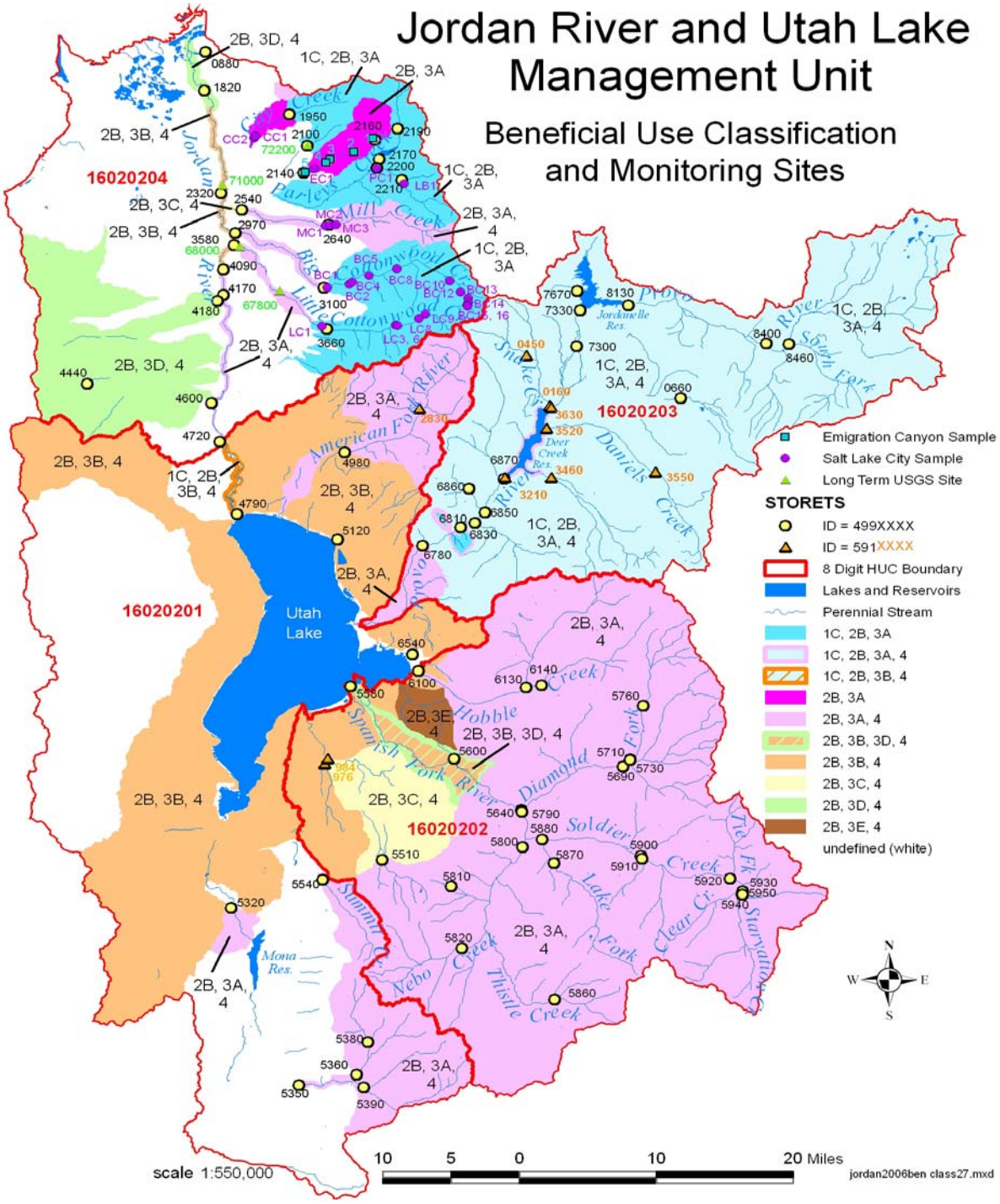


Figure 2.6.2. Beneficial use classifications – Jordan River/Utah Lake Watershed Management Unit.

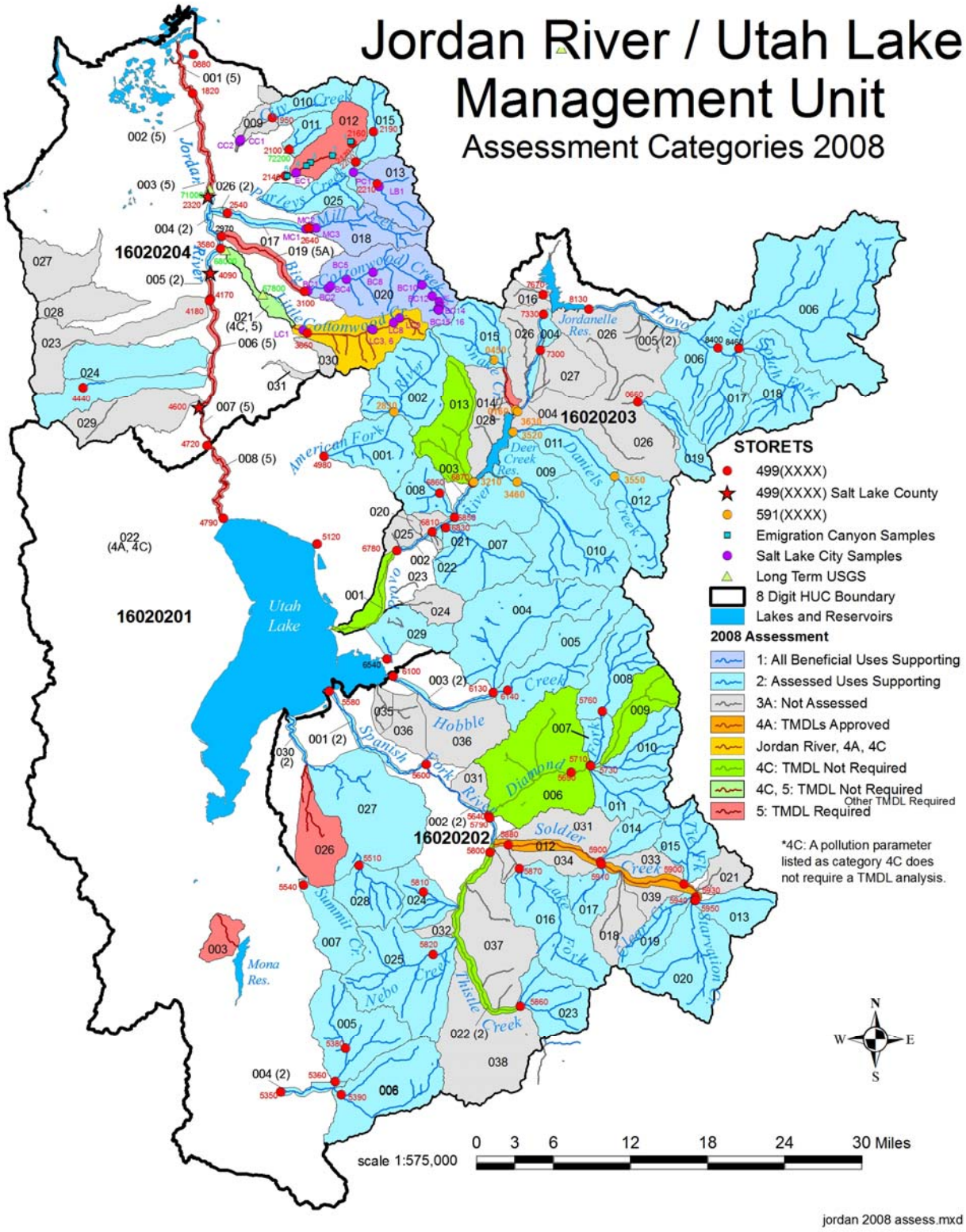


Figure 2.6.3. Beneficial use assessment by category – Jordan River/Utah Lake Watershed Management Unit.

Table 2.6.4. Total Waters Impaired by Various Cause Categories - Jordan River/Utah Lake River Watershed Management Unit.	
Cause Category	**Stream Miles**
Cause unknown	0.0
Unknown toxicity	0.0
Pesticides	0.0
Priority organics	0.0
Nonpriority organics	0.0
Metals	30.5
Ammonia	0.0
Chlorine	0.0
Other inorganics	0.0
Nutrients	22.6
pH	3.4
Siltation/Sediments	18.5
Organic enrichment/low DO	16.3
Salinity/TDS/Chlorides	25.9
Thermal modifications	48.8
Flow alterations	42.8
Other habitat alterations	170.2
Pathogen Indicators	14.6
Radiation	0.0
Oil and grease	0.0
Taste and odor	0.0
Noxious aquatic plants	0.0
Total toxics	0.0
Turbidity	0.0
Exotic species	0.0
Other (specify)	0.0

Sources - Jordan River/Utah Lake Watershed Management Unit.	
Source Category	**Stream Miles**
Industrial Point Sources	34.6
Municipal Point Sources	34.6
Combined Sewer Overflow	0.0
Agriculture	28.8
Silviculture	0.0
Construction	0.0
Urban Runoff/Storm Sewers	49.2
Resource Extraction	21.5
Land Disposal	
Hydromodification	80.4
Habitat Modification	185.5
Marinas	0.0
Atmospheric Deposition	0.0
Contaminated Sediments	0.0
Unknown Source	52.9
Natural Sources	46.6
Reservoir Releases	
Recreation	
Aquaculture	
Extreme Drought	

Table 2.6.5. Total Waters Impaired by Various

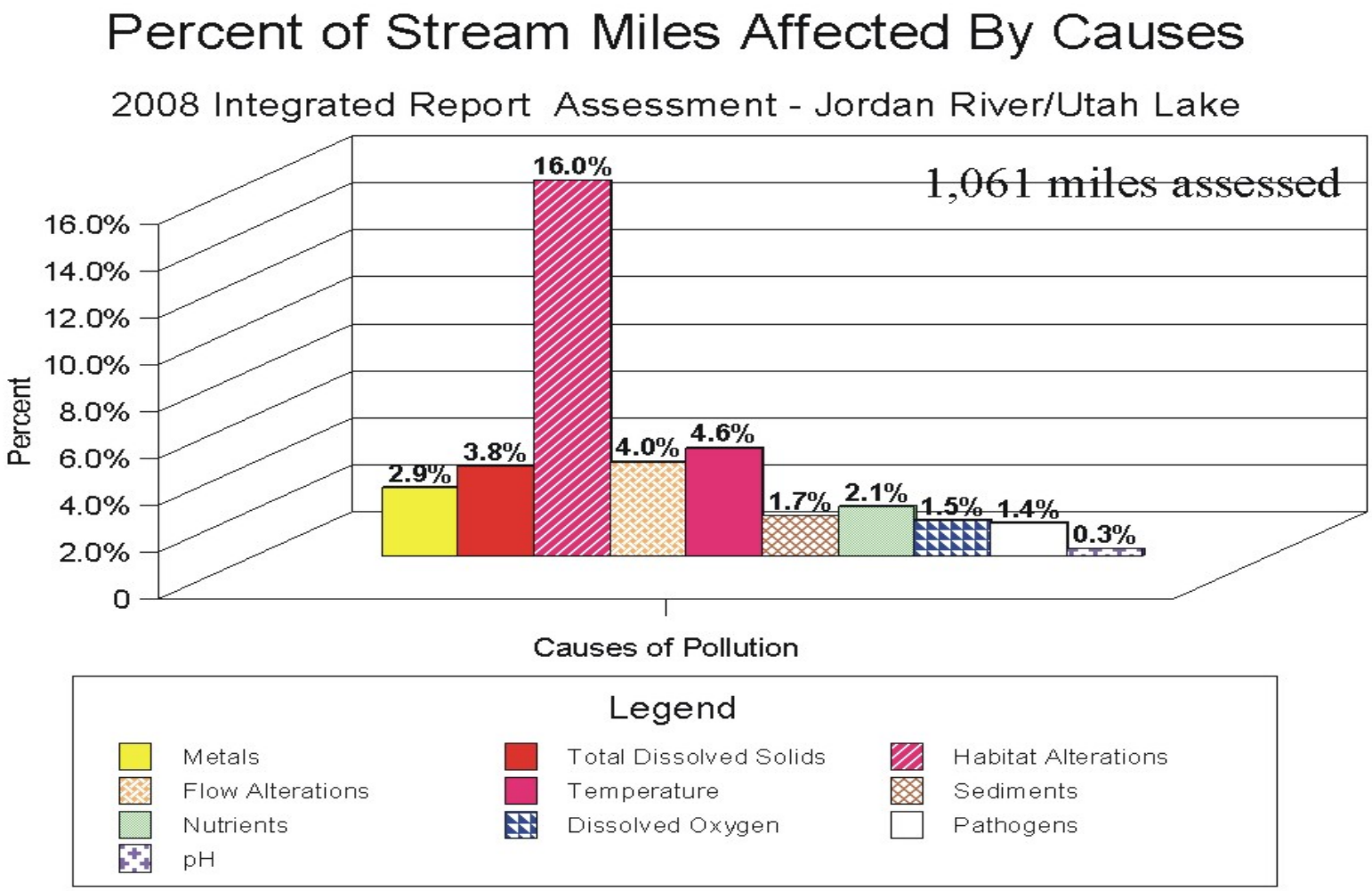


Figure 2.6.4. Percent of stream miles impacted by various causes – Jordan River / Utah Lake Watershed Management Unit.

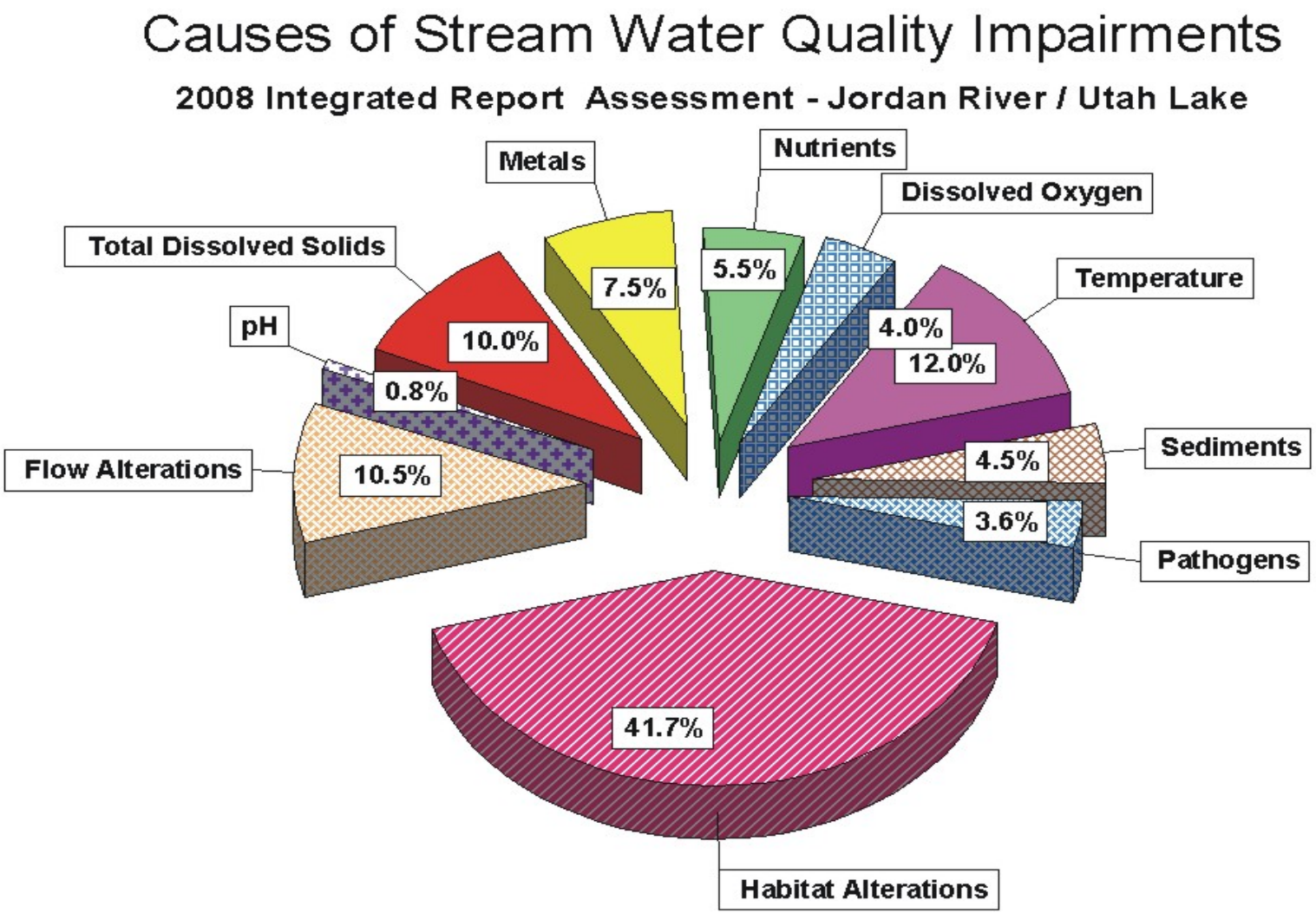


Figure 2.6.5. Relative percent impacted by causes on water quality – Jordan River / Utah Lake Watershed Management Unit.

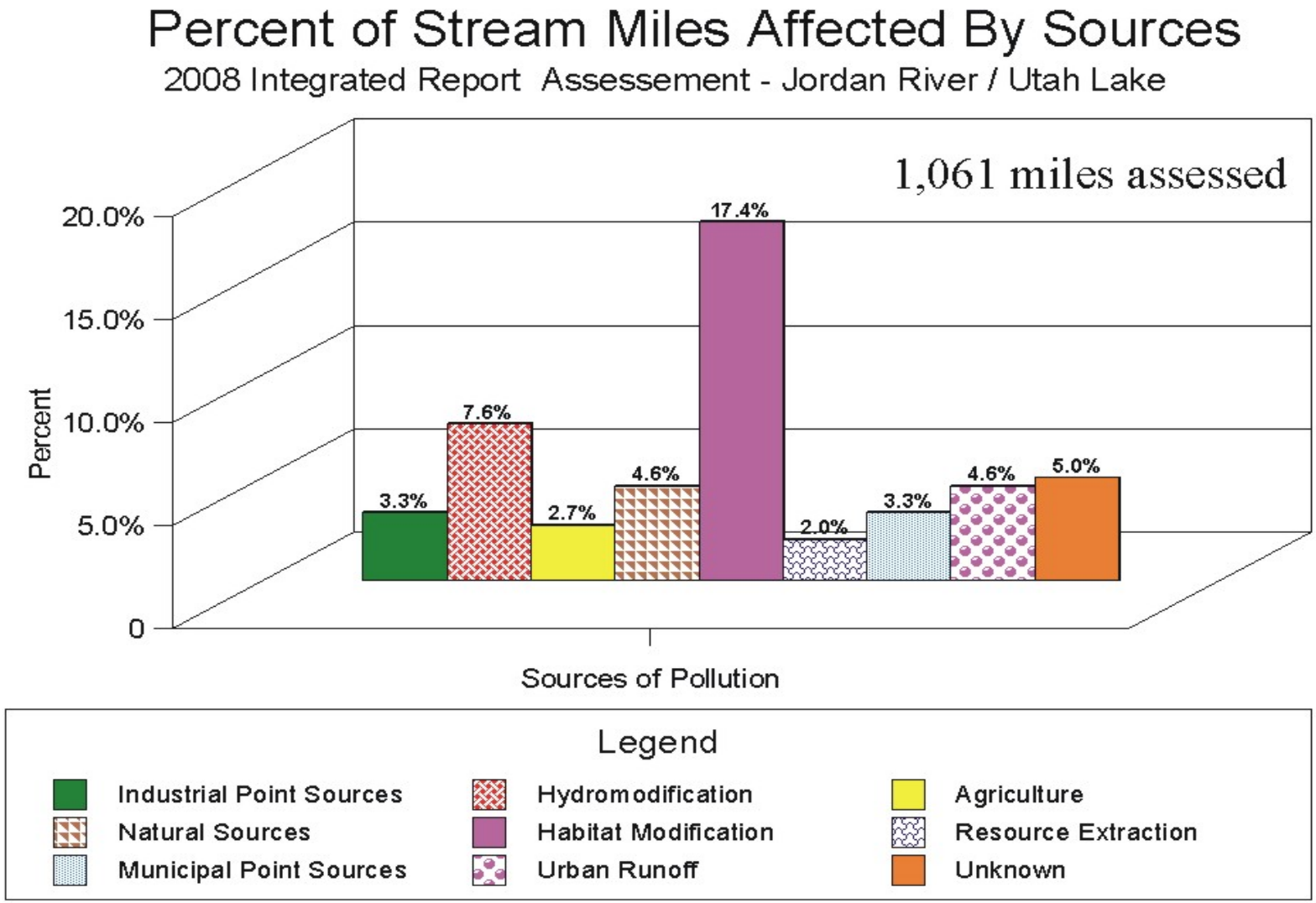


Figure 2.6.6. Percent of assessed stream miles impacted by various sources – Jordan River / Utah Lake Watershed Management Unit.

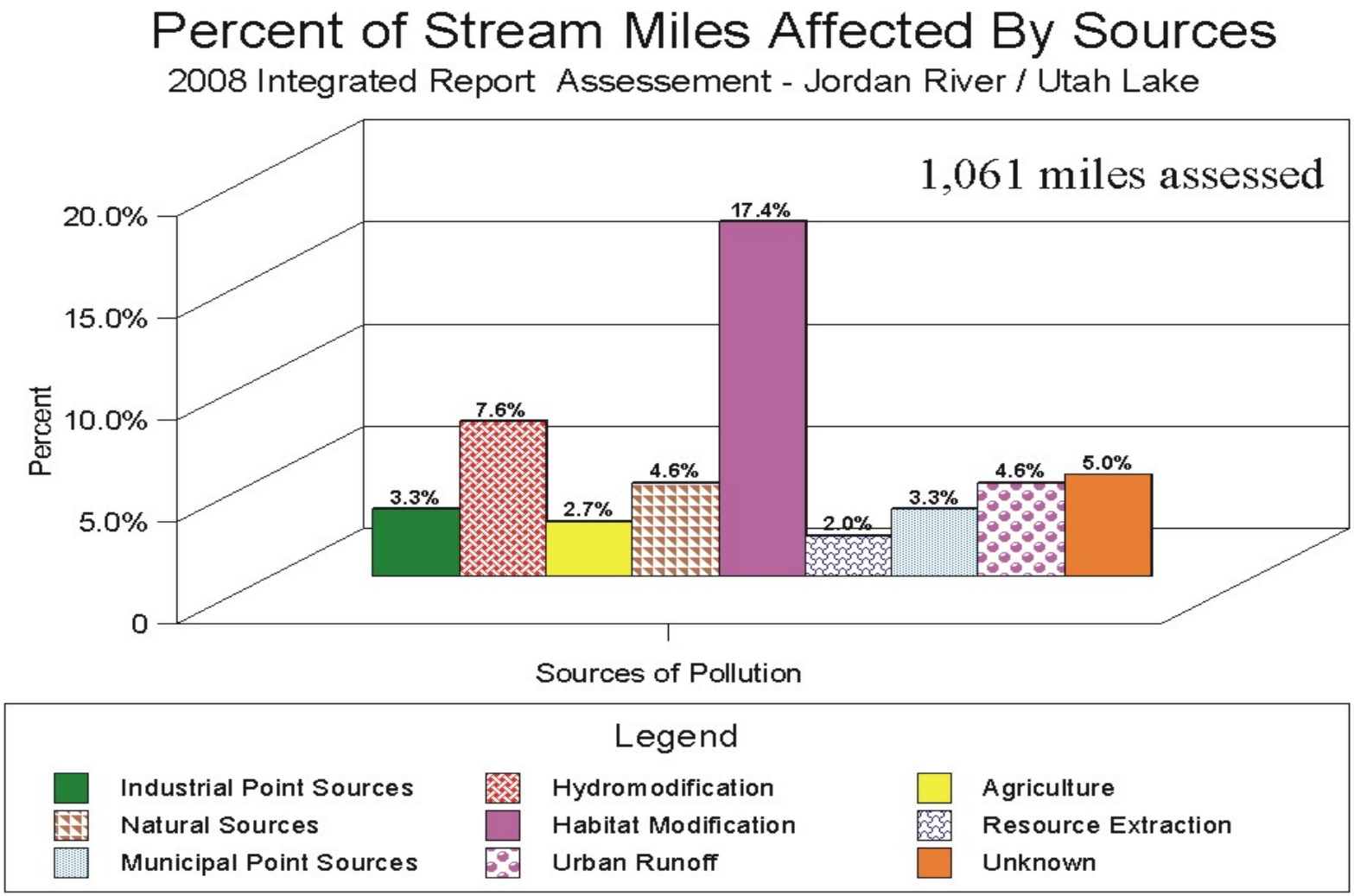


Figure 2.6.7. Relative percent impact by various sources on water quality – Jordan River / Utah Lake Watershed Management Unit.

Table 2.4..6. Impaired Assessment Units In The Bear River Watershed Management Unit.								
Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Beneficial Use Class Impaired	Beneficial Use Support	Support Category	Pollutant Or Pollution	Source	Stream Miles
UT16020201-003	Currant Creek	Current Creek from mouth of Goshen Canyon to Mona Reservoir	2B	NS	5	pH	-	3.44
UT16020201-003	Currant Creek	Current Creek from mouth of Goshen Canyon to Mona Reservoir	3A	NS	5	pH	-	3.44
UT16020201-003	Currant Creek	Current Creek from mouth of Goshen Canyon to Mona Reservoir	3A	NS	5	Temperature	-	3.44
UT16020201-003	Currant Creek	Current Creek from mouth of Goshen Canyon to Mona Reservoir	4	NS	5	pH	-	3.44
UT16020201-008	Jordan River-8	Jordan River from Narrows to Utah Lake	4	NS	5	Salinity/TDS/chlorides	-	14.15
UT16020202-006	Diamond Fork-1	Diamond Fork Creek from and tributaries from confluence w/ Spanish Fork River to Sixth Water confluence	3A	NS	4C	Flow alteration	-	20.06
UT16020202-006	Diamond Fork-1	Diamond Fork Creek from and tributaries from confluence w/ Spanish Fork River to Sixth Water confluence	3A	NS	4C	Other habitat alterations	-	20.06
UT16020202-009	Sixth Water Creek	Sixth Water Creek and tributaries except Fifth Water and First Water Creeks and tributaries from confluence w/ Diamond Fork River	3A	NS	4C	Flow alteration	-	12.45
UT16020202-009	Sixth Water Creek	Sixth Water Creek and and tributaries except Fifth Water and First Water Creeks and tributaries from confluence w/ Diamond Fork River	3A	NS	4C	Other habitat alterations	-	12.45
UT16020202-012	Soldier Creek-1	Soldier Creek from confluence with Thistle Creek to confluence of Starvation Creek	3A	NS	4A	Siltation	-	18.46
UT16020202-012	Soldier Creek-1	Soldier Creek from confluence with Thistle Creek to confluence of Starvation Creek	3A	NS	4A	Total Phosphorus	-	18.46

Table 2.4..6. Impaired Assessment Units In The Bear River Watershed Management Unit.								
Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Beneficial Use Class Impaired	Beneficial Use Support	Support Category	Pollutant Or Pollution	Source	Stream Miles
UT16020202-022	Thistle Creek-1	Thistle Creek from confluence with Soldier Creek to confluence with Little Clear Creek	3A	NS	4C	Habitat Alteration	-	16.82
UT16020202-026	Spring Creek	Spring Creek and tributaries from confluence w/ Beer Creek to headwaters	3A	NS	5	Temperatures	-	11.01
UT16020203-001	Provo River-1	Provo River from Utah Lake to Murdock Diversion	3A	NS	4C	Flow alteration	-	10.26
UT16020203-001	Provo River-1	Provo River from Utah Lake to Murdock Diversion	3A	NS	4C	Habitat Alteration	-	10.26
UT16020203-013	Provo Deer Creek	Provo Deer Creek and tributaries from confluence w/ Provo River to headwaters	3A	NS	4C	Habitat Alteration	-	19.14
UT16020203-014	Snake Creek-1	Snake Creek from confluence w/ Provo River to WMSP Golf Course	1C	NS	5	Arsenic	-	4.09
UT16020204-001	Jordan River-1	Jordan River from Farmington Bay upstream contiguous with the Davis County line.	3B	NS	5	Dissolved Oxygen	-	7.6
UT16020204-001	Jordan River-1	Jordan River from Farmington Bay upstream contiguous with the Davis County line.	4	NS	5	Salinity/TDS/chlorides	-	7.6
UT16020204-002	Jordan River-2	Jordan River from Davis County line upstream to North Temple Street.	2B	NS	5	E. coli	-	4.46
UT16020204-002	Jordan River-2	Jordan River from Davis County line upstream to North Temple Street.	3B	NS	5	Dissolved Oxygen	-	4.46
UT16020204-002	Jordan River-2	Jordan River from Davis County line upstream to North Temple Street.	4	NS	5	Salinity/TDS/Chlorides	-	4.46
UT16020204-003	Jordan River-3	Jordan River from North Temple to 2100 S	2B	NS	5	E. coli	-	4.2
UT16020204-003	Jordan River-3	Jordan River from North Temple to 2100 S	3B	NS	5	Dissolved Oxygen	-	4.2

Table 2.4..6. Impaired Assessment Units In The Bear River Watershed Management Unit.								
Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Beneficial Use Class Impaired	Beneficial Use Support	Support Category	Pollutant Or Pollution	Source	Stream Miles
UT16020204-003	Jordan River-3	Jordan River from North Temple to 2100 S	3B	NS	5	Total Phosphorus	-	4.2
UT16020204-005	Jordan River-5	Jordan River from 6400 S to 7800 S	2B	NS	5	E. coli	-	1.63
UT16020204-005	Jordan River-5	Jordan River from 6400 S to 7800 S	3A	NS	5	Thermal Modifications	-	1.63
UT16020204-005	Jordan River-5	Jordan River from 6400 S to 7800 S	4	NS	5	Salinity/TDS/Chlorides	-	1.63
UT16020204-006	Jordan River-6	Jordan River from 7800 S to Bluffdale	3A	NS	5	Thermal Modifications	-	10.29
UT16020204-007	Jordan River-7	Jordan River from Bluffdale to Narrows	3A	NS	5	Thermal Modifications	-	4.18
UT16020204-007	Jordan River-7	Jordan River from Bluffdale to Narrows	4	NS	5	Salinity/TDS/chlorides	-	4.18
UT16020204-012	Emigration Creek	Emigration Creek and tributaries from Foothill BLVD to headwaters	2B	NS	5	E. coli	-	4.29
UT16020204-019	Big Cottonwood Creek-1	Big Cottonwood Creek and tributaries from Jordan River to Big Cottonwood WTP	3A	NS	5	Thermal Modifications	-	9.53
UT16020204-021	Little Cottonwood Creek-1	Little Cottonwood Creek and tributaries from confluence Jordan River to Metropolitan WTP	3A	NS	5	Thermal Modifications	-	8.73
UT16020204-021	Little Cottonwood Creek-1	Little Cottonwood Creek and tributaries from confluence Jordan River to Metropolitan WTP	4C	NS	4C	Habitat Alterations	-	8.73
UT16020204-021	Little Cottonwood Creek-1	Little Cottonwood Creek and tributaries from confluence Jordan River to Metropolitan WTP	4	NS	5	Salinity/TDS/Chlorides	-	8.73
UT16020204-022	Little Cottonwood Creek-2	Little Cottonwood Creek and tributaries from Metropolitan WTP to headwaters	3A	NS	4A	Zinc	-	21.49
UT16020204-022	Little Cottonwood Creek-2	Little Cottonwood Creek and tributaries from Metropolitan WTP to headwaters	3A	NS	4C	Habitat Alteration	-	21.49

2.6.16

Chapter 2.7 Uinta Watershed Management Unit Water Quality Assessment

2.7.1 Introduction

The Uinta Watershed Management Unit lies in northeastern Utah and includes the U.S.G.S. hydrological units listed in Table 2.7.1. This unit includes the Green River and the tributaries streams that flow into it downstream to approximately where the Price River enters the Green River. Tributary streams include those on the north and south slopes of the Uinta Mountains. Major streams on the north slope include the West Fork Blacks Fork, East Fork Blacks Fork, Blacks Fork, West Fork Smiths Fork, East Fork Smiths Fork, Henry's Fork and Burnt Fork Rivers. Major south slope streams include Currant Creek, Duchesne River, Rock Creek, Lake Fork Creek, Yellowstone River, Uinta River, Ashley Creek, and Brush Creek. Two other major rivers are the Strawberry and White Rivers. The Strawberry River, located in the western part of the management unit, flows east to join the Duchesne River downstream from Starvation Reservoir. The White River flows west from the Utah-Colorado border to join the Green River near the confluence of the Duchesne and Green Rivers. Smaller tributaries to the south include Nine Mile Creek and Range Creek.

Table 2.7.1 . U.S.G.S. Hydrological Units in the Uinta Watershed Management Unit

Number	Name
14040106	Upper Green-Flaming Gorge Reservoir
14040107	Blacks Fork
14040108	Muddy
14050007	Lower White
14060001	Lower Green-Diamond
14060002	Ashley-Brush
14060003	Duchesne
14060004	Strawberry
14060005	Lower Green - Desolation Canyon
14060006	Willow

2.7.2. Water Quality Assessment Results

The intensive survey for this watershed was done from July 1, 2005 to June 30, 2006. In addition, new assessments were based upon data collected at the long term ambient stations and cooperative monitoring sites within the unit. Figure 2.7.1 is a map of the designated beneficial uses assigned to the rivers and streams in the management unit. Benthic macroinvertebrate data were used to assess some streams (Chapter 15).

2.7.2.1 Assessment by Categories –Table 2.7.2 is a list of stream miles assigned to the various assessment categories: Category 1, 2, 3A,3B,3C, 4A, 4B, 4C, and 5. The Uinta Watershed Management Unit beneficial use assessment by categories are listed in Table 2.7.2 and mapped in Figure 2.7.2. Assessment Units assigned to the various categories are listed in Table A.1.6 in the appendix.

Table 2.4.2. Stream Miles By Assessment Category – Uinta Watershed Management Unit.

Category	Category Definition	Stream Miles
1	All beneficial uses fully supported.	0.0
2	Beneficial uses assessed are fully supported.	2,137.9
3A	No data or insufficient data to make an assessment.	1,015.6
3B	Lakes that are not supported for one cycle only.	0.0
3C	Insufficient data to assess but an assessment plan is in place.	0.0
4A	Approved TMDL	91.3
4B	Pollution control requirements are expected to result in full beneficial use support in near future.	0.0
4C	Impaired by pollution, no TMDL required.	99.0
5	Impaired by pollutant, TMDL required.	565.4

2.7.2.2 Overall Beneficial Use Support --There are an estimated 3,445 perennial stream miles within the Uinta Watershed Management Unit. An assessment of the support of beneficial uses was made for 2,856.7 miles. Based upon at least one beneficial use being assessed, 2,376.0 (74.8%), were assessed as fully supporting and 7520.9 miles (25.2%) were assessed as not supporting at least one designated beneficial use (Figure 2.7.1).

2.7.2.3 Individual Use Support--Use support by individual beneficial use designations is summarized in Table 2.7.3. The drinking water use was assessed on 1,644.1 miles of streams. Of these stream miles, about 1,546.3 miles (94.0%) were assessed as supporting this beneficial use and 6.0% were not supporting it. For contact recreation and swimming, 250.3 miles were assessed. All 250.3 miles were assessed as not supporting.

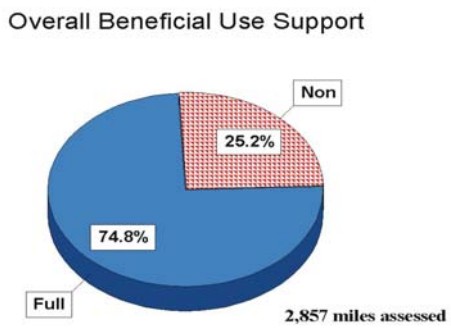


Figure 2.7.2. Overall beneficial use support – Uinta.

Streams classified for agricultural use had 2,664.1 miles (82.3 %) that were rated as fully supporting and 471.4 miles (17.6%) as not supporting agricultural usage.

The aquatic life use was assessed on stream miles. Beneficial use assessment was made on 2,836.4 stream miles. A full support rating was given to 2,135.8 miles (83.8%) and 460.0 miles (16.2%) were rated as not supporting the aquatic life use support category.

Table 2.7.3. Individual Beneficial Use Support - Uinta Watershed Management Unit.					
			Size Fully		
	Size	Size Fully	Supporting	Size Not	Size Not
	Assessed	Supporting	but	Supporting	Attainable
Use			Threatened		
Aquatic Life	2,836.2	2,376.0	0.0	460.0	0.0
Fish Consumption	0.0	0.0	0.0	0.0	0.0
Swimming	250.3	0.0	0.0	250.3	0.0
Secondary Contact	250.3	0.0	0.0	250.3	0.0
Drinking Water	1,644.1	1,546.3	0.0	97.9	0.0
Agricultural	2,664.1	2,193.6	0.0	471.3	0.0
Total	2,856.7	2,135.8	0.0	720.9	0.0
Use					
Aquatic Life		83.8%		16.2%	
Fish Consumption		0.0%		0.0%	
Swimming		0.0%		100.0%	
Secondary Contact		0.0%		100.0%	
Drinking Water		94.0%		6.0%	
Agricultural		82.3%		17.7%	
Total		74.8%		25.2%	

2.7.2.4 Total Waters Impaired by Various Causes – Stream miles impacted by specific causes are summarized in Table 2.7.4. The major causes of water quality impairment were total dissolved solids, metals and temperature violations.

2.7.2.5 Total Waters Impaired by Various Sources - – Stream miles impacted by source categories causes are summarized in Table2.7.5. The major sources of impairment were agricultural activities, natural, and habitat modification (Figure 2.7.6). Other sources included hydromodification, industrial and municipal point discharge sources. The relative percent impacts by sources are shown in Figure 2.7.7.

Table 2.7.4. Total Waters Impaired by Various Cause Categories (Stream Miles).

Cause Category	Total Miles Affected
Cause unknown	0.0
Unknown toxicity	0.0
Pesticides	0.0
Priority organics	0.0
Nonpriority organics	0.0
Metals	308.0
Ammonia	0.0
Chlorine	0.0
Other inorganics	0.0
Nutrients	0.0
pH	0.0
Siltation/Sediments	0.0
Organic enrichment/low DO	0.0
Salinity/TDS/Chlorides	260.8
Thermal modifications	185.8
Flow alterations	64.2
Other habitat alterations	99.0
Pathogen Indicators	0.0
Radiation	0.0
Oil and grease	0.0
Taste and odor	0.0
Noxious aquatic plants	0.0
Total toxics	0.0
Turbidity	0.0
Exotic species	0.0
Other (specify)	0.0

Table 2.7.5. Total Waters Impaired by Various Sources Categories (Stream Miles).

Source Category	Total Miles Affected
Industrial Point Sources	8.1
Municipal Point Sources	8.1
Combined Sewer Overflow	0.0
Agriculture	280.4
Silviculture	0.0
Construction	0.0
Urban Runoff/Storm Sewers	0.0
Resource Extraction	0.0
Land Disposal	0.0
Hydromodification	115.5
Habitat Modification	152.5
Marinas	0.0
Atmospheric Deposition	0.0
Contaminated Sediments	0.0
Unknown Source	271.4
Natural Sources	260.8
Reservoir Releases	0.0
Recreation	0.0
Aquaculture	0.0

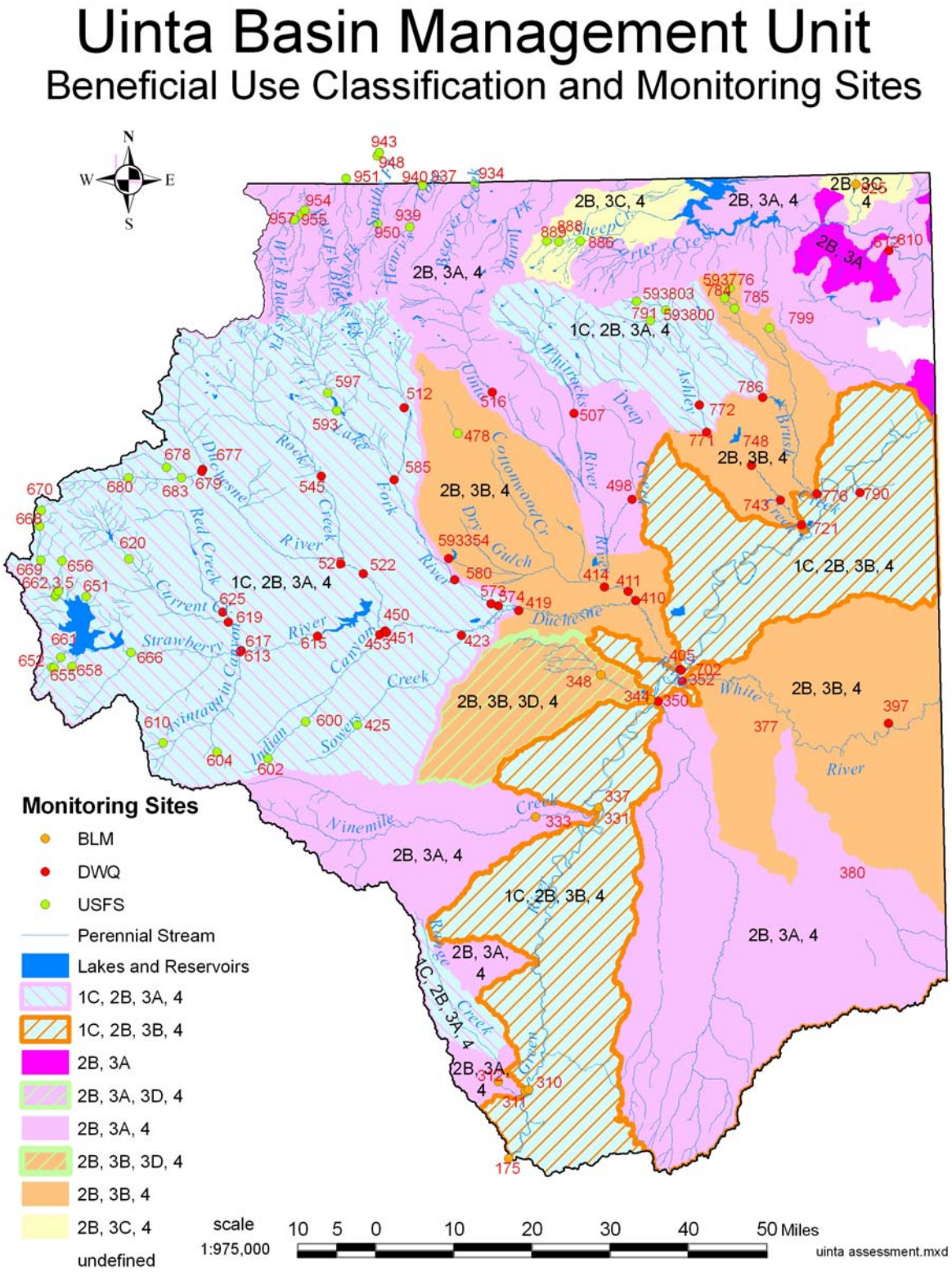


Figure 2.7.1. Beneficial use classifications – Uinta Watershed Management Unit.

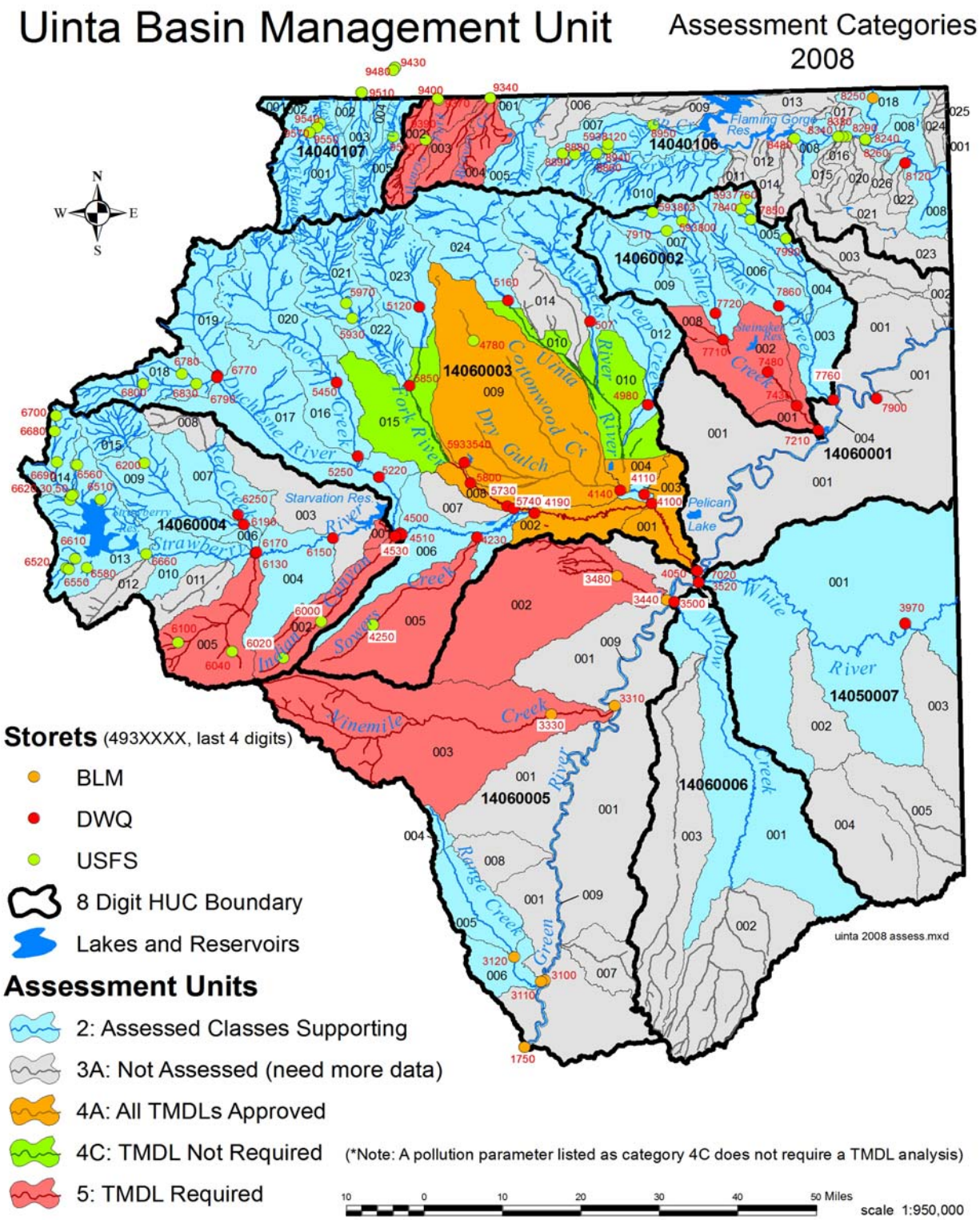


Figure 2.7.3. Beneficial use assessment by categories – Uinta Watershed Management Unit.

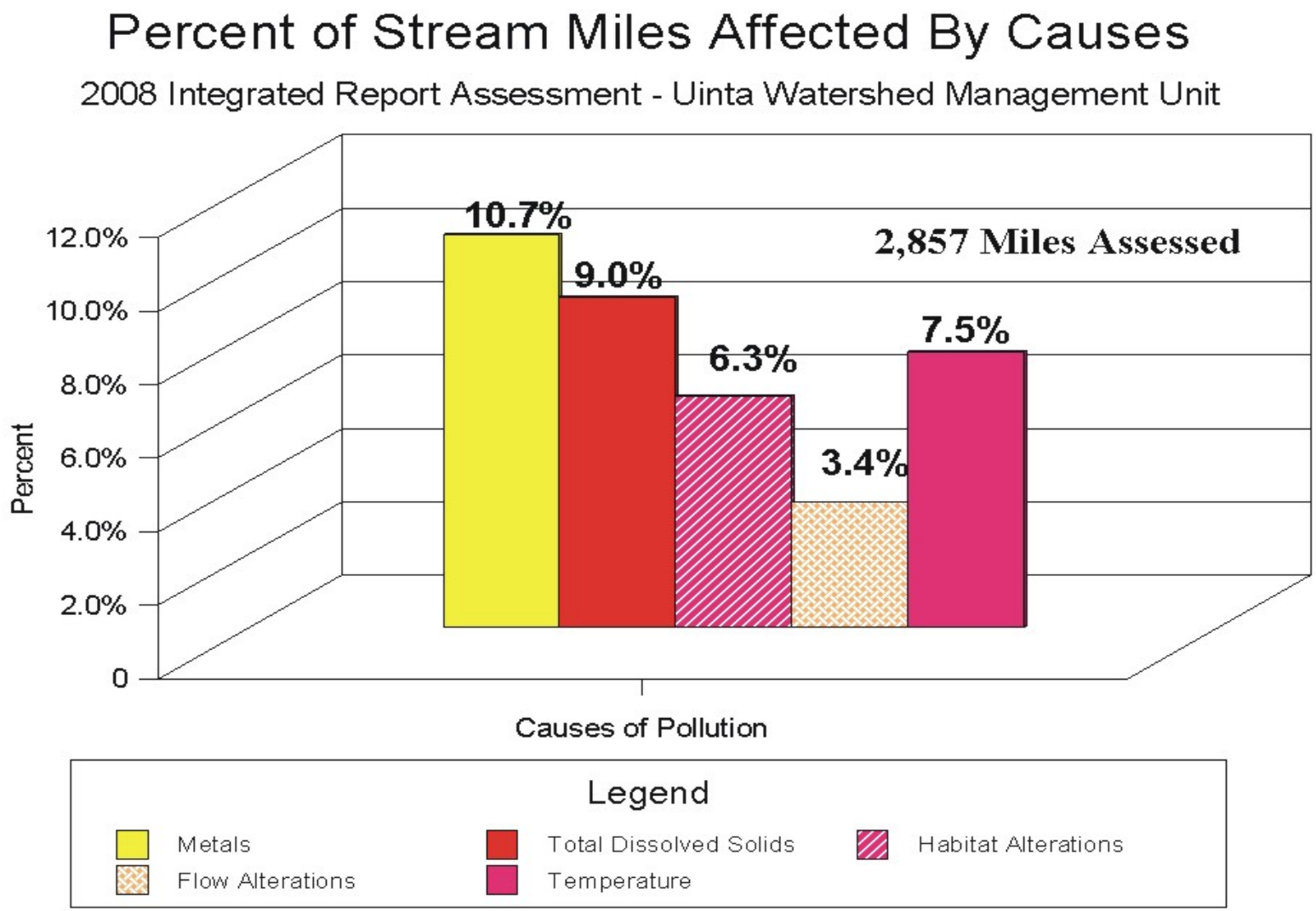


Figure 2.7.4. Percent impact by causes on stream water quality – Uinta Watershed Management Unit.

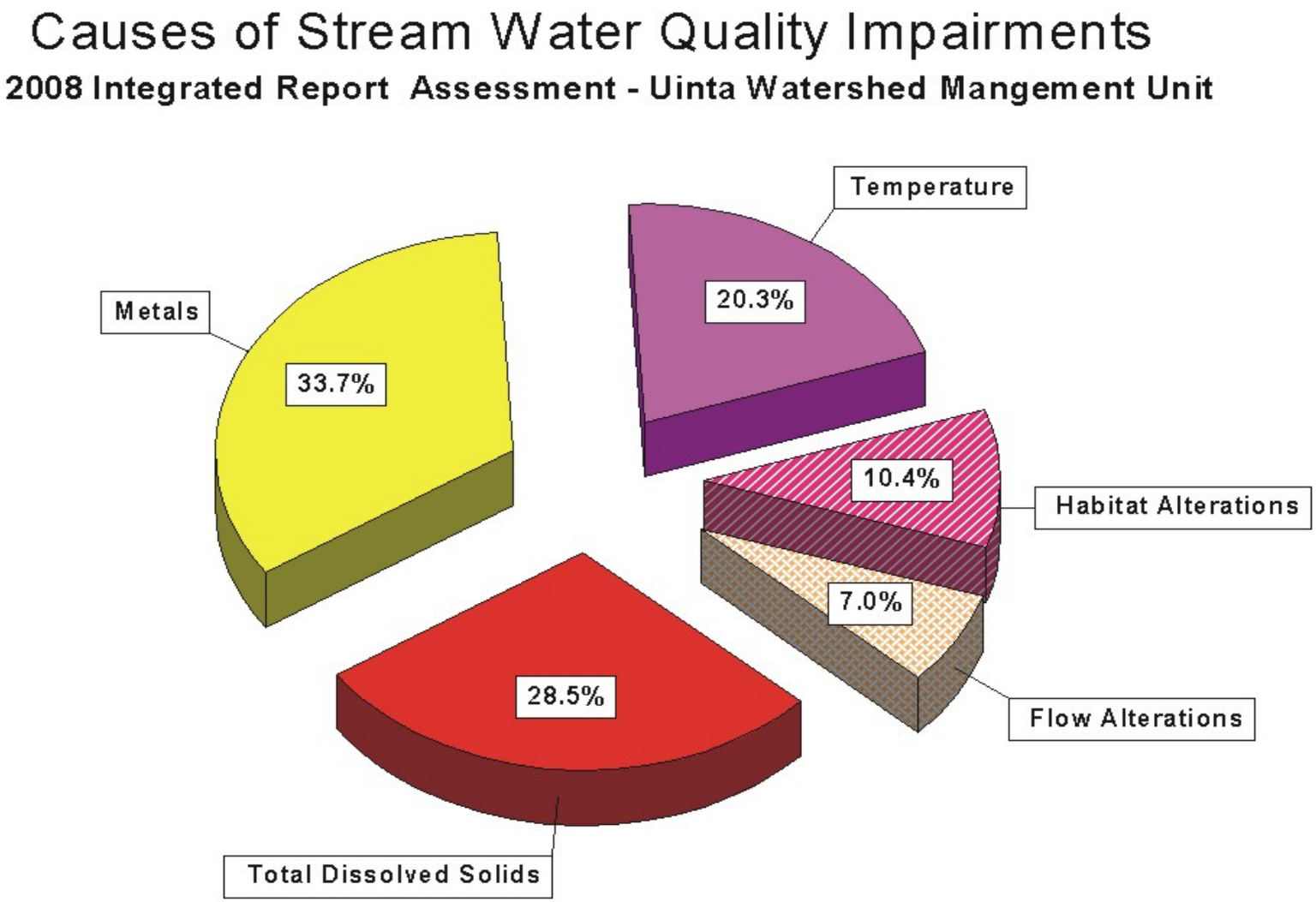


Figure 2.7.5. Relative percent contribution of causes on stream water quality. – Uinta Watershed Management Unit.

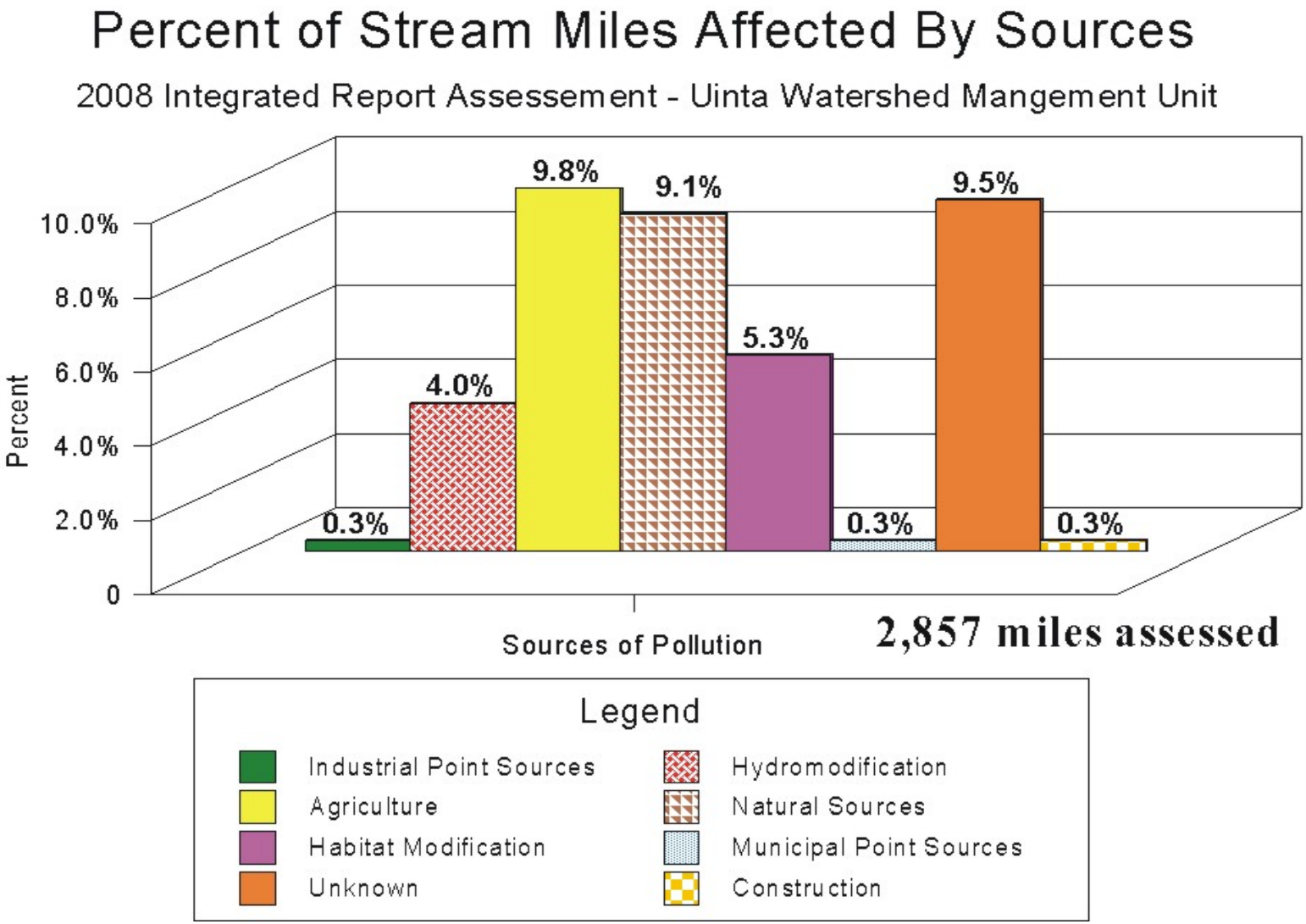


Figure 2.7.6. Percent impact by sources on stream water quality – Uinta Watershed Management Unit.

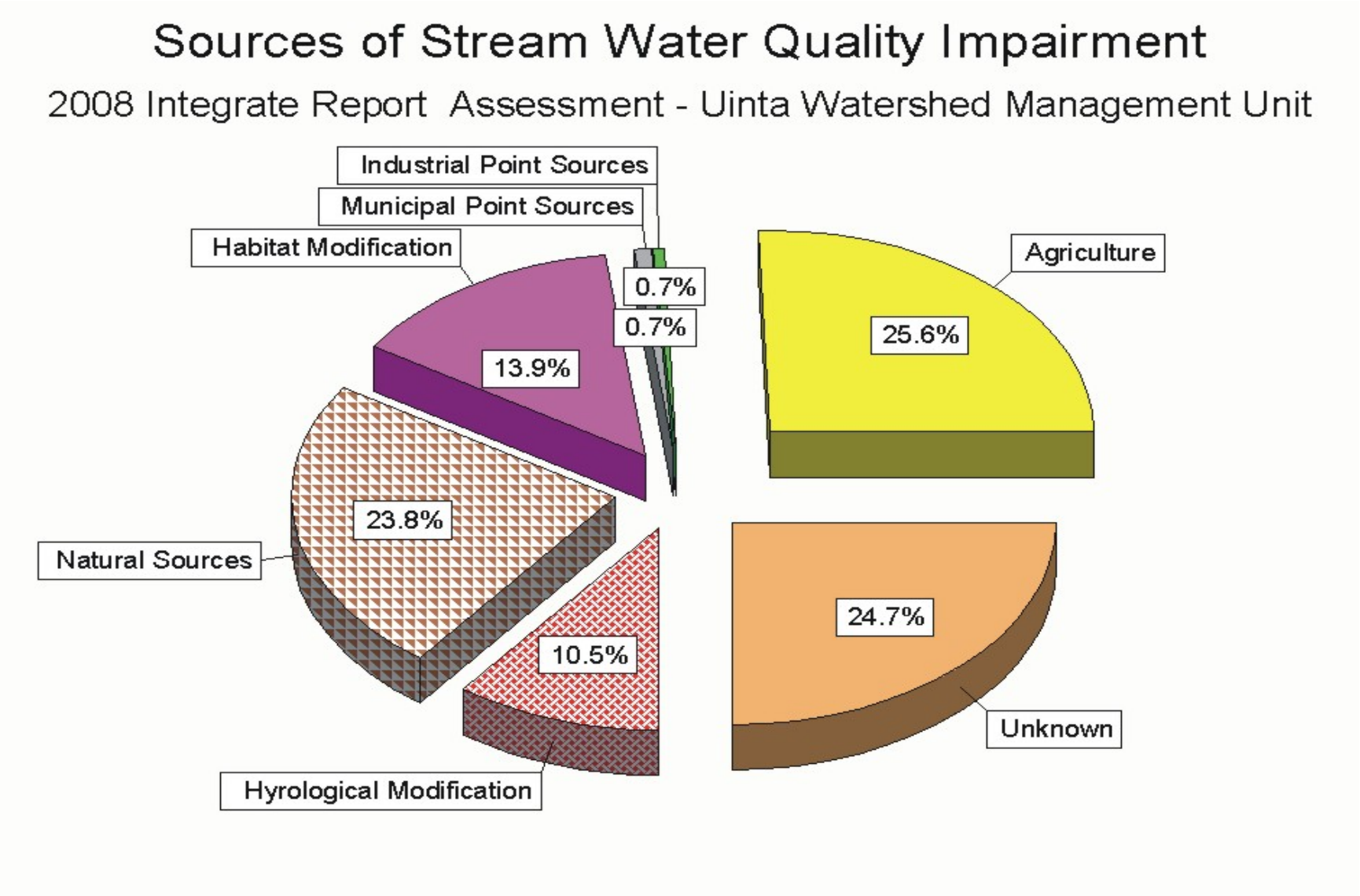


Figure 2.7.7. Relative percent contribution of sources on stream water quality – Uinta Watershed Management Unit.

Table 2.7.6. Impaired Assessment Units In The Bear River Watershed Management Unit.								
Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Beneficial Use Class Impaired	Beneficial Use Support	Support Category	Pollutant Or Pollution	Source	Stream Miles
UT14040106-002	Henrys Fork River	Henrys Fork River and tributaries from Utah-Wyoming state line to headwaters.	2B	NS	5	pH	-	52.02
UT14040106-003	West Fork Beaver Creek	West Fork Beaver Creek: Spring Creek: Poison Creek-tribs; Utah-Wyoming state line to headwaters.	2B	NS	5	pH	-	18.66
UT14040106-004	Middle Fork Beaver Creek	Middle Fork Beaver Creek and tributaries from Utah-Wyoming state line to headwaters.	2B	NS	5	pH	-	30.08
UT14050007-003	Evacuation Creek	Evacuation Creek-tribs: confluence White River to headwaters.	4	NS	5	Boron	-	
UT14050007-003	Evacuation Creek	Evacuation Creek-tribs: confluence White River to headwaters.	4	NS	5	Salinity/TDS/chlorides	-	
UT14060002-001	Lower Ashley Creek	Ashley Creek and tributaries from confluece Green River Vernal Sewage Lagoons.	3B	NS	5	Selenium	-	8.1
UT14060002-001	Lower Ashley Creek	Ashley Creek and tributaries from confluece Green River Vernal Sewage Lagoons.	4	NS	5	Salinity/TDS/chlorides	-	8.1
UT14060002-002	Middle Ashley Creek	Ashley Creek and tributaries from Vernal sewage lagoons to Dry Fork confluence.	3B	NS	4A	Selenium	-	12.28
UT14060002-002	Middle Ashley Creek	Ashley Creek and tributaries from Vernal sewage lagoons to Dry Fork confluence.	4	NS	4A	Salinity/TDS/chlorides	-	12.28
UT14060002-008	Dry Fork Creek	Dry Fork Creek and tributaries from confluence Ashley Creek to headwaters.	3A	NS	5	Thermal Modification	-	47.05
UT14060003-001	Duchesne River-1	Duchesne River and tributaries from confluence Green River to Uinta River confluence.	4	NS	4A	Salinity/TDS/chlorides	-	19.49
UT14060003-004	Uinta River-2	Uinta River from Dry Gulch confluence upstream to U.S. Highway 40.	3B	NS	4C	Other habitat alterations	-	3.15
UT14060003-004	Uinta River-2	Uinta River from Dry Gulch confluence upstream to U.S. Highway 40.	4	NS	4A	Salinity/TDS/chlorides	-	3.15
UT14060003-005	Antelope Creek	Antelope Creek and tributaries from confluence Duchesne River to headwaters.	4	NS	5	Boron	-	31.57
UT14060003-005	Antelope Creek	Antelope Creek and tributaries from confluence Duchesne River to headwaters.	4	NS	5	Salinity/TDS/chlorides	-	31.57

Table 2.7.6. Impaired Assessment Units In The Bear River Watershed Management Unit.								
Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Beneficial Use Class Impaired	Beneficial Use Support	Support Category	Pollutant Or Pollution	Source	Stream Miles
UT14060003-008	Lake Fork-1	Lake Fork River and tribsutaries from confluence Duchesne River to Pigeon Water Creek confluence.	3A	NS	5	Thermal Modification	-	19.64
UT14060003-009	Dry Gulch Creek	Dry Gulch Creek and tributaries from confluence Duchesne River to headwaters.	4	NS	4A	Salinity/TDS/chlorides	-	88.1
UT14060003-010	Uinta River-3	Uinta River and tributaries from beneficial use classification change to USFS boundary (excluding Whiterocks River).	3A	NS	4C	Flow Alteration	-	64.16
UT14060003-010	Uinta River-3	Uinta River and tributaries from beneficial use classification change to USFS boundary (excluding Whiterocks River).	3A	NS	4C	Other habitat alterations	-	64.16
UT14060003-015	Lake Fork-2	Lake Fork River and tributaries from Pigeon Creek confluence to Yellowstone River confluence (includes Yellowstone River	3A	NS	4C	Other habitat alterations	-	31.68
UT14060004-001	Strawberry River-1	Strawberry River from confluence Duchesne River to Starvation Dam.	4	NS	5	Boron	-	5.94
UT14060004-002	Indian Canyon Creek	Indian Canyon Creek and tributaries from confluence Strawberry River to headwaters.	1C	NS	5	Arsenic	-	44.01
UT14060004-002	Indian Canyon Creek	Indian Canyon Creek and tributaries from confluence Strawberry River to headwaters.	4	NS	5	Boron	-	44.01
UT14060004-002	Indian Canyon Creek	Indian Canyon Creek and tributaries from confluence Strawberry River to headwaters.	4	NS	5	Salinity/TDS/chlorides	-	44.01
UT14060004-005	Avintaquin Creek	Avintaquin Creek and tributaries confluence Strawberry River to headwaters.	1C	NS	5	Arsenic	-	53.84
UT14060005-002	Pariette Draw Creek	Pariette Draw Creek and tributaries from confluence Green River to headwaters.	3B	NS	5	Selenium	-	54.1
UT14060005-002	Pariette Draw Creek	Pariette Draw Creek and tributaries from confluence Green River to headwaters.	4	NS	5	Boron	-	54.1
UT14060005-002	Pariette Draw Creek	Pariette Draw Creek and tributaries from confluence Green River to headwaters.	4	NS	5	Salinity/TDS/chlorides	-	54.1
UT14060005-003	Nine Mile	Nine Mile Creek and tributaries from confluence Green River to headwaters	3A	NS	5	Thermal Modification	-	119.08

Chapter 2.8 Sevier River Watershed Management Unit Assessment

2.8.1. Introduction

The Sevier River Watershed Management Unit includes all streams located in the U.S.G.S Hydrological Units (HUCs) listed in Table 2.8.1. Some of the major streams within unit are the Sevier River, San Pitch River, Otter Creek, Salina Creek, and the East Fork Sevier River.

Table 2.8.1. Hydrological Unit Codes and Names

Hydrological Unit Code	Hydrological Unit Name
14030001	Upper Sevier
14030002	East Fork Sevier
14030003	Middle Sevier
14030004	San Pitch
14030005	Lower Sevier
14030009	Sevier Lake

2.8.2. Water Quality Assessment Results

Data from samples collected from January 1, 2002 through December 31, 2006 were used in making this assessment. The data include data collected by DWQ, and Cooperators. Benthic macroivertebrate data collected at several sites were also used to determine support of the aquatic life beneficial use. Figure 2.8.2 is a map of the designated beneficial uses assigned to the streams in this management unit.

2.8.2.2 Overall Beneficial Use Support - There are an estimated 1,885 perennial stream miles within the Sevier River Watershed Management Unit. Of these, 1,572.2 miles were assessed. There are 934.7 stream miles (59.4%) supporting the beneficial uses that were assessed and 637.6 miles (40.6%) were assessed as not supporting at least one designated beneficial use. The overall beneficial use assessment is illustrated in Figure 2.8.1. Individual beneficial use support is listed in Table 2.8.3.

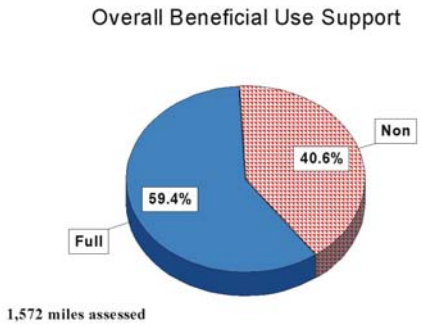


Figure 2.8.2. Overall beneficial use support.

2.8.2.3 Beneficial Use Assessment By Categories-- Table 2.8.2 lists the streams miles that were assigned to each of the assessment categories. An AU can be placed in multiple categories when it is assessed. Therefore, the number of stream miles listed in the table may exceed the number of miles assessed.

Table 2.8.2. Stream Miles By Assessment Category – Sevier River Watershed Management Unit.		
Category	**Category Definitions**	**Stream Miles**
1	All beneficial uses fully supported.	0.0
2	Beneficial uses assessed are fully supported.	934.7
3A	No data or insufficient data to make an assessment.	336.6
3B	Lakes that are not supported for one cycle only.	0.0
3C	Insufficient data to assess but an assessment plan is in place.	0.0
4A	Approved TMDL	442.1
4B	Pollution control requirements are expected to result in full beneficial use support in near future.	0.0
4C	Impaired by pollution, no TMDL required.	356.4
5	Impaired by pollutant, TMDL required.	242.1

2.8.1.3. Individual Use Support--One-thousand five-hundred seventy-two miles stream miles were assessed for aquatic life beneficial use. Of the streams assessed for aquatic life, 1,409.2 miles (66.7%) were assessed as fully supporting and 523.1 miles (33.3%) partially supporting this beneficial use and no miles were listed as being not supporting.

Of the streams assessed for agricultural use, 1,456.8 miles (81.7%) were assessed as fully supporting and 266.5 miles (18.3%) as not supporting this beneficial use. The streams within the Sevier Watershed Management Unit were placed in the various categories of beneficial use assessment. Table 2.8.3 includes a list the categories and the number of stream miles that were placed in each category. The beneficial use support by categories is mapped in Figure 2.8.3.

			Size Fully		
	Size	**Size Fully**	**Supporting**	**Size Not**	**Size Not**
	Assessed	**Supporting**	**but**	**Supporting**	**Attainable**
Use			**Threatened**		
Aquatic Life	1,572.2	1,049.2	0.0	523.1	0.0
Fish Consumption	0.0	0.0	0.0	0.0	0.0
Swimming	125.4	0.0	0.0	125.4	0.0
Secondary Contact	125.4	0.0	0.0	125.4	0.0
Drinking Water	2.8	0.0	0.0	2.8	0.0
Agricultural	1,535.4	1268.7	0.0	266.5	0.0
Total	1,572.2	934.7	0.0	637.6	0.0
Use					
Aquatic Life		66.7%		33.3%	
Fish Consumption		0.0%		0.0%	

Use	Size Assessed	Size Fully Supporting	Size Fully Supporting but Threatened	Size Not Supporting	Size Not Attainable
Swimming		0.0%		100.0%	
Secondary Contact		0.0%		100.0%	
Drinking Water		0.0%		100.0%	
Agricultural		82.6%		17.4%	
Total		59.4%		40.6%	

2.8.1.4 Total Waters Impaired by Various Causes. The causes and sources of impairment are listed in Table 2.8.4. The major causes of impairment were nutrients (total phosphorus), sediment, habitat alterations, Thermal Modification, pH and total dissolved solids (Figure 2.8.4). The relative impact of these causes is shown in Figure 2.8.5

2.8.1.4. Total Waters Impaired by Various Sources--The major sources of impairment were hydromodification and agricultural activities (Table 2.8.5). The percent of impact by sources are shown in Figure 2.8.6. The relative percent impacts by sources are shown in Figure 2.8.7.

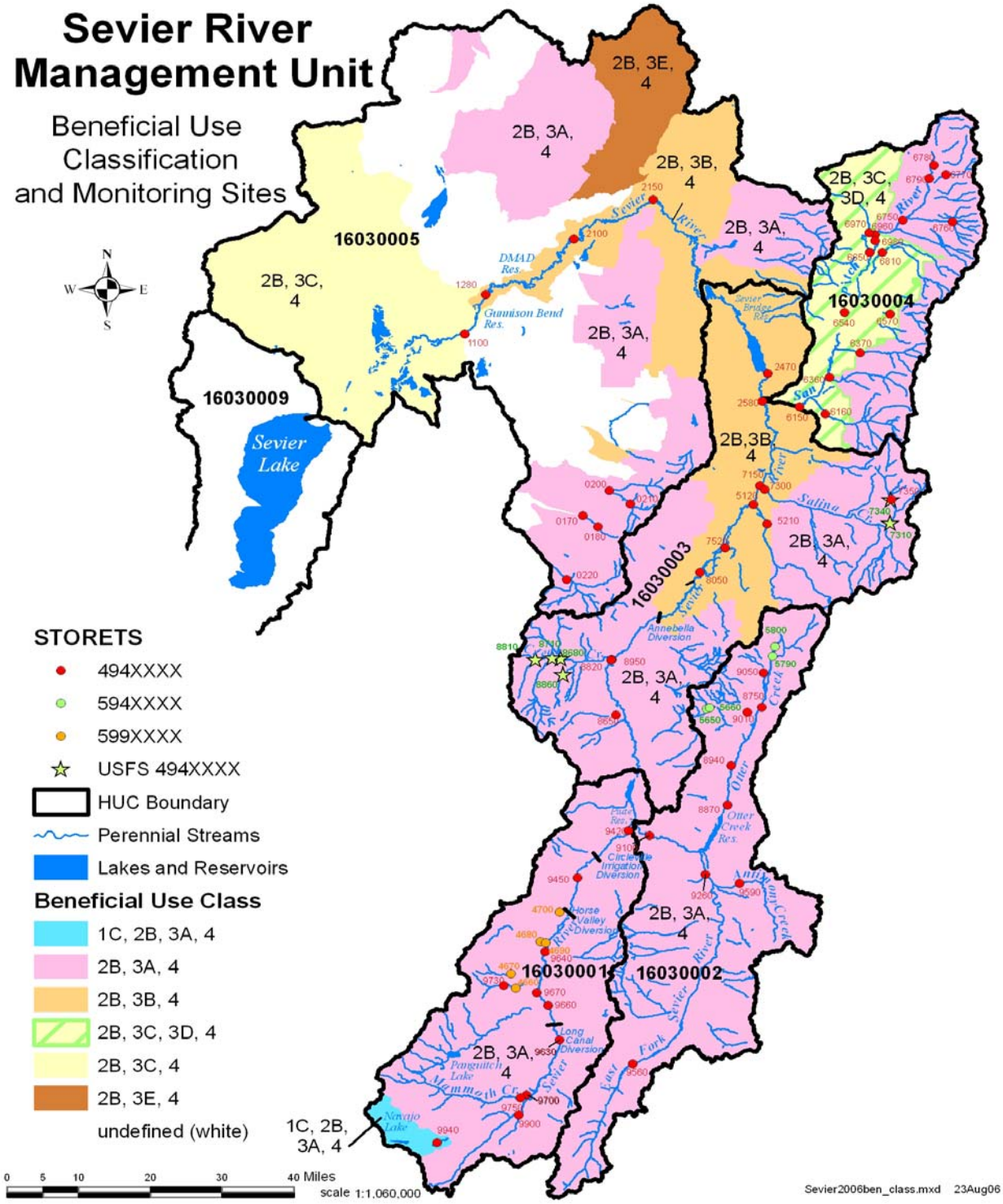


Figure 2.8.2. Beneficial use classifications – Sevier Watershed Management Unit

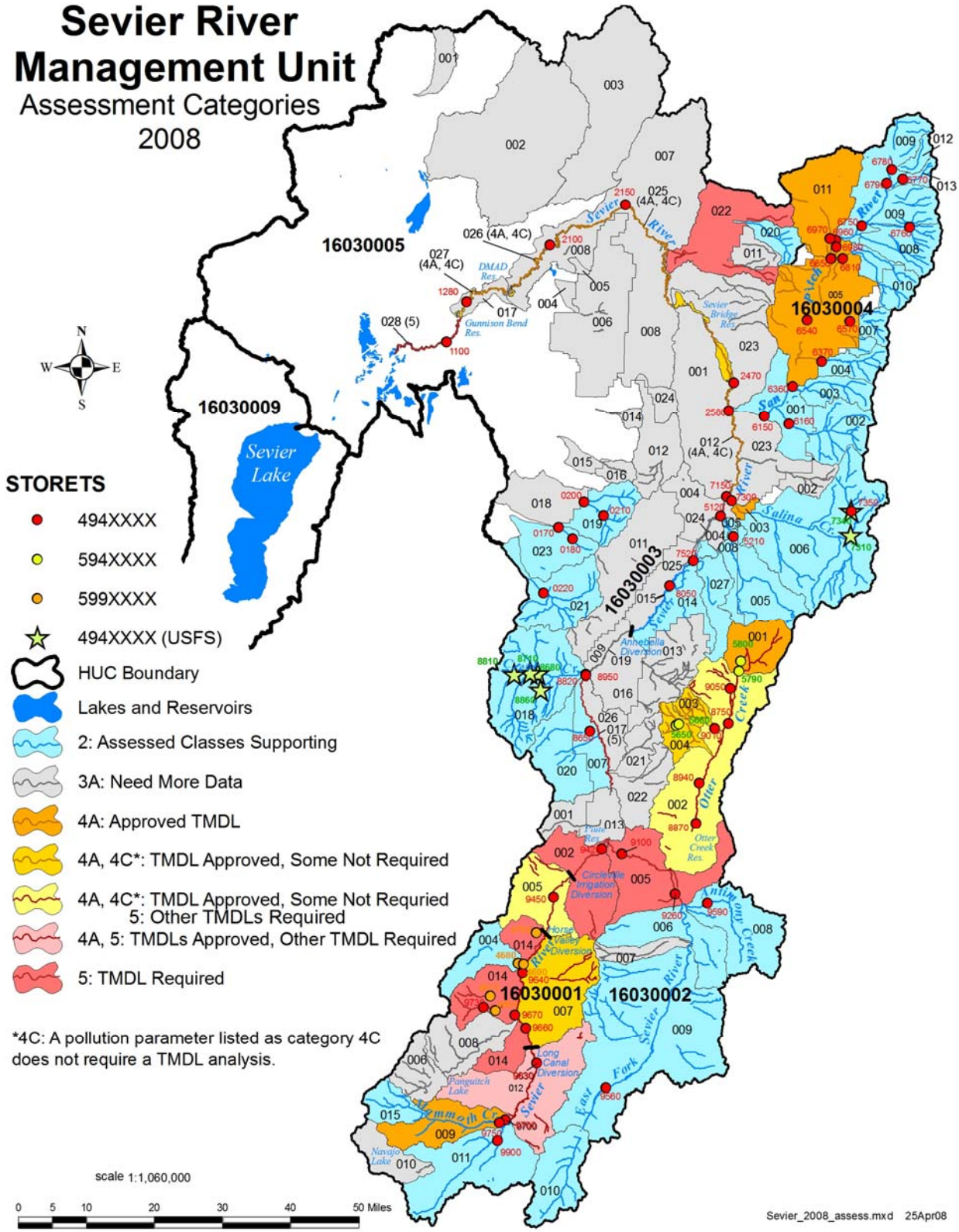


Figure 2.8.3. Beneficial use assessment by category – Sevier River Watershed Management Unit.

Table 2.8.4 Total Waters Impaired by Various Cause Categories (Stream Miles) – Sevier Watershed Management Unit	
Cause Category	**Stream Miles**
Cause unknown	
Unknown toxicity	
Pesticides	
Priority organics	
Nonpriority organics	
Metals	193.4
Ammonia	
Chlorine	
Other inorganics	
Nutrients	
pH	
Siltation/Sediment/Sediments	
Organic enrichment/low DO	31.77
Salinity/TDS/Chlorides	57.15
Thermal modifications	57.15
Flow alterations	
Other habitat alterations	
Pathogen Indicators	
Radiation	21.8
Oil and grease	
Taste and odor	
Noxious aquatic plants	
Total toxics	
Turbidity	
Exotic species	
Other (specify)	

Table 2.8.5. Total Waters Impaired by Various Source Categories (Stream Miles) – Sevier Watershed Management Unit.	
Source Category	**Stream Miles**
Industrial Point Sources	
Municipal Point Sources	
Combined Sewer Overflow	
Agriculture	57.2
Silviculture	
Construction	
Urban Runoff/Storm Sewers	
Resource Extraction	21.8
Land Disposal	
Hydromodification	
Habitat Modification	
Marinas	
Atmospheric Deposition	
Contaminated Sediments	
Unknown Source	93.5
Natural Sources	25.4
Reservoir Releases	
Recreation	
Aquaculture	
Extreme Drought	75.2
Out of State	136.2

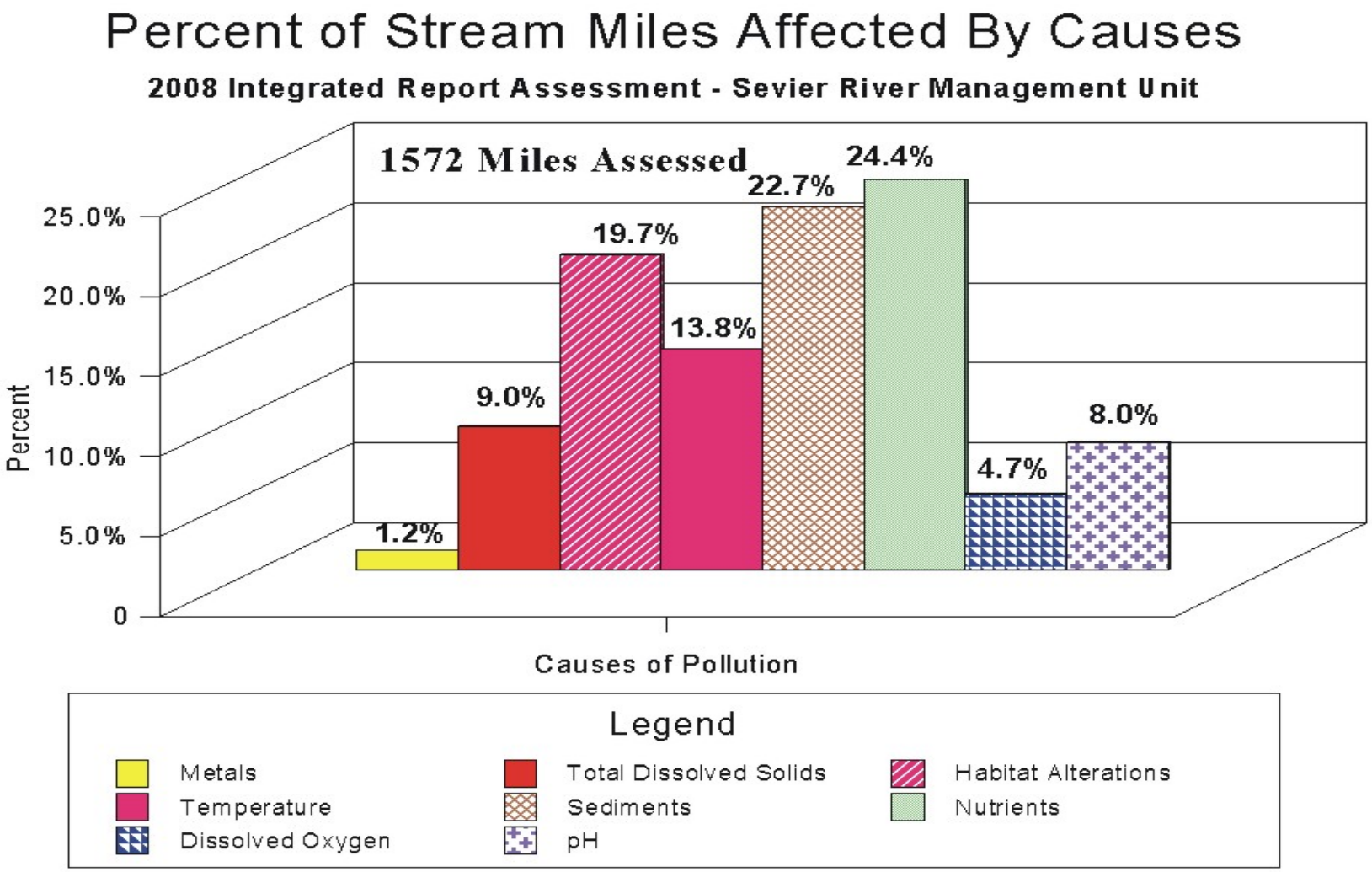


Figure 2.8.4. Percent impact by causes on stream water quality – Sevier Watershed Management Unit.

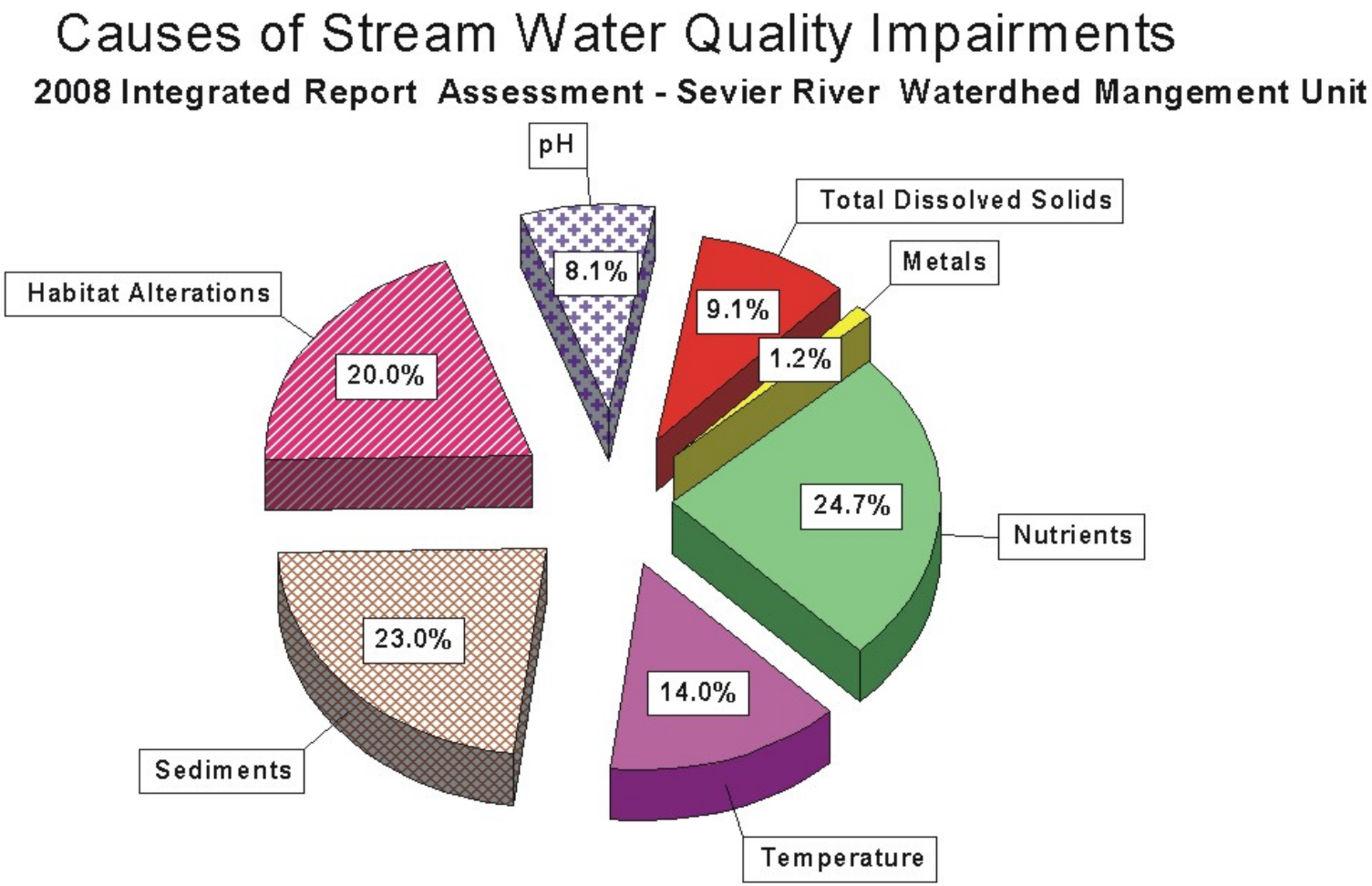


Figure 2.8..5. Relative percent contribution of causes on stream water quality – Sevier River Watershed Management Unit.

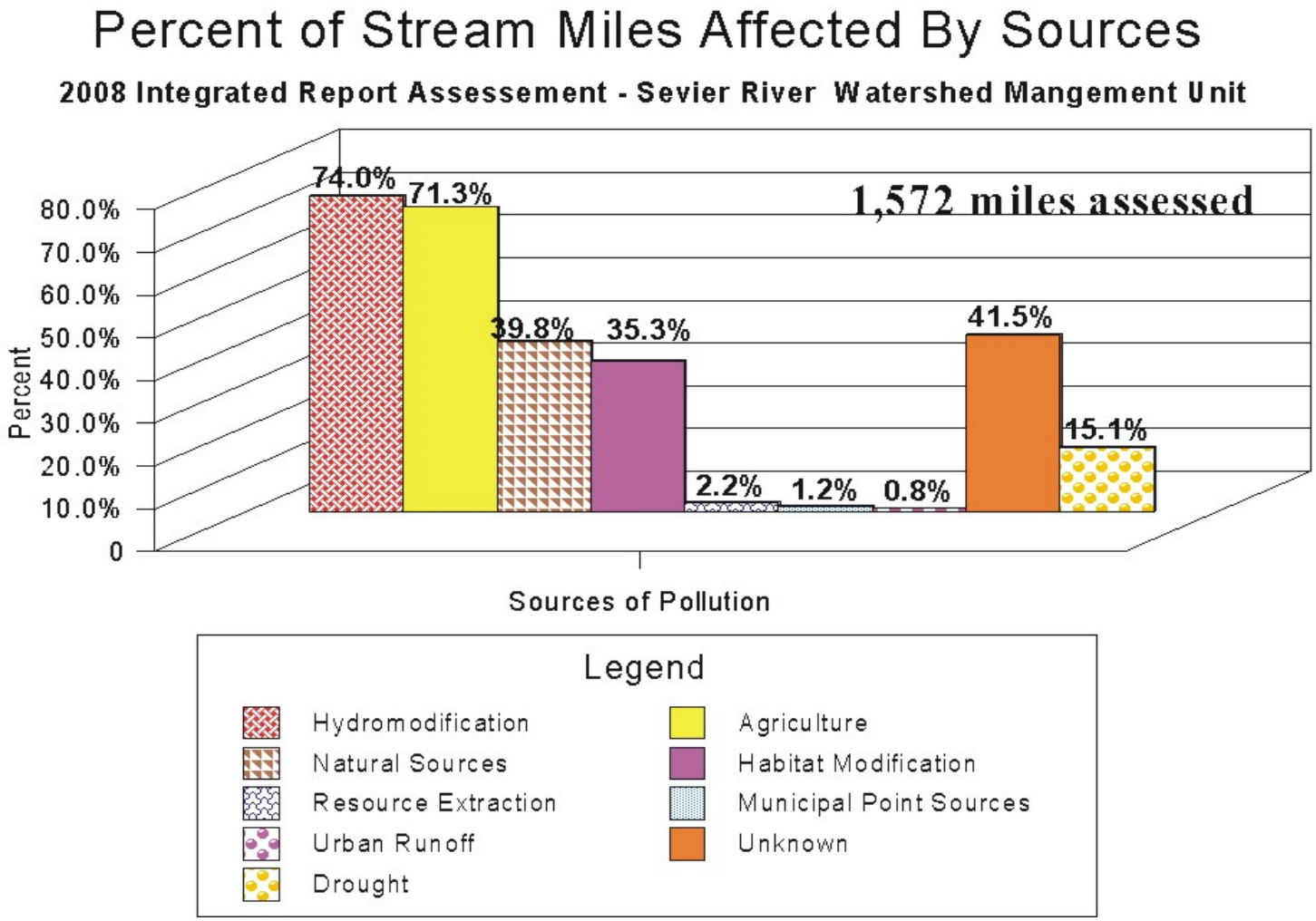


Figure 2.8.6. Percent impact by sources on stream water quality – Sevier River Watershed Management Unit.

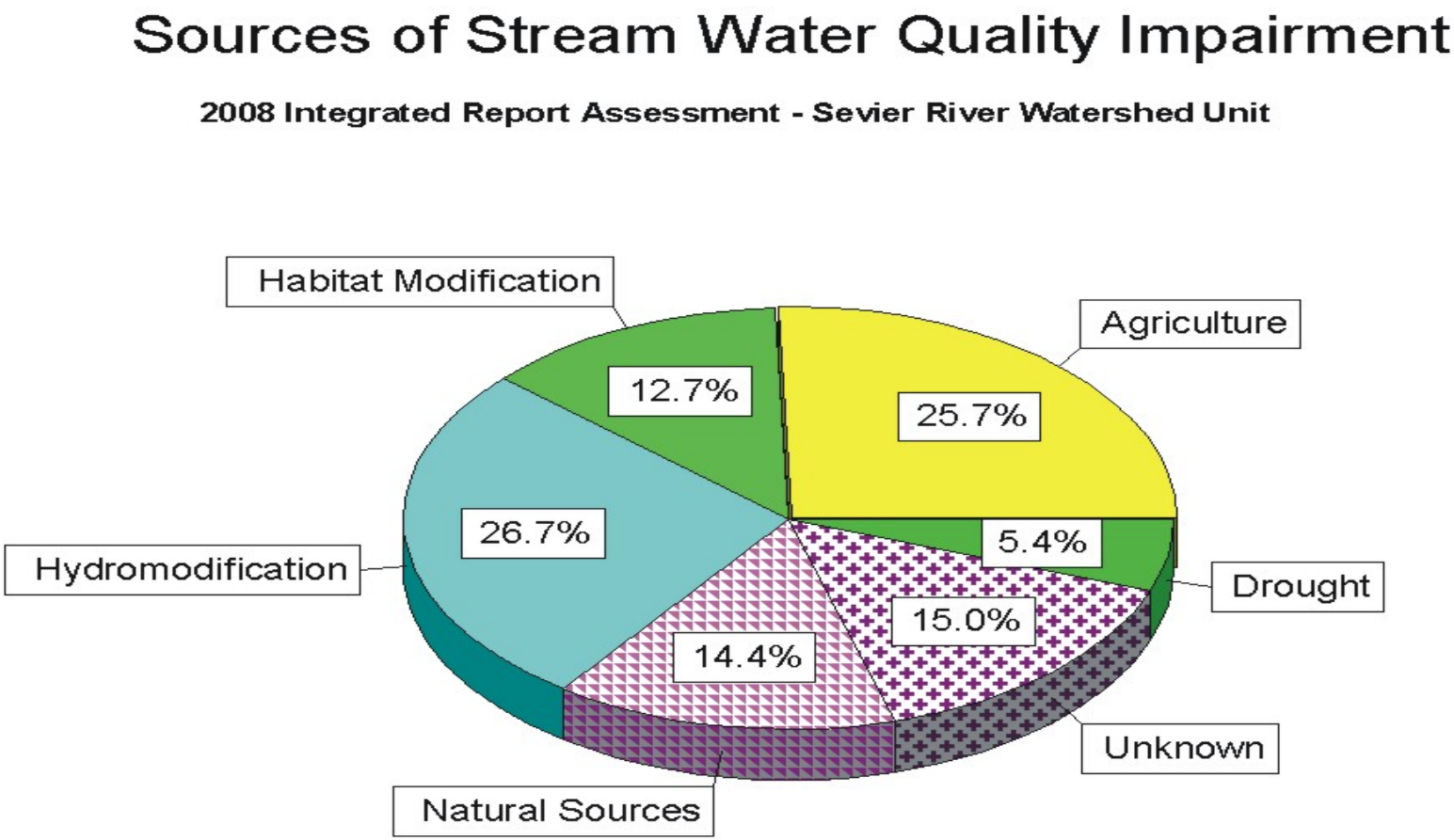


Figure 2.8.7. Relative percent contribution of sources on stream water quality – Sevier Watershed Management Unit.

Table 2.8.7. Impaired Waters Located in the Sevier River Watershed Management Unit.								
Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Beneficial Use Class Impaired	Beneficial Use Support	Support Category	Pollutant Or Pollution	Source	Stream Miles
UT16030001-005	Sevier River-3	Sevier River and tributaries from Circleville Irrigation Diversion to Horse Valley Diversion	3A	NS	4A	Siltation	-	20.73
UT16030001-005	Sevier River-3	Sevier River and tributaries from Circleville Irrigation Diversion to Horse Valley Diversion	3A	NS	4A	Total Phosphorus	-	20.73
UT16030001-007	Sevier River-2	Sevier River and east side tributaries from Horse Valley Bridge Diversion upstream to Long Canal.	3A	NS	4A	Siltation	-	46.98
UT16030001-007	Sevier River-2	Sevier River and east side tributaries from Horse Valley Bridge Diversion upstream to Long Canal.	3A	NS	4A	Total Phosphorus	-	46.98
UT16030001-009	Mammoth Creek Lower	Mammoth Creek and tributaries from confluence w/Sevier River to Mammoth Spring confluence	3A	NS	4A	Total Phosphorus	-	22.2
UT16030001-012	Sevier River-1	Sevier River and tributaries from Long Canal to Mammouth Creek confluence	3A	NS	4A	Siltation	-	28.48
UT16030001-012	Sevier River-1	Sevier River and tributaries from Long Canal to Mammouth Creek confluence	3A	NS	4A	Total Phosphorus	-	28.48
UT16030002-001	Otter Creek-4	Otter Creek and tributaries from Koosharem Reservoir to headwaters	3A	NS	4A	Total Phosphorus	-	18.58
UT16030002-001	Otter Creek-4	Otter Creek and tributaries from Koosharem Reservoir to headwaters	3A	NS	4A	Siltation	-	18.58
UT16030002-002	Otter Creek-1	Otter Creek and tributaries Otter Creek Reservoir to Koosharem Reservior, except Box and Greenwitch Creeks.	3A	NS	4A	Total Phosphorus	-	59.82
UT16030002-002	Otter Creek-1	Otter Creek and tributaries Otter Creek Reservoir to Koosharem Reservior, except Box and Greenwitch Creeks.	3A	NS	4A	Siltation	-	59.82
UT16030002-003	Otter Creek-3	Greenwich Creek and tributaries confluence w/Otter Creek to headwaters	3A	NS	4A	Total Phosphorus	-	23.77

Table 2.8.7. Impaired Waters Located in the Sevier River Watershed Management Unit.								
Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Beneficial Use Class Impaired	Beneficial Use Support	Support Category	Pollutant Or Pollution	Source	Stream Miles
UT16030002-003	Otter Creek-3	Greenwich Creek and tributaries confluence w/Otter Creek to headwaters	3A	NS	4A	Siltation	-	23.77
UT16030002-005	East Fork Sevier River-4	East Fork Sevier River and tributaries from confluence with Sevier River upstream to Antimony Creek confluence, excludin	3A	NS	4A	Total Phosphorus	-	25.74
UT16030003-003	Salina Creek-1	Salina Creek and tributaries from confluence w/Sevier River to USFS boundary	4	NS	4A	Salinity/TDS/chlorides	-	4.71
UT16030003-012	Sevier River-17	Sevier River from Yuba Dam upstream to confluence with Salina Creek	3B	NS	4A	Siltation	-	45.24
UT16030003-012	Sevier River-17	Sevier River from Yuba Dam upstream to confluence with Salina Creek	3B	NS	4A	Total Phosphorus	-	45.24
UT16030003-012	Sevier River-17	Sevier River from Yuba Dam upstream to confluence with Salina Creek	4	NS	4A	Salinity/TDS/chlorides	-	45.24
UT16030004-005	San Pitch-2	San Pitch River and tributaries from Gunnison Reservoir to U132 crossing below USFS boundary	4	NS	4A	Salinity/TDS/chlorides	-	55.79
UT16030004-011	San Pitch-4	Silver Creek and tributaries from confluence with San Pitch to headwaters	4	NS	4A	Salinity/TDS/chlorides	-	10.84
UT16030005-025	Sevier River-20	Sevier River from U-132 at ther northern most point of the Sevier River (near Dog Valley Wash confluence) upstream to Yu	3B	NS	4A	Siltation	-	34.43
UT16030005-025	Sevier River-20	Sevier River from U-132 at ther northern most point of the Sevier River (near Dog Valley Wash confluence) upstream to Yu	3B	NS	4A	Total Phosphorus	-	34.43

Table 2.8.7. Impaired Waters Located in the Sevier River Watershed Management Unit.								
Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Beneficial Use Class Impaired	Beneficial Use Support	Support Category	Pollutant Or Pollution	Source	Stream Miles
UT16030005-026	Sevier River-22	Sevier River from DMAD Reservoir upstram to U-132 crossing at the northern most point of the Sevier River (near Dog Vall	3B	NS	4A	Siltation	-	42.27
UT16030005-026	Sevier River-22	Sevier River from DMAD Reservoir upstram to U-132 crossing at the northern most point of the Sevier River (near Dog Vall	3B	NS	4A	Total Phosphorus	-	42.27
UT16030005-027	Sevier River-24	Sevier River from Gunnison bend Reservoir to DMAD Reservoir	3B	NS	4A	Siltation	-	17.45
UT16030005-027	Sevier River-24	Sevier River from Gunnison bend Reservoir to DMAD Reservoir	3B	NS	4A	Total Phosphorus	-	17.45
UT16030001-005	Sevier River-3	Sevier River and tributaries from Circleville Irrigation Diversion to Horse Valley Diversion	3A	NS	4C	Other habitat alterations	-	20.73
UT16030001-007	Sevier River-2	Sevier River and east side tributaries from Horse Valley Bridge Diversion upstream to Long Canal.	3A	NS	4C	Other habitat alterations	-	46.98
UT16030002-002	Otter Creek-1	Otter Creek and tributaries Otter Creek Reservoir to Koosharem Reservior, except Box and Greenwitch Creeks.	3A	NS	4C	Other habitat alterations	-	59.82
UT16030002-003	Otter Creek-3	Greenwich Creek and tributaries confluence w/Otter Creek to headwaters	3A	NS	4C	Other habitat alterations	-	23.77
UT16030003-012	Sevier River-17	Sevier River from Yuba Dam upstream to confluence with Salina Creek	3B	NS	4C	Other habitat alterations	-	45.24
UT16030004-009	San Pitch-5	San Pitch River and tributaries from beneficial U132 to Pleasant Creek confluence, excluding Cedar Creek, Oak Creek, Pleasant Creek, and Cottonwood Creek	3A	NS	4C	Other Habitat Alterations	-	65.66
UT16030005-025	Sevier River-20	Sevier River from U-132 at ther northern most point of the Sevier River (near Dog Valley Wash confluence) upstream to Yu	3B	NS	4C	Other habitat alterations	-	34.43

Table 2.8.7. Impaired Waters Located in the Sevier River Watershed Management Unit.								
Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Beneficial Use Class Impaired	Beneficial Use Support	Support Category	Pollutant Or Pollution	Source	Stream Miles
UT16030005-026	Sevier River-22	Sevier River from DMAD Reservoir upstram to U-132 crossing at the northern most point of the Sevier River (near Dog Vall	3B	NS	4C	Other habitat alterations	-	42.27
UT16030005-027	Sevier River-24	Sevier River from Gunnison bend Reservoir to DMAD Reservoir	3B	NS	4C	Other habitat alterations	-	17.45
UT16030001-002	Sevier River-4	Sevier River and tributaries from Piute Reservoir to Circleville Irrigation Diversion, excluding East Fork Sevier River	3A	NS	5	Temperature	-	16.21
UT16030001-012	Sevier River-1	Sevier River and tributaries from Long Canal to Mammouth Creek confluence	3A	NS	5	Temperature	-	28.48
UT16030001-014	Threemile Creek	Threemile Creek and other Sevier River west side tributaries from Horse Valley Diversion upstream to Long Canal, excluding Panguitch and Bear Creeks	3A	NS	5	Temperature	-	19.91
UT16030002-002	Otter Creek-1	Otter Creek and tributaries Otter Creek Reservoir to Koosharem Reservior, except Box and Greenwitch Creeks.	3A	NS	5	Temperature	-	59.82
UT16030002-002	Otter Creek-1	Otter Creek and tributaries Otter Creek Reservoir to Koosharem Reservior, except Box and Greenwitch Creeks.	3A	NS	5	pH	-	59.82
UT16030002-005	East Fork Sevier River-4	East Fork Sevier River and tributaries from confluence with Sevier River upstream to Antimony Creek confluence, excludin	3A	NS	5	Temperature	-	25.74
UT16030003-017	Sevier River-6	Sevier River from Clear Creek confluence to HUC unit boundary	3A	NS	5	Temperature	-	28.06
UT16030004-009	San Pitch-5	San Pitch River and tributaries from beneficial U132 to Pleasant Creek confluence, excluding Cedar Creek, Oak Creek, Ple	3A	NS	5	Temperature	-	65.66

Table 2.8.7. Impaired Waters Located in the Sevier River Watershed Management Unit.								
Assessment Unit ID	**Assessment Unit Name**	**Assessment Unit Description**	**Beneficial Use Class Impaired**	**Beneficial Use Support**	**Support Category**	**Pollutant Or Pollution**	**Source**	**Stream Miles**
UT16030005-022	Chicken Creek-2	Chicken Creek and tributaries from confluence w/Sevier River to Levan	4	NS	5	Salinity/TDS/chlorides	-	24.51
UT16030005-028	Sevier River-25	Sevier River from Crear Lake to Gunnison Bend Reservoir	4	NS	5	Boron	-	18.66

Chapter 2.9.1 Cedar / Beaver Watershed Management Unit Assessment

2.9.1. Introduction

The Cedar / Beaver Watershed Management Unit includes all streams located in the U.S.G.S Hydrological Units (HUCs) listed in Table 2.9.1. There are not many streams within this unit with the major streams being the Beaver River, Coal Creek, Shoal Creek and Pinto Creek.

Table 2.9.1. U.S.G.S. Hydrological Units in the Cedar / Beaver Watershed Management Unit.

Hydrological Unit Code	Hydrological Unit Name
16030006	Escalante Desert
16030007	Beaver Bottoms-Upper Beaver
16030008	Lower Beaver

2.9.2. Water Quality Assessment Results

2.9.2.1. Overall Beneficial Use Support--The results of the 2006 305(b) assessment were used as part of the assessment. Additional data collected since the 2006 assessment were also used to determine beneficial use support. Benthic macroinvertebrate data were used for the first time in making beneficial use assessments (Chapter xx).

Beneficial use support assessments are made by comparing data against numeric standards established for each beneficial use. Figure 2.9.1 is a map of the designated beneficial uses assigned to the stream and river Assessment Units. Assessments using benthic macroinvertebgrate data are based upon the State's narrative standard.

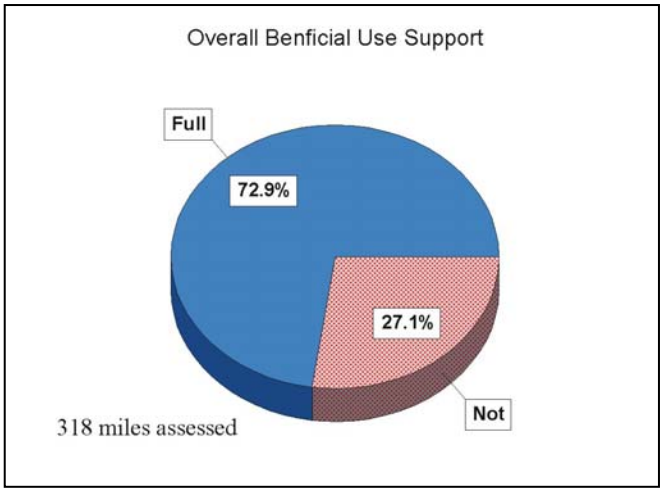


Figure 2.9.2. Cedar/ Beaver overall beneficial use support based upon at least one beneficial use being assessed .

An assessment of support for at least one beneficial use was made for 318 stream miles. Of those assessed, 231.8 miles (72.9%) were assessed as fully supporting all the beneficial uses assessed and (27.1%) were assessed as not supporting at least one designated beneficial use. The overall beneficial use assessment is shown in Figure 2.9.2.

2.9.2.2. Beneficial Use Assessment By Categories-- The number of stream miles assessed by categories is listed in Table 2.9.2. Figure 2.9.3 is a map of the assessment categories that rivers and streams were assigned to after the beneficial uses were evaluated. An Assessment Unit (AU) can be in more than one category.

Table. 2.9.2.Stream Miles By Assessment Category – Cedar / Beaver		
Category	**Category Definition**	**Stream Miles**
1	All beneficial uses fully supported.	0
2	Beneficial uses assessed are fully supported.	231.6
3A	No data or insufficient data to make an assessment.	111.9
3B	Lakes that are not supported for one cycle only.	0.0
3C	Insufficient data to assess but an assessment plan is in place.	0.0
4A	Approved TMDL	57.6
4B	Pollution control requirements are expected to result in full beneficial use support in near future.	0
4C	Impaired by pollution, no TMDL required.	28.1
5	Impaired by pollutant, TMDL required.	0.0

2.9.2.3. Individual Beneficial Use Support-- Individual beneficial use support is listed in Table 2.9.3. For aquatic life use support, 317.8 miles (72.9%) were assessed as fully supporting and 85.7 miles (27.1%) as not supporting. Of the 275.7 stream miles assessed for agricultural use, 218.1 (79.1%) were assessed as fully supporting and 57.7 miles (20.9%) not supporting this designated beneficial use.

Table 2.9.3. Individual Use Support Summary – Cedar/Beaver Watershed Management Unit.					
Use	**Size Assessed**	**Size Fully Supporting**	**Size Fully Supporting but Threatened**	**Size Not Supporting**	**Size Not Attainable**
Aquatic Life	317.8	231.6	0.0	85.7	0.0
Fish Consumption	0.0	0.0	0.0	0.0	0.0
Swimming	57.6	0.0	0.0	57.6	0.0
Secondary Contact	57.6	0.0	0.0	57.6	0.0
Drinking Water	0.0	0.0	0.0	0.0	0.0
Agricultural	275.7	218.1	0.0	57.6	0.0
Total	317.8	231.6	0.0	85.7	0.0
Use					
Aquatic Life		72.9%		27.0%	
Fish Consumption		0.0%		0.0%	
Swimming		0.0%		100.0%	
Secondary Contact		0.0%		100.0%	
Drinking Water		0.0%		0.0%	
Agricultural		79.1%		20.9%	
Total		72.9%		27.1%	

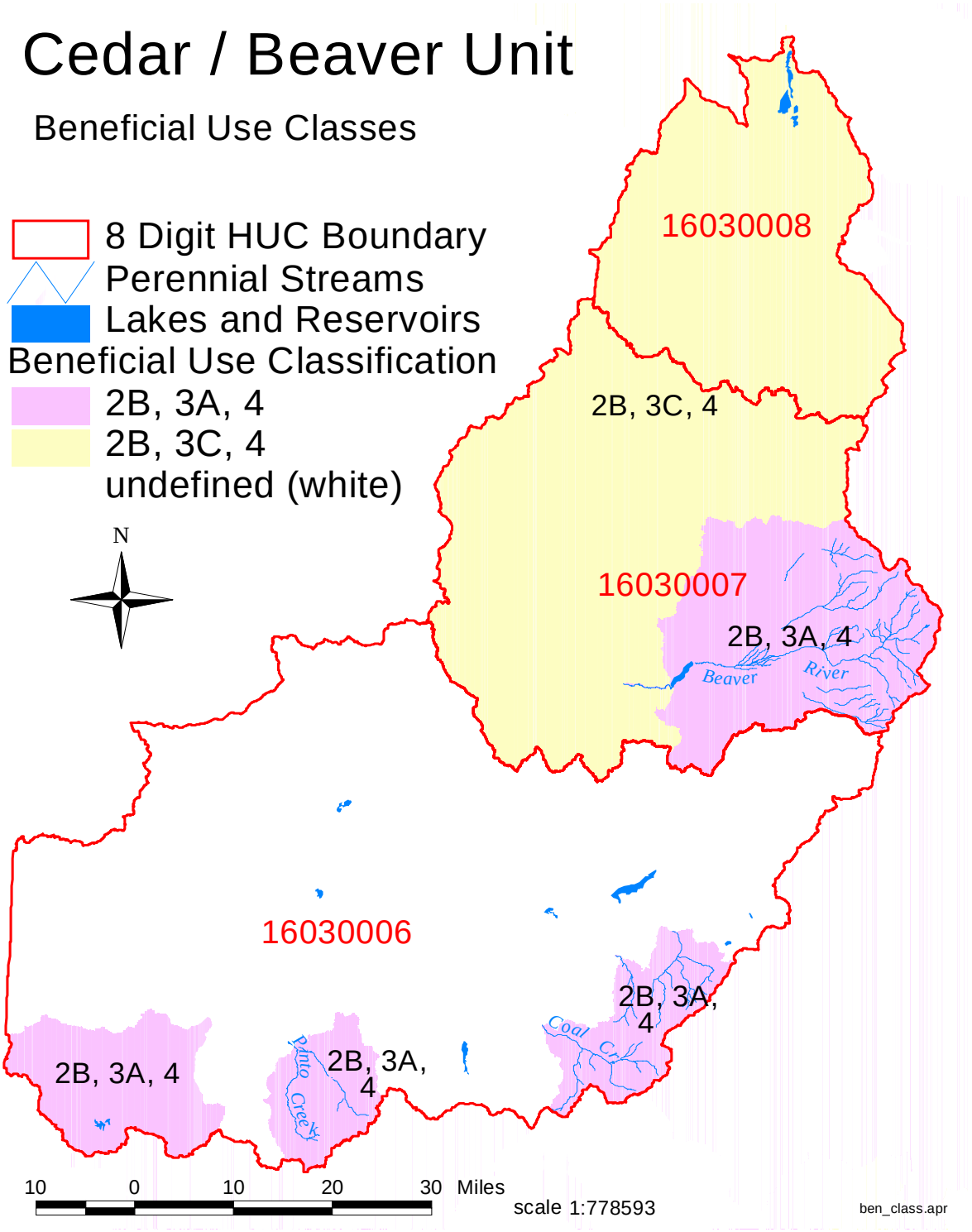


Figure 2.9.2. River and stream designated beneficial use classes – Cedar/Beaver Watershed Management Unit.

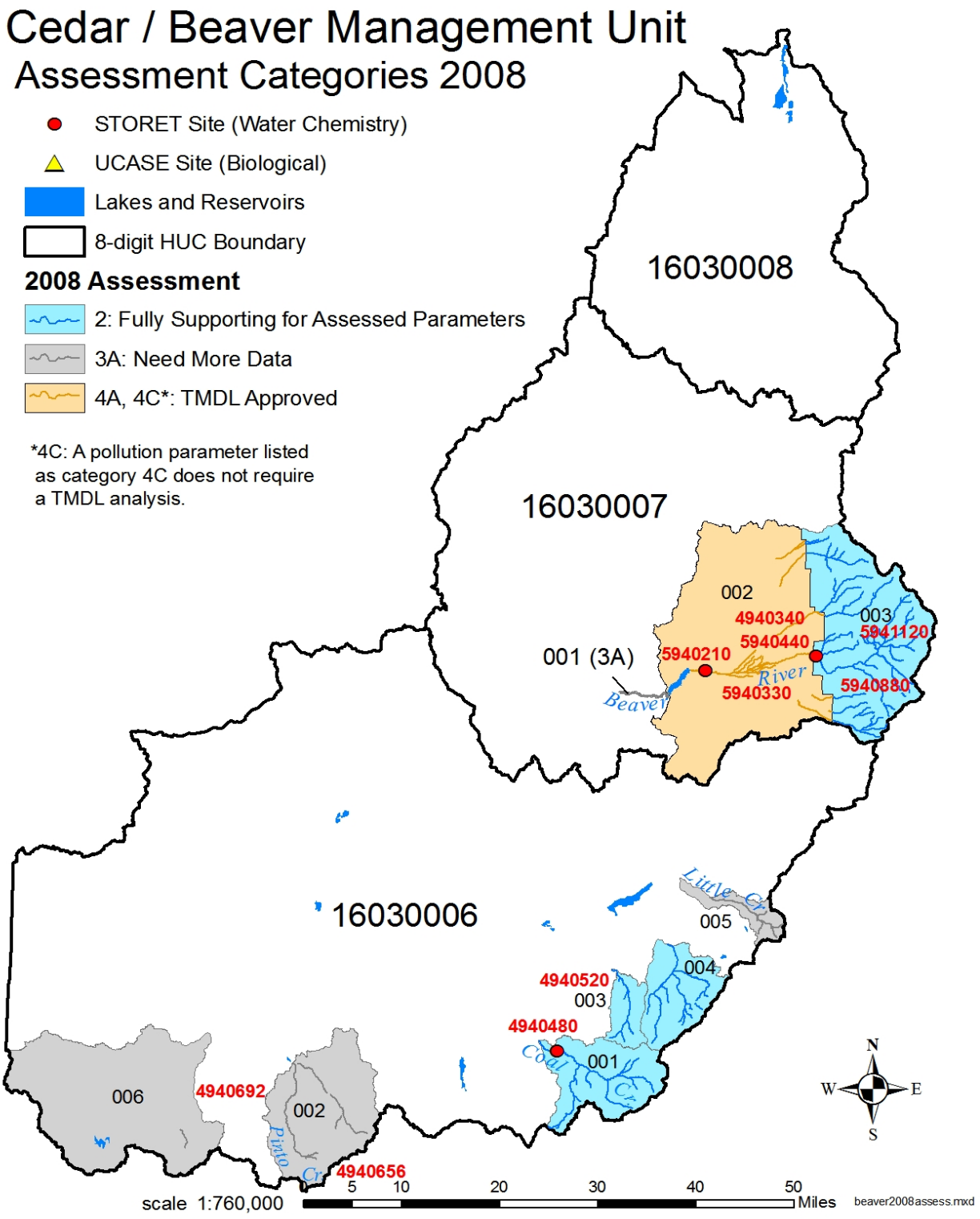


Figure 2.9.3. Beneficial use assessment by category – Cedar / Beaver Watershed Management Unit.

2.9.2.4. Total Waters Impaired by Various Causes— The causes of impairment are listed in Table 2.9.4. The major causes of impairment are nutrients (total phosphorus), temperature, pH and habitat alterations. The percent of miles impacted by various causes are shown in Figure 2.9.3 were 19.9% percent respectively for all causes.(Figure 2.9.4). The relative impact of these causes is shown in Figure 2.9.5.

2.9.2.5. Total Waters Impaired by Various Sources—The number of stream miles impacted by sources are listed in table 2.9.4. The major sources of impairment were agricultural activities, hydromodification, habitat modification, and unknown sources as shown in Figure 2.9.6. The relative percent impairment by sources is illustrated in Figure 2.9.7.

The impaired Assessment Units are listed in Table 2.9.6. The table includes the class of beneficial uses impaired and the pollutant or pollution causing the impairment.

Table 2.9.4. Total Waters Impaired by Various Cause Categories – Cedar/Beaver Watershed Management Unit.	
Cause Category	**Stream Miles**
Cause unknown	0.0
Unknown toxicity	0.0
Pesticides	0.0
Priority organics	-
Nonpriority organics	-
Metals	0.0
Ammonia	0.0
Chlorine	0.0
Other inorganics	0.0
Nutrients	57.6
pH	57.6
Siltation/Sediments	0.0
Organic enrichment/low DO	0.0
Salinity/TDS/Chlorides	0.0
Thermal modifications	57.6
Flow alterations	0.0
Other habitat alterations	85.7
Pathogen Indicators	0.0
Radiation	-
Oil and grease	-
Taste and odor	0.0
Noxious aquatic plants	0.0
Total toxics	0.0
Turbidity	-
Exotic Species	-
Other (Specify)	

Table 2.9.5. Total Waters Impaired by Various Source Categories – Cedar/Beaver Watershed Management Unit.	
Source Category	**Stream Miles**
Industrial Point Sources	0.0
Municipal Point Sources	0.0
Combined Sewer Overflow	0.0
Agriculture	85.4
Silviculture	-
Construction	0.0
Urban Runoff/Storm Sewers	0.0
Resource Extraction	0.0
Land Disposal	0.0
Hydromodification	57.6
Habitat Modification	85.4
Marinas	*
Atmospheric Deposition	-
Contaminated Sediments	-
Unknown Source	0.0
Natural Sources	57.6
Reservoir Releases	0.0
Recreation	0.0
Aquaculture	
Extreme Drought	57.6

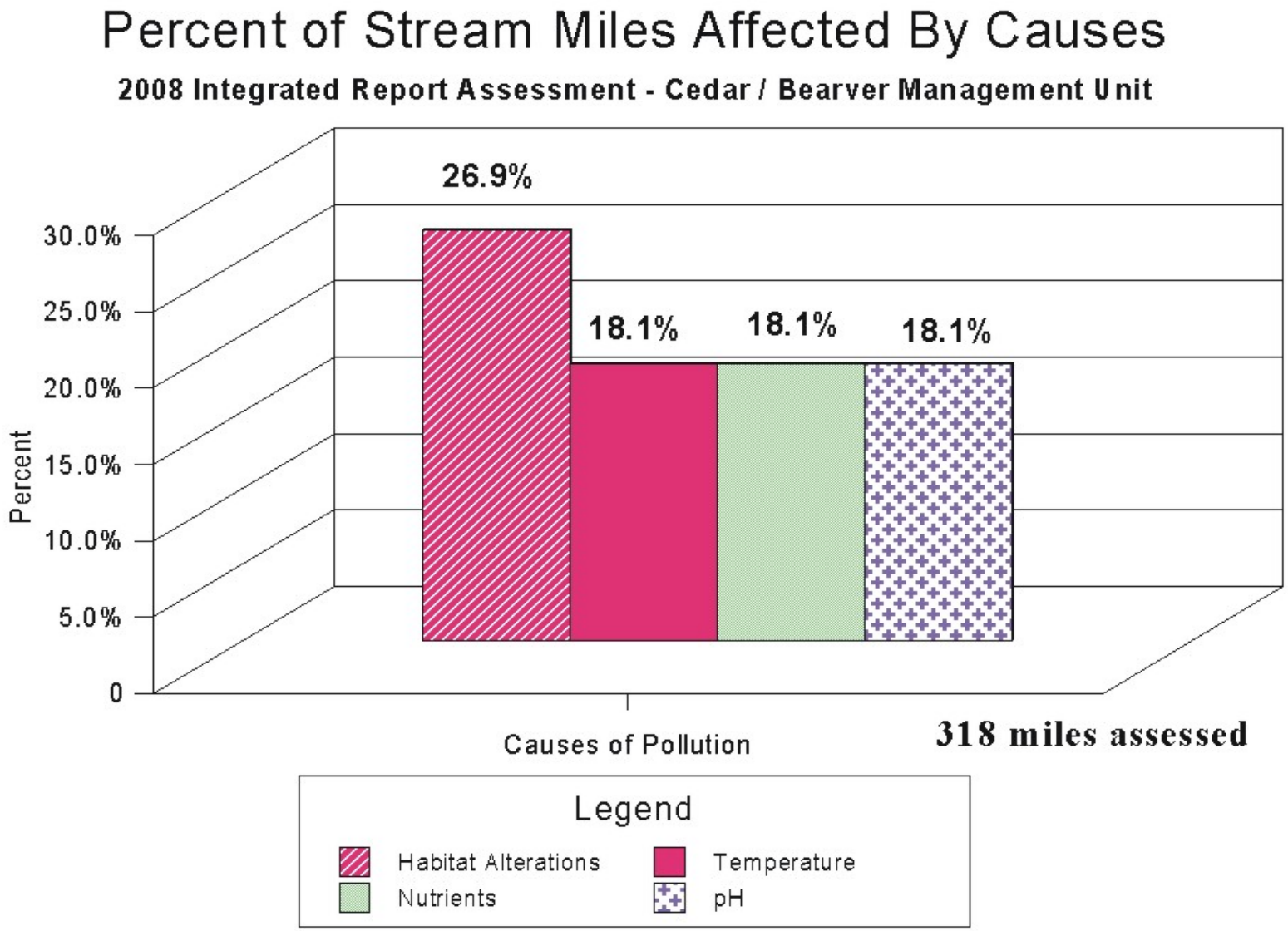


Figure 2.9.4. Percent of assessed stream miles impacted by various causes – Cedar/Beaver Watershed Management Unit.

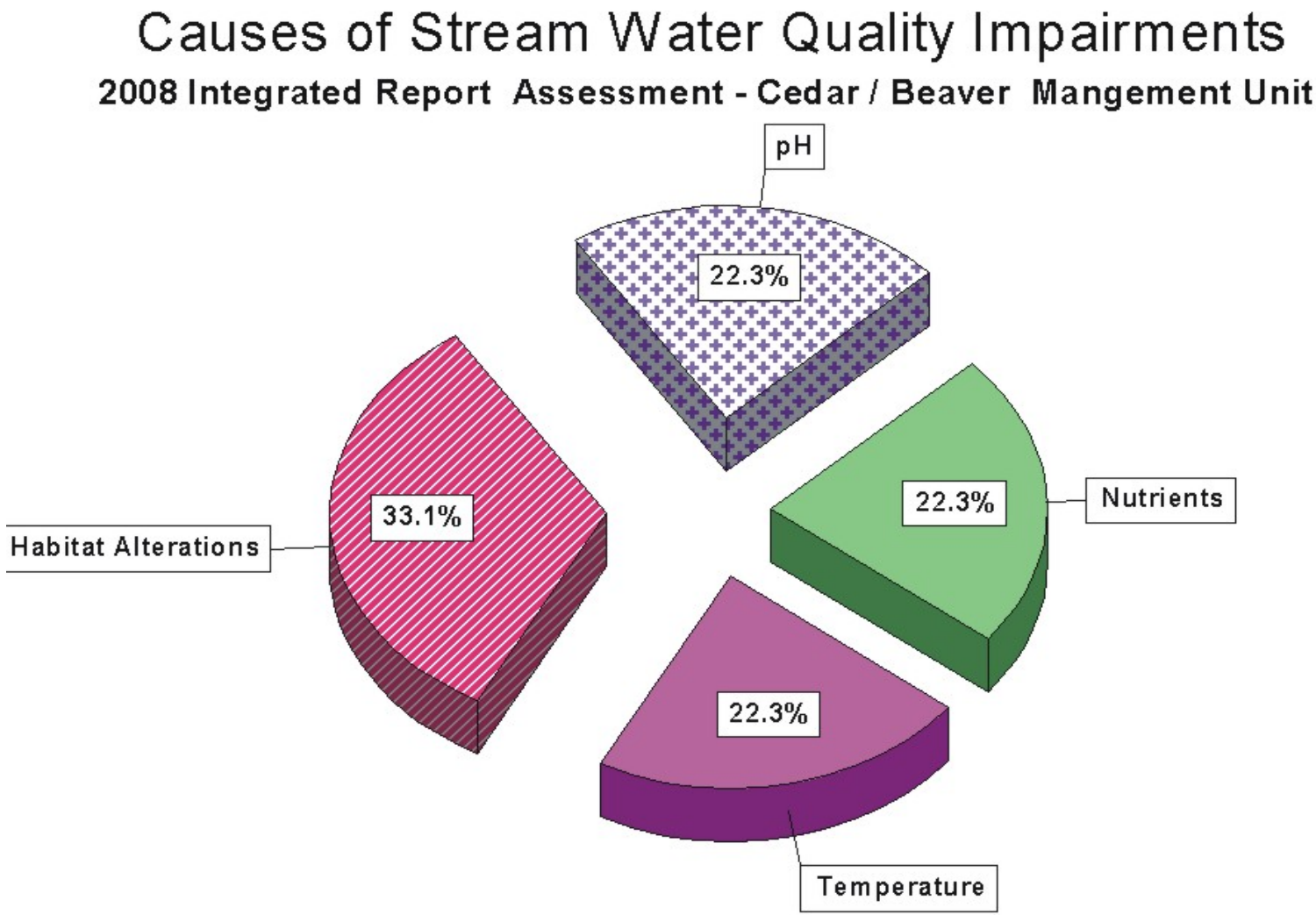


Figure 2.9.5. Relative percent impact by causes on water quality – Cedar / Beaver Watershed Management Unit.

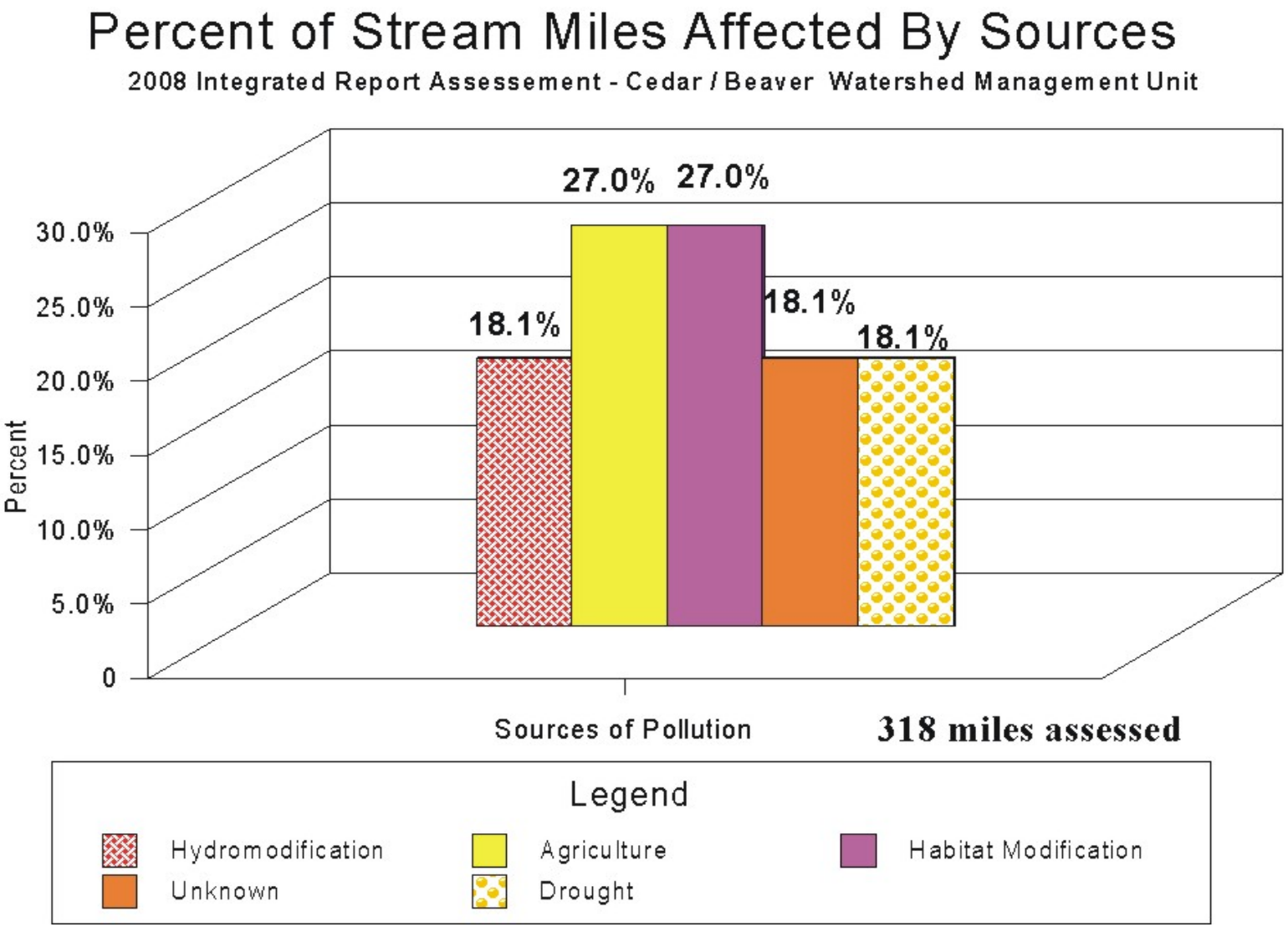


Figure 2.9.6. Percent of assessed stream miles impacted by various sources – Cedar / Beaver Watershed Management Unit.

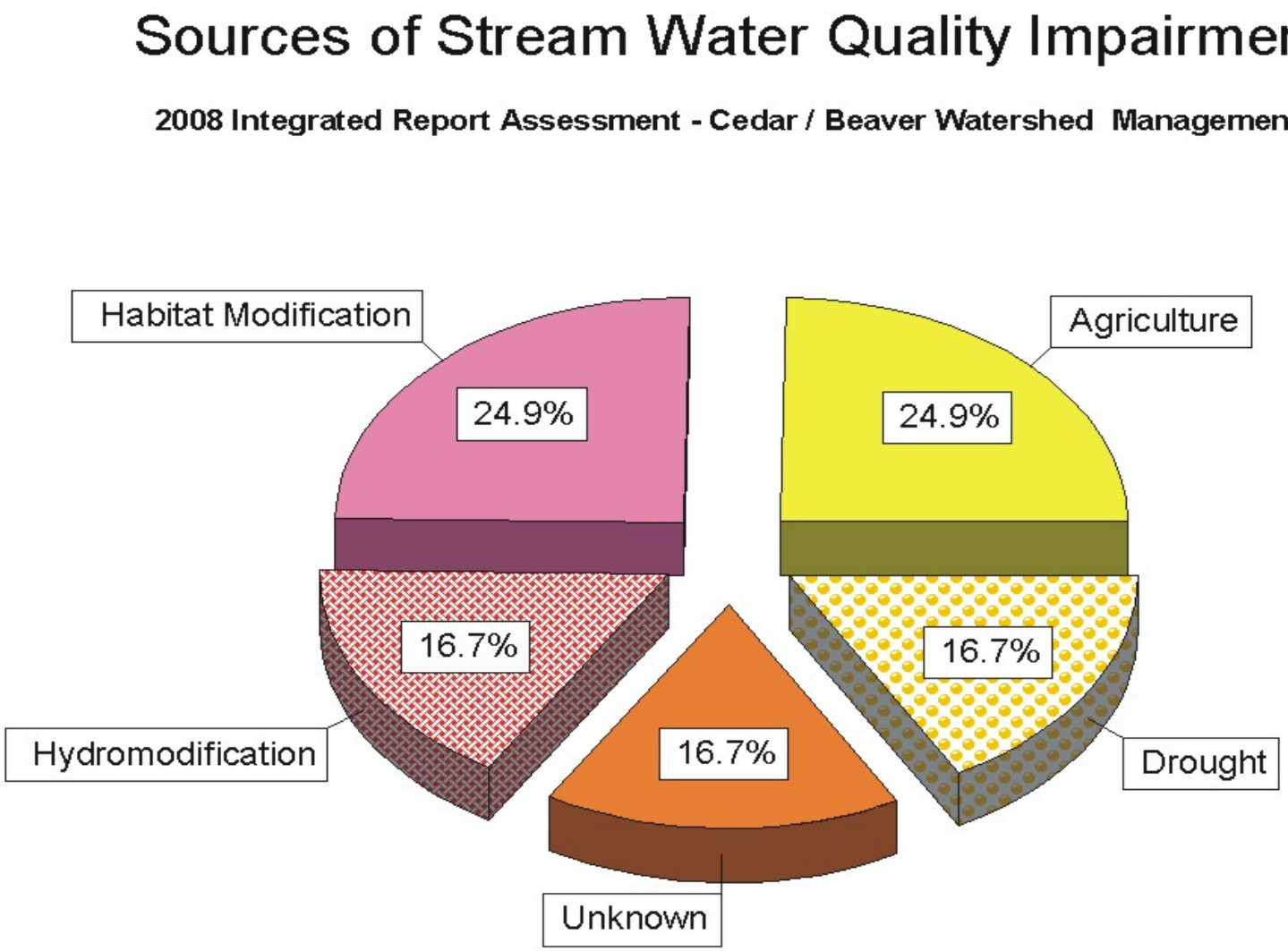


Figure 2.9.7. Relative percent contribution of causes on stream water quality – Cedar / Beaver Watershed Management Unit.

Table 2.9.6. Impaired Assessment Units in the Cedar / Beaver Watershed Management Unit.								
			Beneficial		Beneficial			
Assessment	Assessment	Assessment	Use		Use	Pollutant		
Unit	Unit	Unit	Class	Support	Assessment	Or		Stream
ID	Name	Description	Impaired	Category	Category	Pollution	Source	Stream Miles
UT16030007-002	Beaver River-2	Beaver River and tributaries from Minersville Reservoir to USFS boundary	2B, 3A, 4	NS	4A	pH	-	57.57
UT16030007-002	Beaver River-2	Beaver River and tributaries from Minersville Reservoir to USFS boundary	3A	NS	4A	Total Phosphorus	-	57.57
UT16030007-002	Beaver River-2	Beaver River and tributaries from Minersville Reservoir to USFS boundary	3A	NS	4A	Thermal modifications	-	57.57
UT16030007-002	Beaver River-2	Beaver River and tributaries from Minersville Reservoir to USFS boundary	3A	NS	4C	Other habitat alterations	-	57.57
UT16030006.002	Pinto Creek	Pinto and Little Pinto Creeks and their tributaries from Newcastle Reservoir to headwaters	3A	NS	4C	Other habitat alterations	-	28.10

Chapter 2.10. Lower Colorado River Watershed Management Unit Assessment

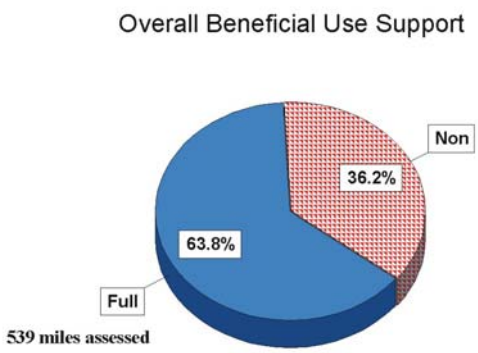
2.10.1. Introduction

The Lower Colorado River Watershed Management Unit includes all streams located in the U.S.G.S. Hydrological Units (HUCs) listed in Table 2.10.1. Some of the major streams are the Santa Clara River, Virgin River, East Fork of the Virgin River, North Fork of the Virgin River, North Creek, Kanab Creek and Laverken Creek.

Table 2.10.1. U.S.G.S. Hydrological Units in the Lower Colorado Watershed Management Unit.

Hydrological Unit Code	Hydrological Unit Name
15010003	Kanab
15010008	Upper Virgin
15010009	Fort Pierce Wash
15010010	Lower Virgin

2.10.2. Water Quality Assessment Results



Results of the 2006 Integrated Report were used to assess the waters. Data collected since the intensive survey were included in the assessment. Water chemistry and field data are compared against State standards to do the assessment. In addition, benthic macroinvertebrate data were used to assess aquatic life beneficial use support under the narrative standard (Chapter 17). Figure 2.10.1 is a map of the designated beneficial uses assigned to streams in this watershed management unit. An assessment of support for at least one beneficial use was made for 526.2 stream miles. Of those assessed, 353.3 miles (67.1%) were assessed as fully supporting all the beneficial uses assessed and 172.9 (32.9%) were assessed as not supporting at least one designated beneficial use. The overall beneficial use assessment is shown in Figure 2.10.2.

2.10.2.1. Beneficial Use Assessment By Categories – The beneficial uses assigned to streams in unit are illustrated in Figure 2.10.2. The number of stream miles assessed by categories is listed in Table 2.10.2. Figure 2.8.3 is a map of the beneficial use assessment results by categories.

Table 2.4.2. Stream Miles By Assessment Category - Lower Colorado Watershed Management Unit.

Category	Category Definition	Stream Miles
1	All beneficial uses fully supported.	0
2	Beneficial uses assessed are fully supported.	353.3
3A	No data or insufficient data to make an assessment.	86.1
3B	Lakes that are not supported for one cycle only.	0.0
3C	Insufficient data to assess but an assessment plan is in place.	0.0
4A	Approved TMDL	23.7
4B	Pollution control requirements are expected to result in full beneficial use support in near future.	0.0
4C	Impaired by pollution, no TMDL required.	0.0
5	Impaired by pollutant, TMDL required.	172.9

2.10.2.2--Individual Beneficial Use Support--. Individual beneficial use assessments are listed in Table 2.10.3. Of the 453.9 miles assessed for aquatic life use 348.9 (76.9%), were assessed as fully supporting and 105.0 miles (23.1%) were assessed as impaired. Of the streams assessed for agricultural use, 347.6 miles (78.1%) were assessed as fully supporting, 97.7 miles (21.9%) not supporting this beneficial use.

2.10.2.3--Total Waters Impaired by Various Causes-- The causes of impairment are listed in Tables 2.10.4. The major causes of impairment are nutrients (total phosphorus), temperature, pH and habitat alterations. The percent of miles impacted were 19.9% percent respectively for all causes (Figure 2.10.4). The relative impact of these causes is shown in Figure 2.10.5.

2.10.2.4--Total Waters Impaired by Various Causes--The number of stream miles impacted by sources are listed in table 2.10.5. The major sources of impairment were agricultural activities, hydromodification, habitat modification, and unknown sources as shown in Figure 2.10.6. The relative percent impairment by sources is illustrated in Figure 2.10.7.

Table 2.10.3. Individual Beneficial Use Support Summary – Lower Colorado Watershed Management Unit

Use	Size Assessed	Size Fully Supporting	Size Fully Supporting but Threatened	Size Not Supporting	Size Not Attainable
Aquatic Life	505.7	340.3	0.0	165.1	0.0
Fish Consumption	0.0	0.0	0.0	0.0	0.0
Swimming	0.0	0.0	0.0	0.0	0.0
Secondary Contact	0.0	0.0	0.0	0.0	0.0
Drinking Water	210.3	210.3	0.0	0.0	0.0
Agricultural	445.2	347.6	0.0	97.7	0.0
Total	543.2	344.7	0.0	172.9	0.0

Table 2.10.3. Individual Beneficial Use Support Summary – Lower Colorado Watershed Management Unit					
			Size Fully		
	Size	Size Fully	Supporting	Size Not	Size Not
	Assessed	Supporting	but	Supporting	Attainable
Use			Threatened		
Use					
Aquatic Life		67.3%		32.7%	
Fish Consumption		0.0%		0.0%	
Swimming		0.0%		0.0%	
Secondary Contact		0.0%		0.0%	
Drinking Water		100.0%		0.0%	
Agricultural		78.1%		21.9%	
Total		63.5%		31.8%	

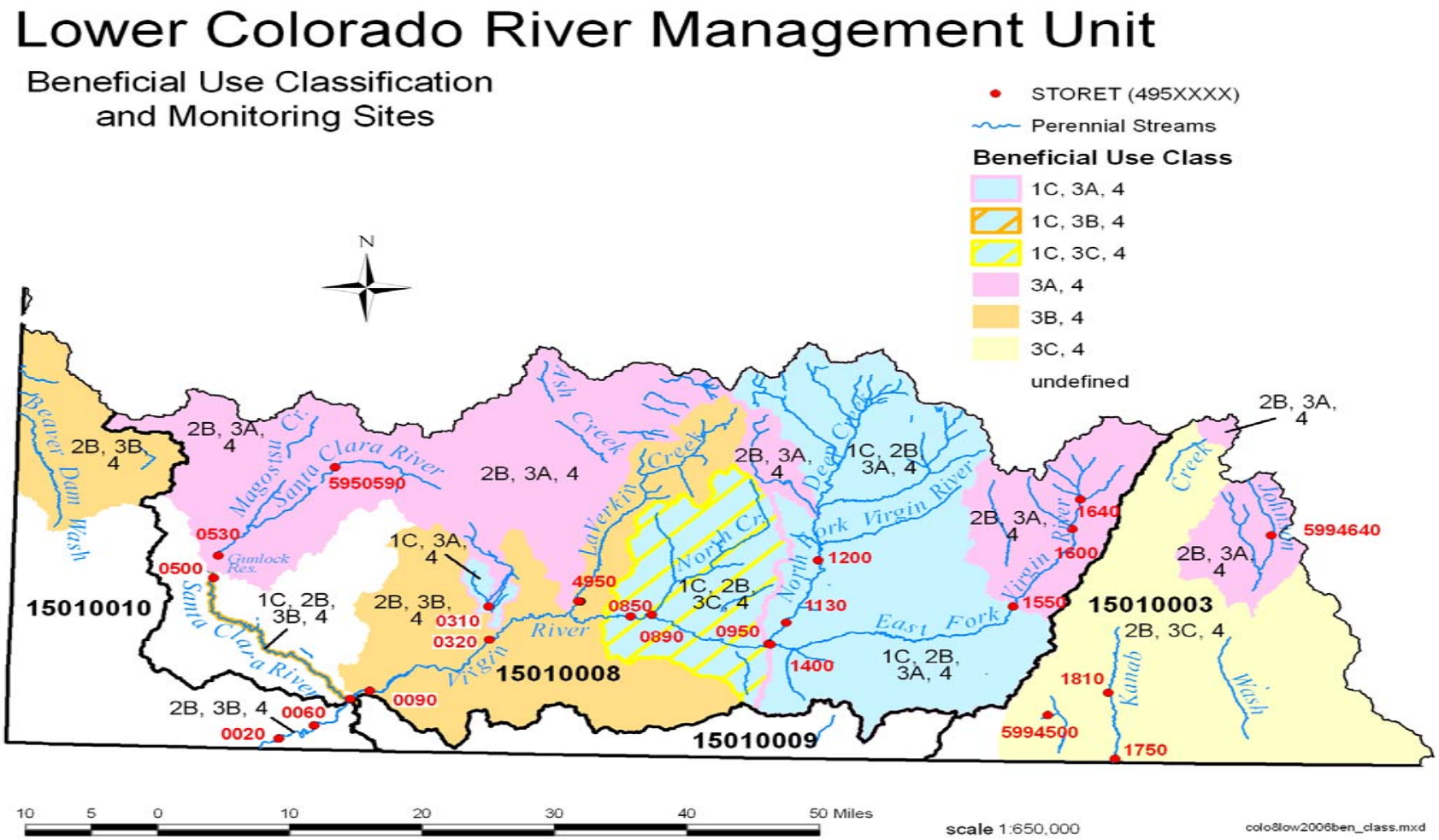


Figure 2.10.2. River and stream designated beneficial use classes – Lower Colorado Watershed Management Unit.

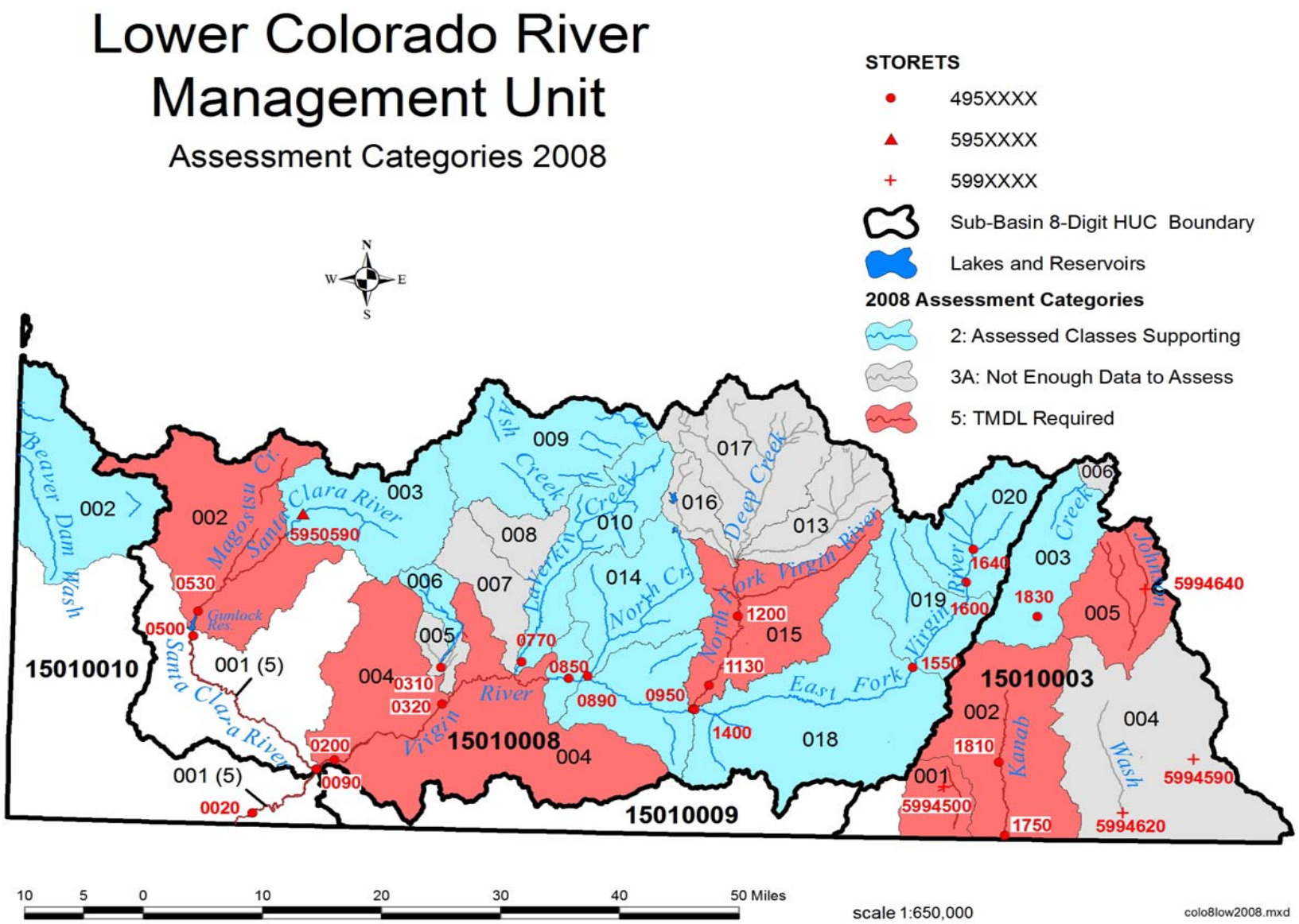


Figure 2.10.2. River and stream designated beneficial use classes – Lower Colorado Watershed Management Unit.

Table 2.10.4. Total Waters Impaired by Various Cause Categories – Lower Colorado Watershed Management Unit.	
Cause Category	**Stream Miles**
Cause unknown	0.0
Unknown toxicity	0.0
Pesticides	-
Priority organics	-
Nonpriority organics	-
Metals	103.9
Ammonia	0.0
Chlorine	0.0
Other inorganics	0.0
Nutrients	0.0
pH	0.0
Siltation/Sediments	0.0
Organic enrichment/low DO	0.0
Salinity/TDS/Chlorides	29.6
Thermal modifications	117.5
Flow alterations	0.0
Other habitat alterations	0.0
Pathogen Indicators	0.0
Radiation	-
Oil and grease	-
Taste and odor	0.0
Noxious aquatic plants	0.0
Total toxics	0.0
Turbidity	-
Exotic Species	-
Other (Specify)	

Table 2.10.5. Total Waters Impaired by Various Source Categories – Lower Colorado Watershed Management Unit.	
Source Category	**Stream Miles**
Industrial Point Sources	0.0
Municipal Point Sources	0.0
Combined Sewer Overflow	0.0
Agriculture	109.7
Silviculture	-
Construction	0.0
Urban Runoff/Storm Sewers	23.7
Resource Extraction	0.0
Land Disposal	0.0
Hydromodification	23.7
Habitat Modification	0.0
Marinas	*
Atmospheric Deposition	-
Contaminated Sediments	-
Unknown Source	0.0
Natural Sources	97.6
Reservoir Releases	0.0
Recreation	0.0
Aquaculture	
Extreme Drought	104.4

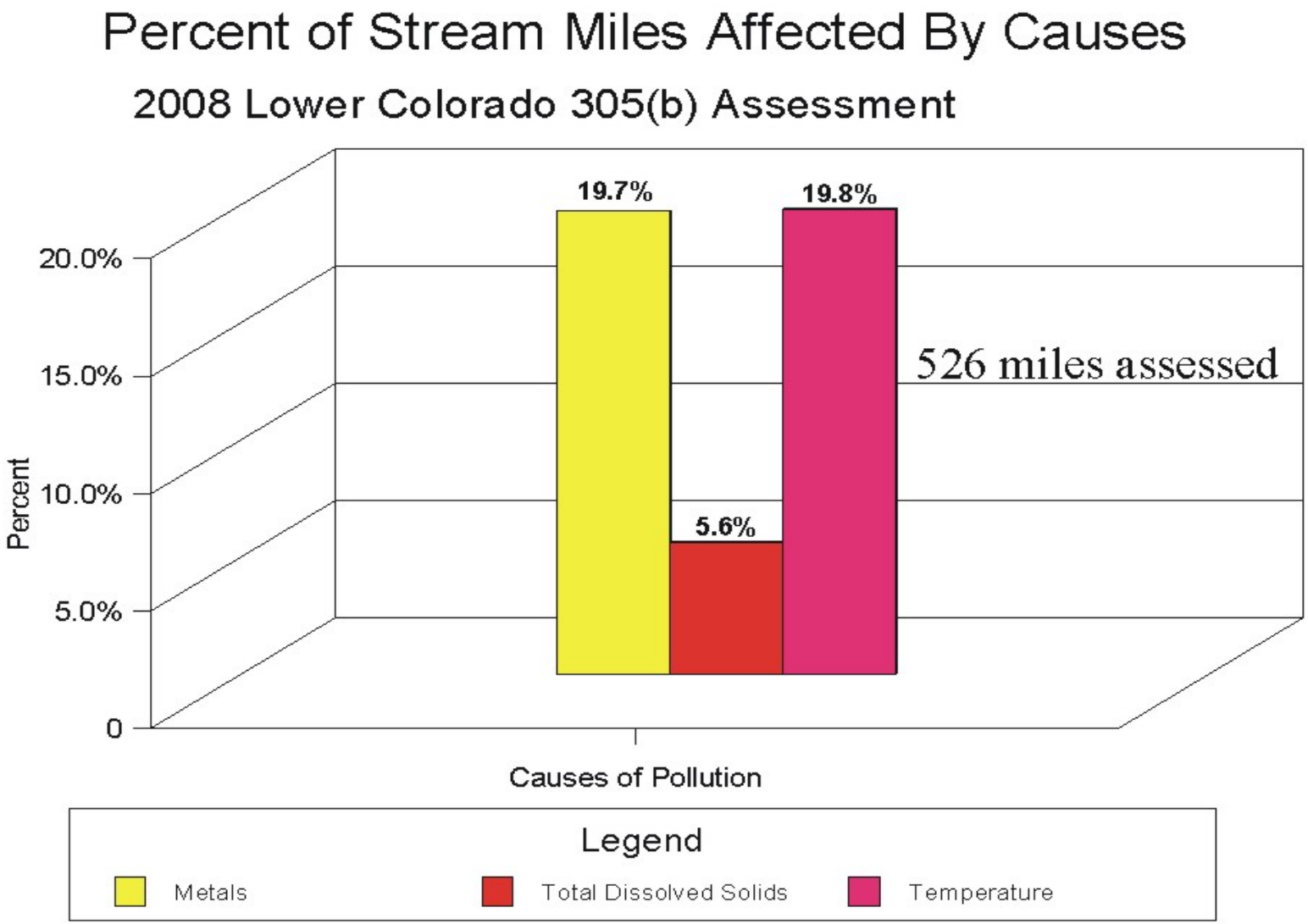


Figure 2.10.4. Percent of assessed stream miles impacted by various causes – Lower Colorado Watershed Management Unit.

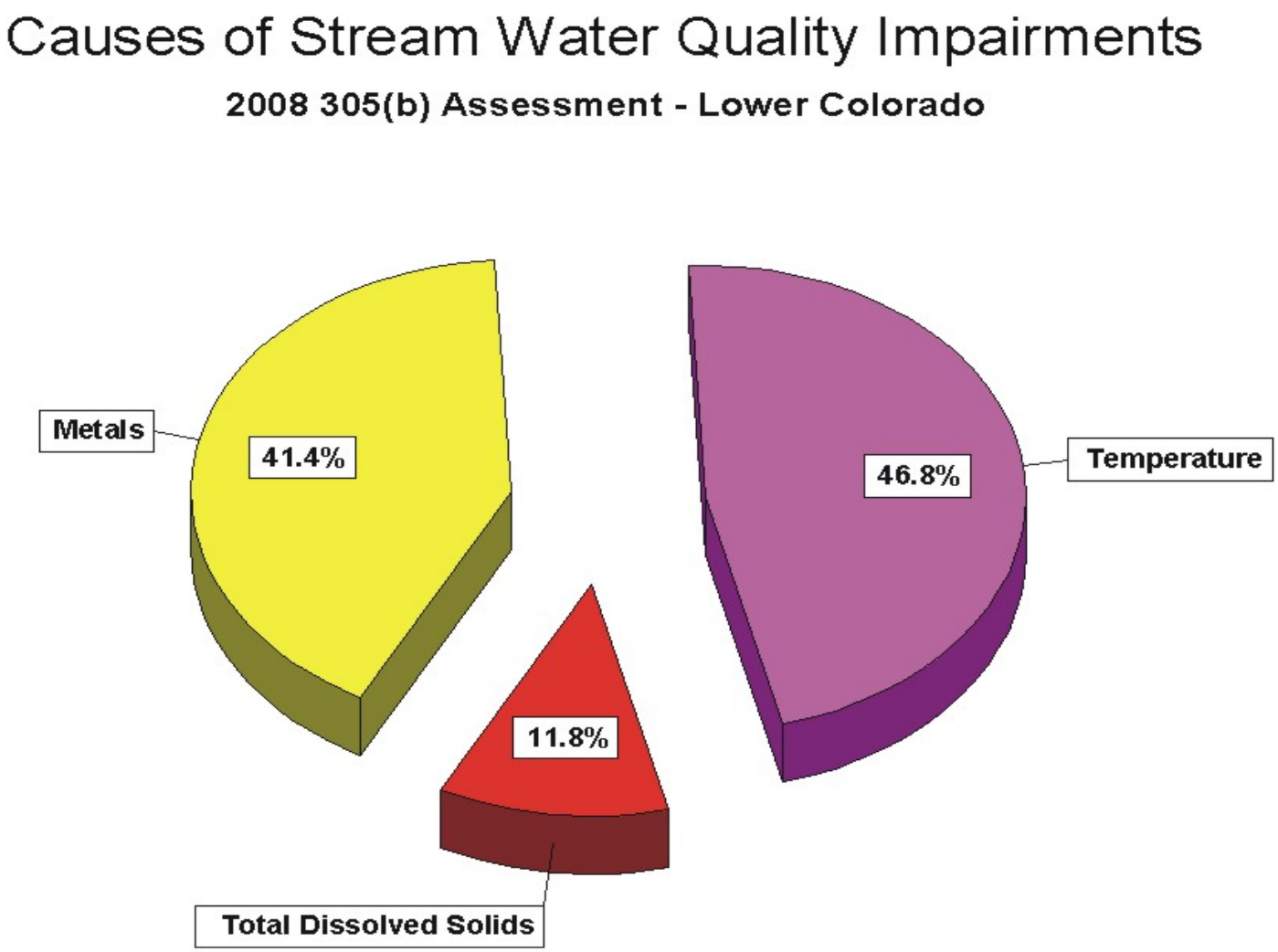


Figure 2.10.5. Relative percent impact by causes on water quality – Lower Colorado Watershed Management Unit.

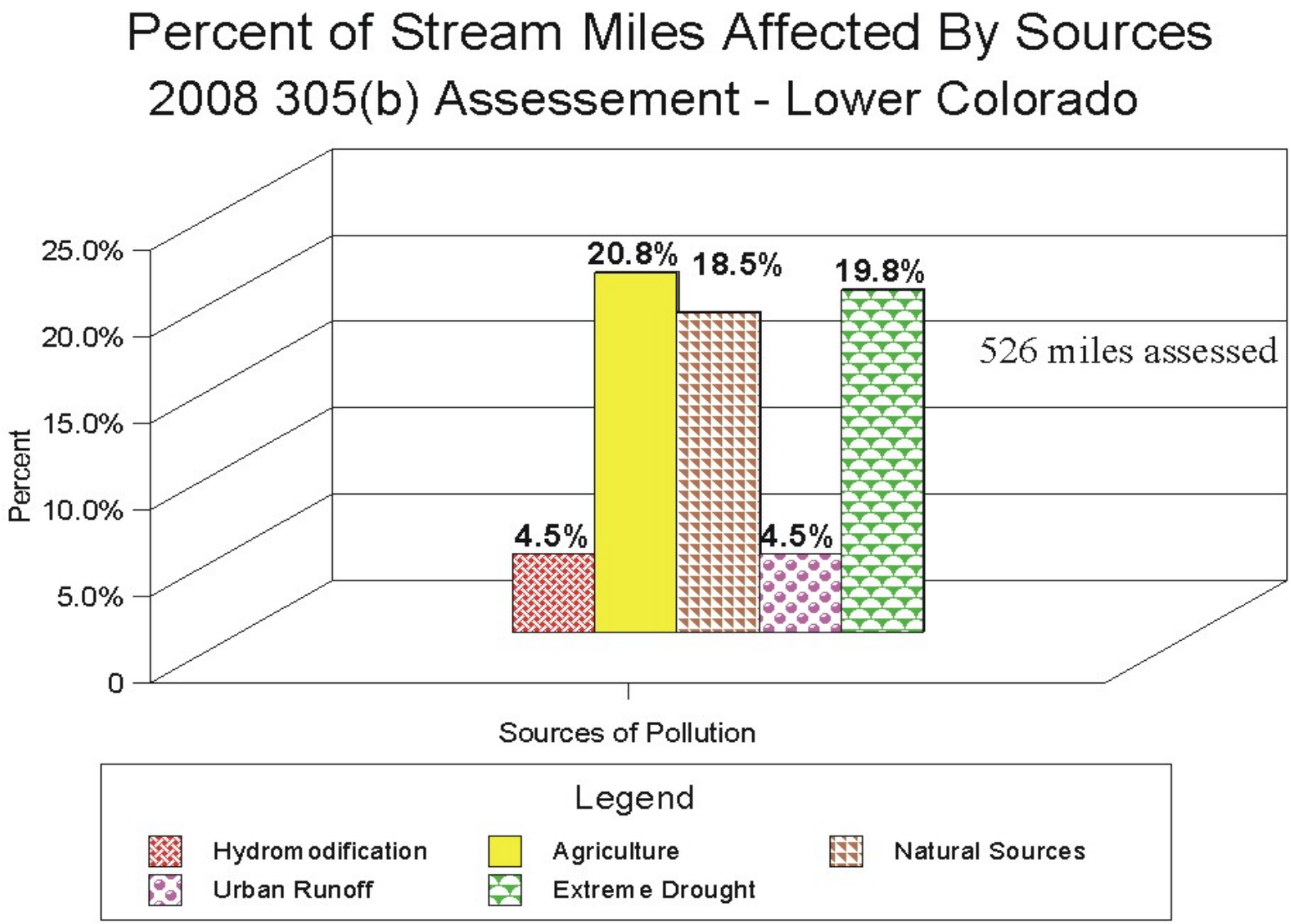


Figure 2.10.6. Percent of assessed stream miles impacted by various sources – Lower Colorado Watershed Management Unit.

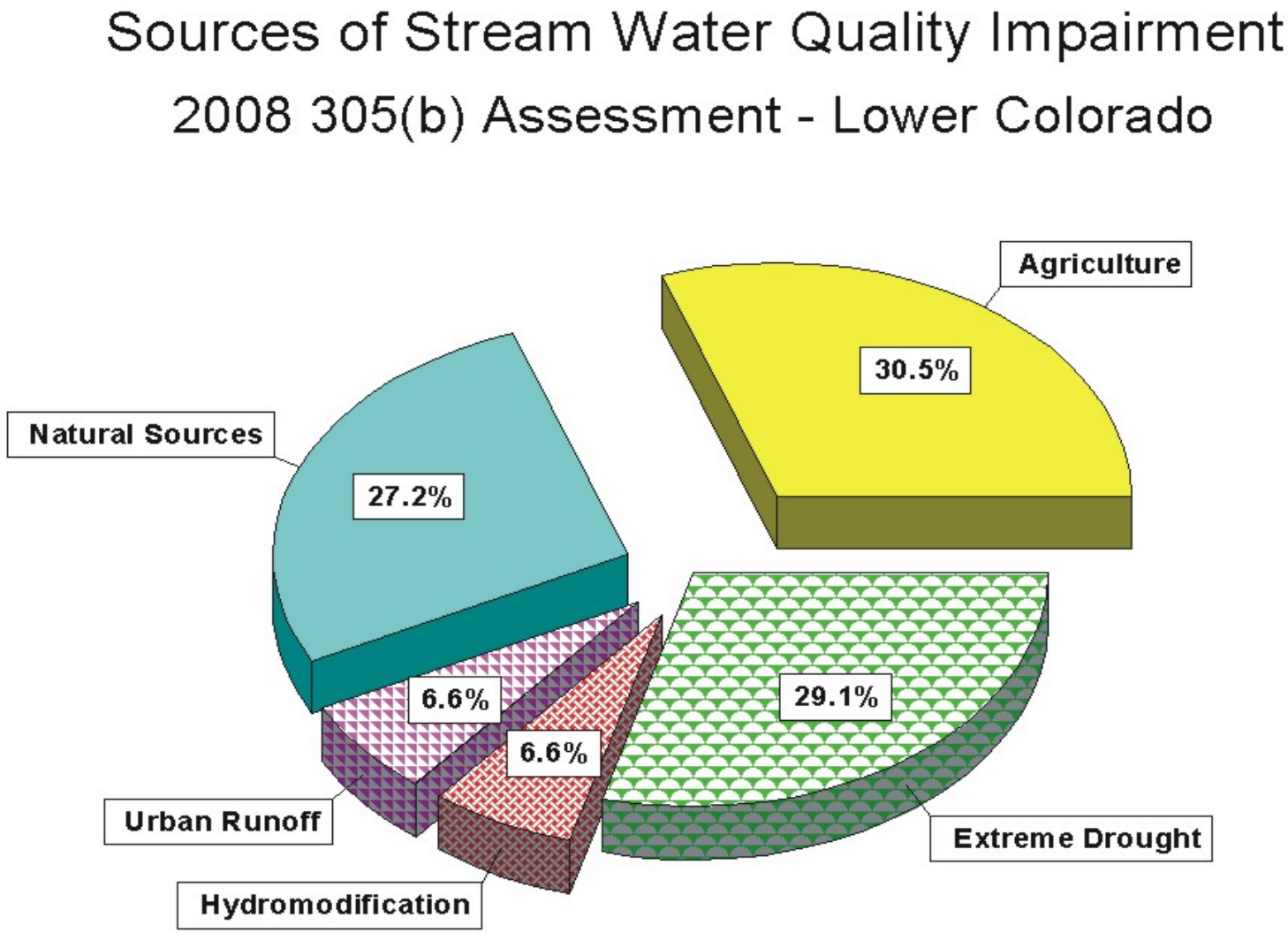


Figure 2.10.7. Relative percent impact by sources on stream water quality – Lower Colorado Watershed Management Unit.

Table 2.10.6 Impaired Assessment Units In The Lower Colorado Watershed Management Unit.								
Assessment Unit ID	**Assessment Unit Name**	**Assessment Unit Description**	**Beneficial Use Class Impaired**	**Beneficial Use Support**	**Support Category**	**Pollutant Or Pollution**	**Source**	**Stream Miles**
UT15010008-001	Santa Clara-1	Santa Clara River from confluence w/Virgin River to Gunlock Reservoir	4	NS	5	Boron	-	23.67
UT15010008-001	Santa Clara-1	Santa Clara River from confluence w/Virgin River to Gunlock Reservoir	4	NS	5	Selenium	-	23.67
UT15010008-004	Virgin River-2	Virgin River and tributaries from Santa Clara River confluence to Quail Creek diversion (excludes Quail Creek and Leeds Creek	4	NS	5	Boron	-	41.11
UT15010010-001	Virgin River-1	Virgin River from state line to Santa Clara Confluence	4	NS	5	Boron	-	15.24
UT15010008-001	Santa Clara-1	Santa Clara River from confluence w/Virgin River to Gunlock Reservoir	3C	NS	5	Temperature	-	23.67
UT15010008-002	Santa Clara-2	Santa Clara River and tributaries from Gunlock Reservoir to Baker Dam Reservoir (include Maogatsue Creek and tributaries to USF	3A	NS	5	Temperature	-	24.96
UT15010008-004	Virgin River-2	Virgin River and tributaries from Santa Clara River confluence to Quail Creek diversion (excludes Quail Creek and Leeds	3B	NS	5	Temperature	-	41.11
UT15010008-015	North Fork Virgin River-1	North Fork Virgin River and tributaries from confluence w/East Fork Virgin River to Kolob Creek confluence	3A	NS	5	Temperature	-	38.32
UT15010010-001	Virgin River-1	Virgin River from state line to Santa Clara Confluence	3B	NS	5	Temperature	-	15.24
UT15010003-002	Kanab Creek-1	Kanab Creek and tributaries from state line to the confluence with Fourmile Hollow near the White Cliffs.	4	NS	5	Total Dissolved Solids	-	17.64
UT15010003-004	Johnson Wash-1	Johnson Wash and tributaries from stateline to Redwash confluence	4	NS	5	Total Dissolved Solids	-	11.96

2.10.12

Chapter 2.11 Colorado River West Watershed Management Unit Water Quality Assessment

2.11.1 Introduction

The West Colorado Watershed Management Unit includes all streams located in the U.S.G.S. Hydrological Units (HUCs) listed in Table 5-1 Some of the major streams are the Price River, Huntington Creek, Cottonwood Creek, Ferron Creek, San Rafael River, Escalante River, Muddy Creek, Dirty Devil River, the Fremont River, and portions of the Green River.

Table 2.11.1. U.S.G.S. Hydrological Units in the Colorado River West Watershed Management Unit.

Hydrological Unit Code	Hydrological Unit Name
14060007	Price
14060008	Lower Green
14060009	San Rafael
14070001	Upper Lake Powell
14070002	Muddy
14070003	Fremont
14070004	Dirty Devil
14070005	Escalante
14070006	Lower Lake Powell

2.11.2 Water Quality Assessment Results

The results of the 2006 assessment were the primary source for assessments in the Colorado River West Watershed Management Unit. Additional data collected since the 2006 assessment were included in the assessment. Assessments were made using data collected since the intensive survey. To do the assessment, field and water chemistry data were compared against the water quality standards for the designated beneficial use classifications assigned to the rivers and streams in this management unit (Figure 2.11.1). Benthic macroinvertebrate data were used to assess some streams under DWQ's narrative standard (Chapter 15).

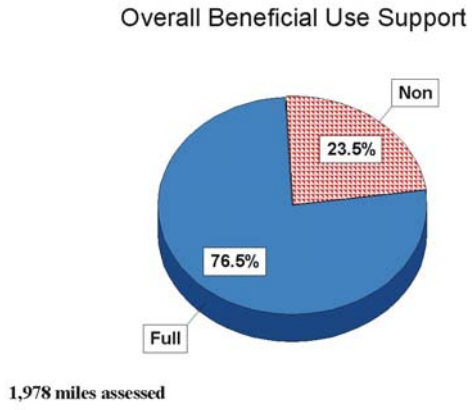


Figure 2.11.2. Overall Beneficial Use Support – Colorado River West

2.11.2.1 Overall Beneficial Use Support --There are an estimated 2,551 perennial stream miles within the West Colorado River Watershed Management

Unit. An assessment of at least one beneficial use was made on 1,976.5 miles of streams. Of these 1,579.6 (76.8%) miles were assessed as fully supporting at least one beneficial use and 458.8 miles (23.2%) were assessed as not supporting at least one designated beneficial use (Figure 2.11.2).

2.11.2.2 Beneficial Use Assessment By Categories--Table 2.11.2 lists the streams miles that were assigned to each of the assessment categories. An AU can be placed in multiple categories when it is assessed. Therefore the number of stream miles listed in the table may exceed the number assessed.

Table 2.11.2. Stream Miles By Assessment Category – Colorado River West Watershed Management Unit

Category	Category Definitions	Stream Miles
1	All beneficial uses fully supported.	0.0
2	Beneficial uses assessed are fully supported.	1,512.7
3A	No data or insufficient data to make an assessment.	389.9
3B	Lakes that are not supported for one cycle only.	0.0
3C	Insufficient data to assess but an assessment plan is in place.	0.0
4A	Approved TMDL	192.6
4B	Pollution control requirements are expected to result in full beneficial use support in near future.	0.0
4C	Impaired by pollution, no TMDL required.	193.3
5	Impaired by pollutant, TMDL required.	164.9

2.11.2.3. Individual Use Support--Table 2.11.3 lists the beneficial use support by individual beneficial use classes. Eight-hundred eleven of Class 1C (source of drinking water) were assessed as fully supporting this beneficial use. The aquatic beneficial use was supported in 1,512.7 stream miles. This was 76.6% of the stream miles assessed. Four-hundred sixty-five (23.4%) were not supporting aquatic life. Of the, 1,649.0 miles assessed for agricultural use, 1,501.4 (91.0 %) were fully supporting, and 147.6 (9.0%) not supporting this beneficial use. Of the 1,976.1 miles assessed, 1,579.6 (79.9%) were assessed as fully supporting and 397.0 miles (20.1%) were assessed as not supporting as least one beneficial use.

2.11.2.4 Total l Waters Impaired by Various Causes--Table 2.11.4 is a list of streams miles affected by the various causes identified as generally affecting water quality. The major causes of water quality impairment were temperature, total dissolved solids and metals (Table 2.11.4) (Figure 2.11.4). Other factors affecting beneficial uses were nutrients and pH. The relative percent impact by causes is shown in Figure 2.11.5.

2.11.2.5. Total Waters Impaired by Various Sources The major sources of impairment were drought, natural sources and agricultural activities (Figure 2.11.6). The relative percent impacts by sources are shown in Figure 2.11.7.

Table 2.11.3 Individual Beneficial Use Support – Colorado River West Watershed Management Unit (Stream Miles)					
			Size Fully		
	Size	Size Fully	Supporting	Size Not	Size Not
	Assessed	Supporting	but	Supporting	Attainable
Use			Threatened		
Aquatic Life	1,9776.5	1,517.7	0.0	397.0	0.0
Fish Consumption	0.0	0.0	0.0	0.0	0.0
Swimming	62.8	0.0	0.0	62.8	0.0
Secondary Contact	62.8	0.0	0.0	62.8	0.0
Drinking Water	848.6	811.6	0.0	37.1	0.0
Agricultural	1,649.0	1,501.4	0.0	147.6	0.0
Total	1,976.1	1,512.7	0.0	397.0	0.0
Use					
Aquatic Life		79.9%		20.1%	
Fish Consumption		0.0%		0.0%	
Swimming		0.0%		0.0%	
Secondary Contact		0.0%		0.0%	
Drinking Water		95.6%		4.4%	
Agricultural		91.0%		9.0%	
Total		76.8%		23.2%	

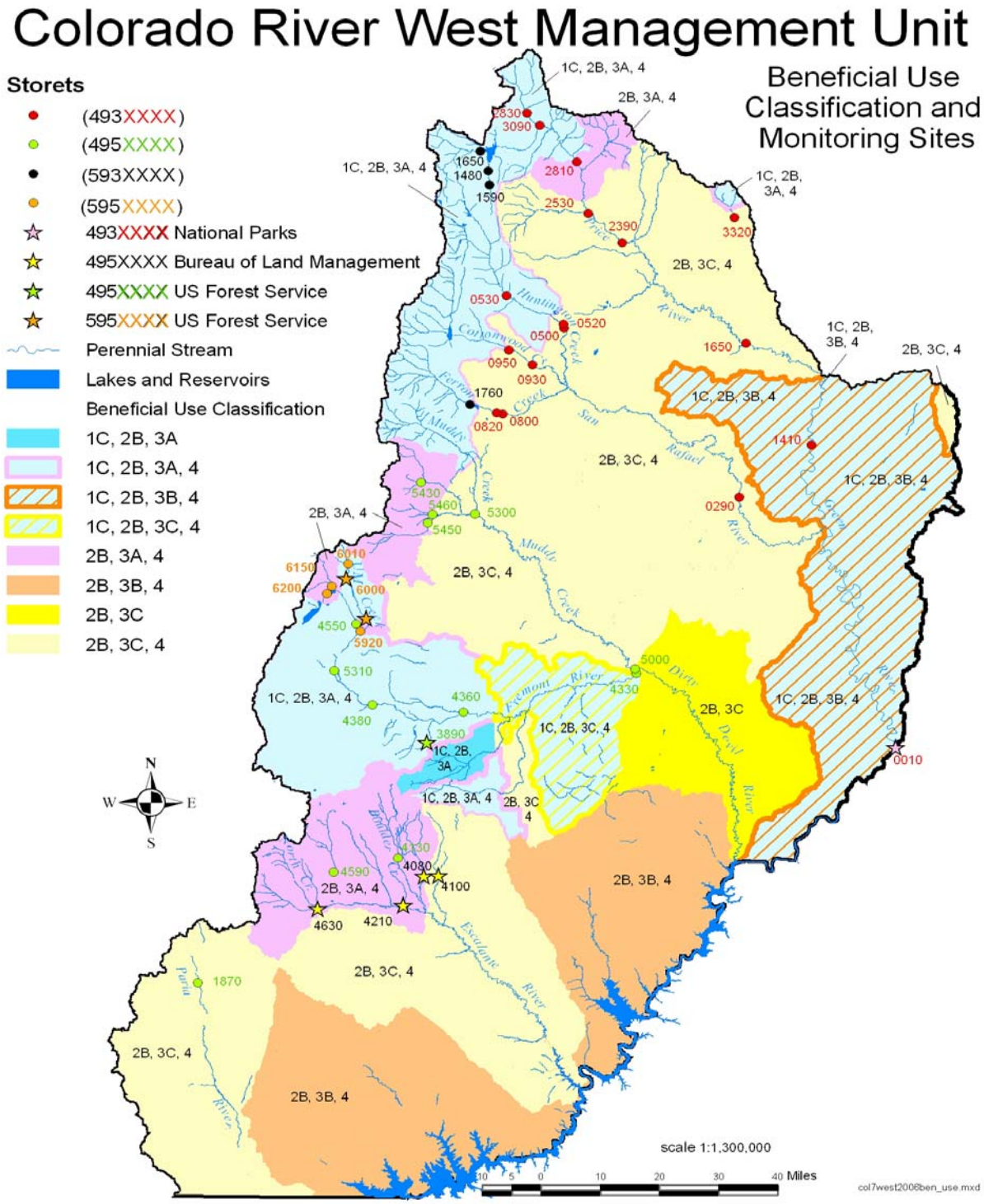


Figure 2.6.2. Beneficial use classifications – Colorado River West Watershed Management Unit.

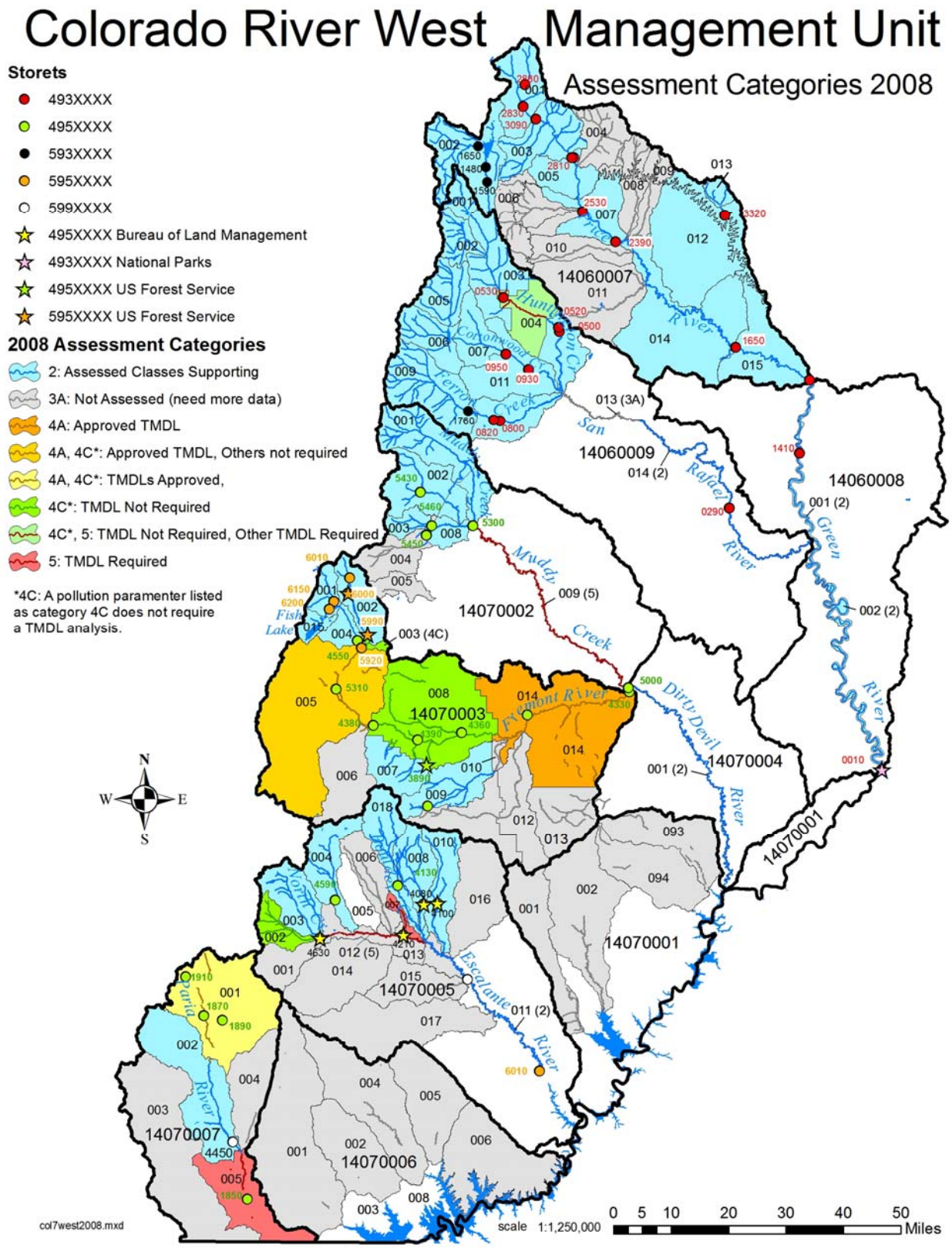


Figure 2.3.3. Beneficial use assessment by category – Colorado River West Watershed Management Unit.

Table 2.11.4 Total Waters Impaired by Various Cause Categories (Stream Miles) – Colorado River West Watershed Management Unit	
Cause Category	**Stream Miles**
Cause unknown	0.0
Unknown toxicity	0.0
Pesticides	0.0
Priority organics	0.0
Nonpriority organics	0.0
Metals	104.0
Ammonia	0.0
Chlorine	0.0
Other inorganics	0.0
Nutrients	0.0
pH	0.0
Siltation/Sediments	0.0
Organic enrichment/low DO	3138
Salinity/TDS/Chlorides	84.9
Thermal modifications	136.5
Flow alterations	0.0
Other habitat alterations	0.0
Pathogen Indicators	0.0
Radiation	0.0
Oil and grease	0.0
Taste and odor	0.0
Noxious aquatic plants	0.0
Total toxics	0.0
Turbidity	0.0
Exotic species	0.0
Other (specify)	0.0

Table 2.11.5. Total Waters Impaired by Various Source Categories (Stream Miles) – Colorado River West Watershed Management Unit.	
Source Category	**Stream Miles**
Industrial Point Sources	0.0
Municipal Point Sources	0.0
Combined Sewer Overflow	0.0
Agriculture	188.9
Silviculture	0.0
Construction	0.0
Urban Runoff/Storm Sewers	0.0
Resource Extraction	0.0
Land Disposal	0.0
Hydromodification	0.0
Habitat Modification	0.0
Marinas	0.0
Atmospheric Deposition	0.0
Contaminated Sediments	0.0
Unknown Source	31.3
Natural Sources	31.3
Reservoir Releases	0.0
Recreation	0.0
Aquaculture	0.0
Extreme Drought	136.5
Out of State	0.0

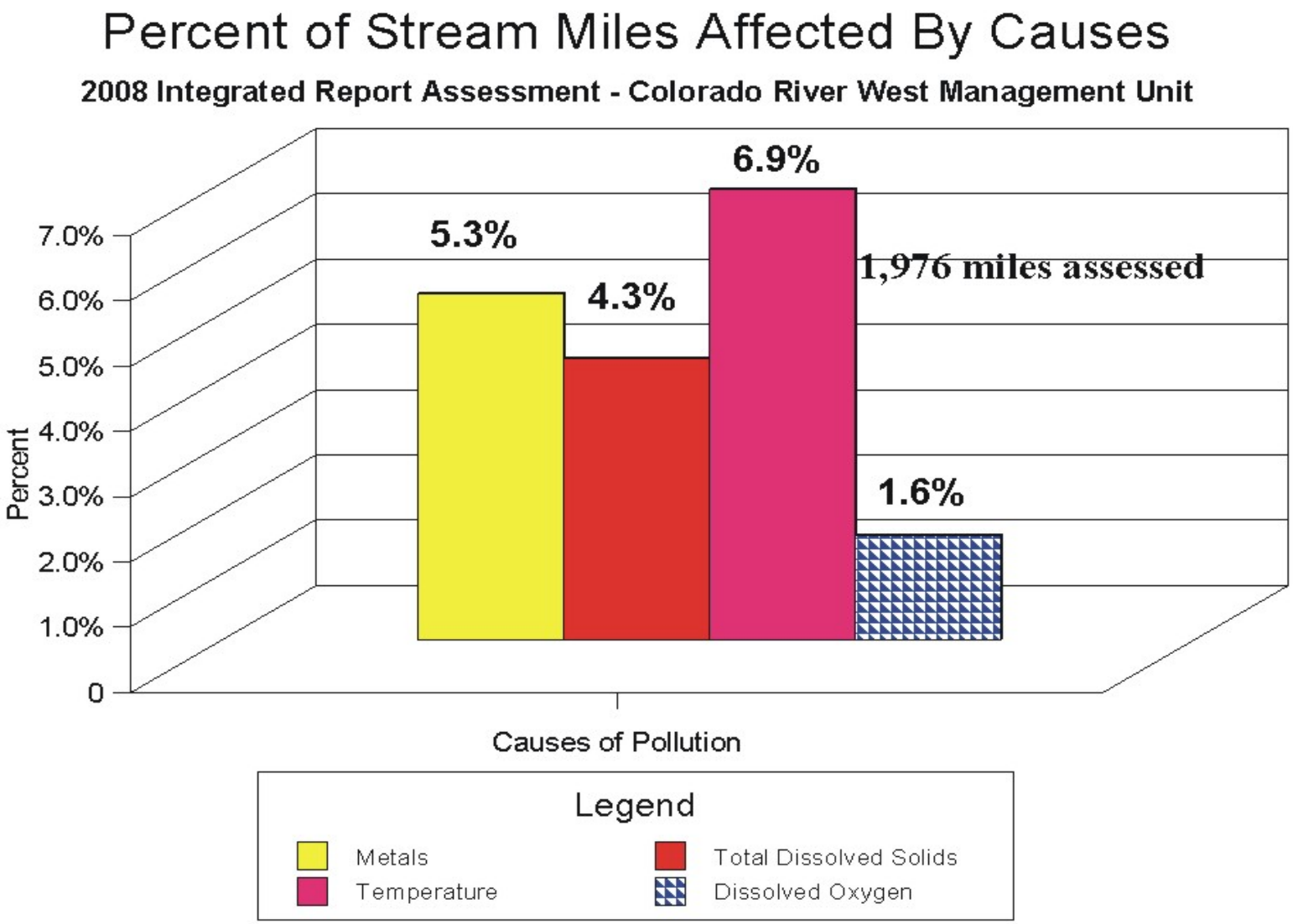


Figure 2.11.4. Percent impact by causes on stream water quality – Colorado River West Watershed Management Unit.

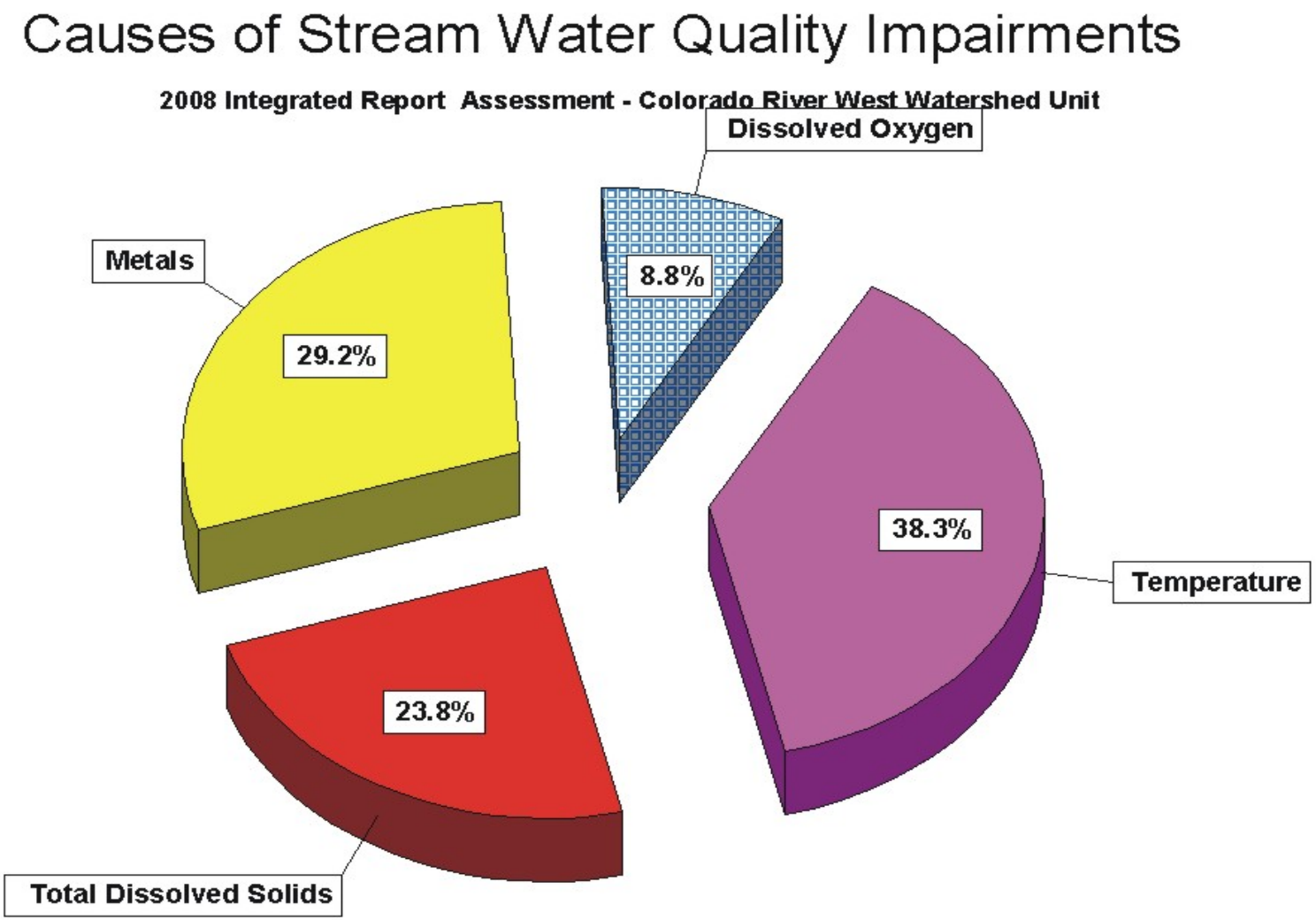


Figure 2.11.7. Relative percent contribution of causes on stream water quality – Colorado River West Watershed Management Unit.

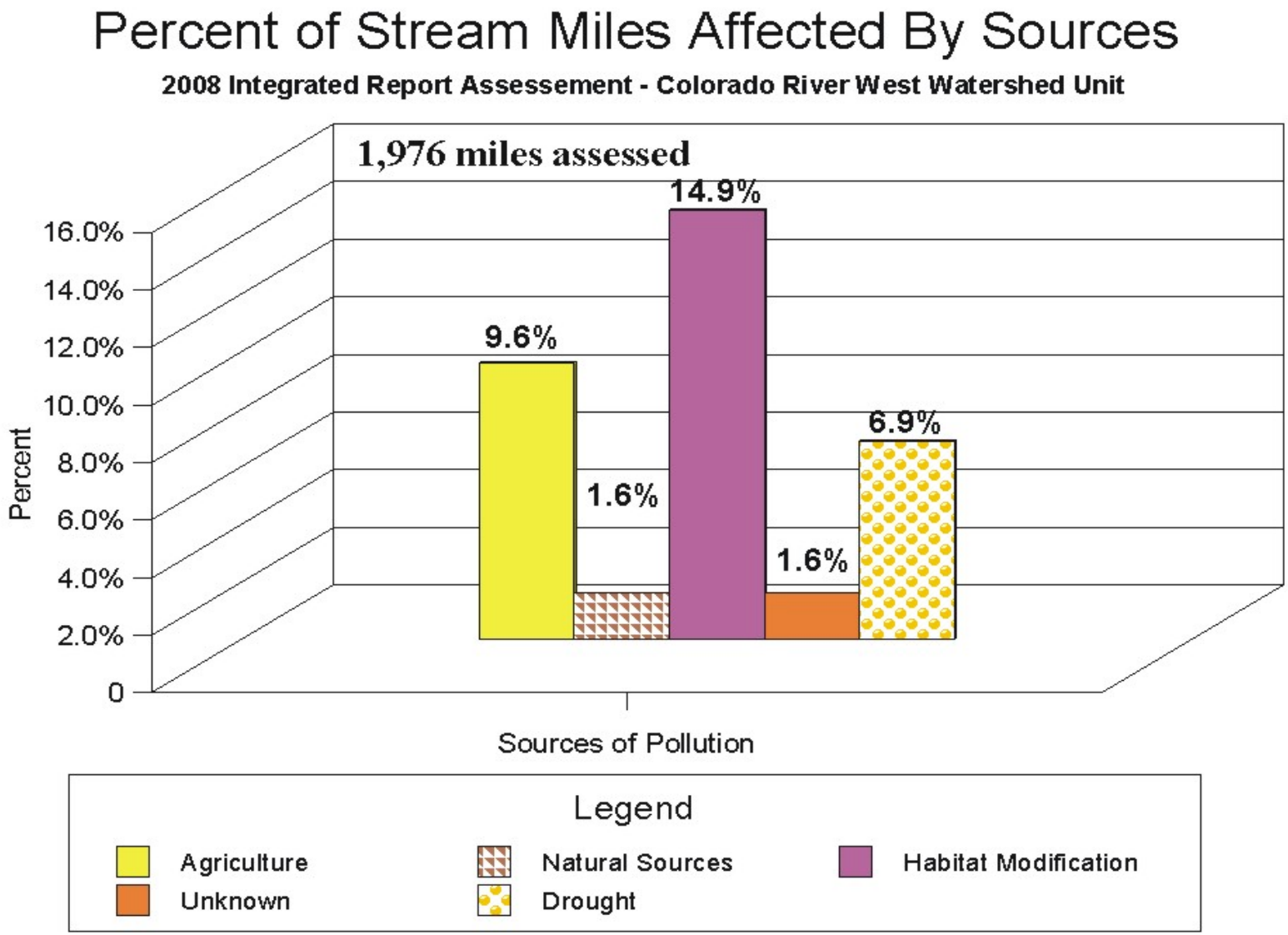


Figure 2.11.6. Percent impact by sources on stream water quality – Colorado River West Watershed Management Unit.

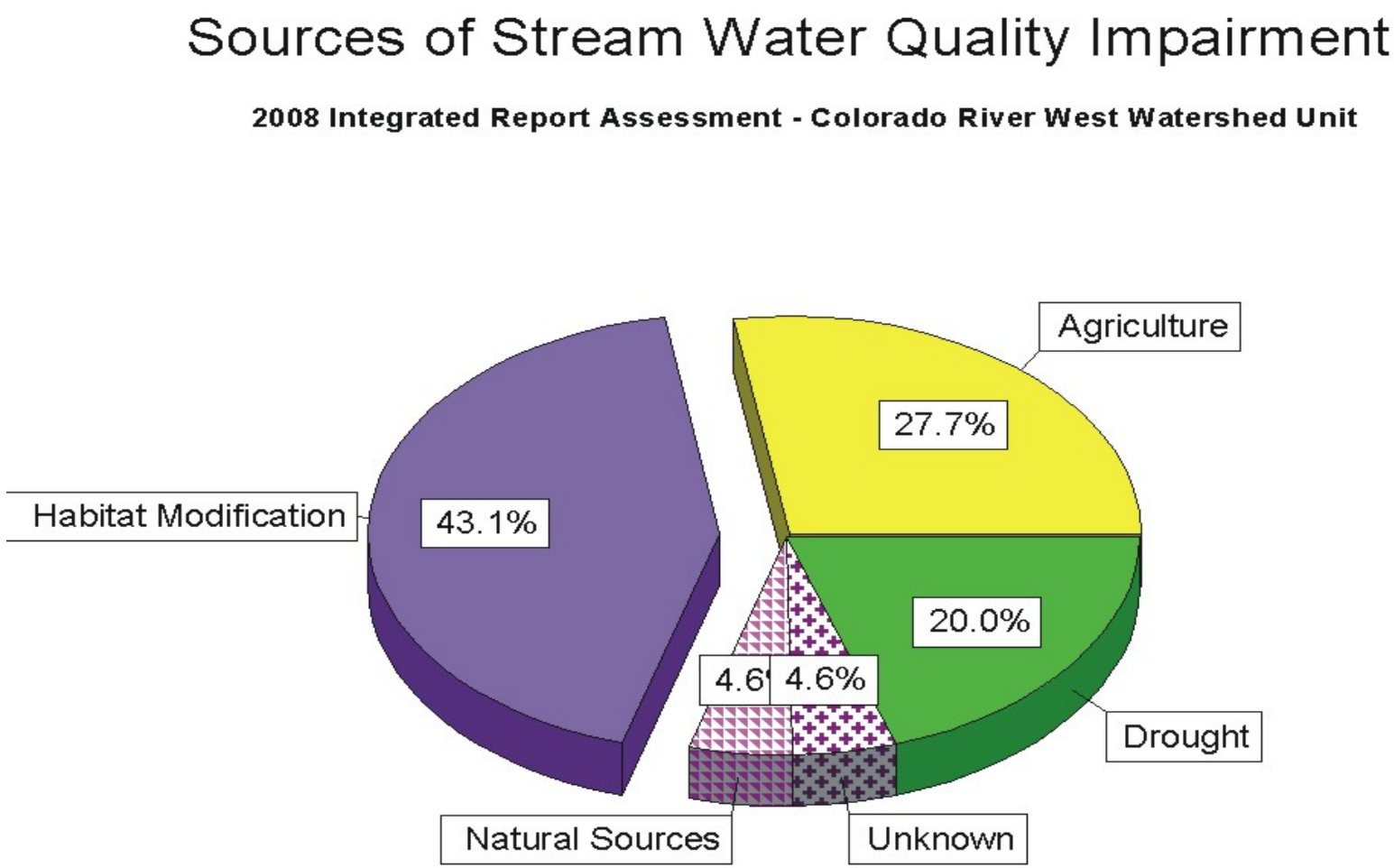


Figure 2.11.7. Relative percent contribution of sources on stream water quality – Colorado River West Watershed Management Unit.

Table 2.11..6. Impaired Assessment Units In The Colorado River West Watershed Management Unit.								
Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Beneficial Use Class Impaired	Beneficial Use Support	Support Category	Pollutant Or Pollution	Source	Stream Miles
UT14070005-007	Calf Creek	Calf Creek from cnflu3nce w/Escalante River to headwaters	3A	NS	5	Temperature	-	8.13
UT14070006-004	Chance Creek	Chance Creek and tributaries from Lake Powell to headwaters	3A	NS	4C	Habitat Alterations	-	16.72
UT14070003-005	Fremont River-2	Fremont River near Bicknell to U.S. FS boundary	3A	FS	4C	Habitat Alterations	`	29.34
UT14070003-005	Fremont River-2	Fremont River near Bicknell to U.S. FS boundary	3A	FS	4A	Organic enrichment/Low DO	-	29.34
UT14070003-008	Fremont River-3	Fremont River and tributaries from east boundary of Capitol Reef National Park to Bicknell	3A	NS	4C	Habitat Alterations	-	82.88
UT14070003-014	Fremont River-4	Freemont River and tributaries from cnfluence w/Dirty Devil to east boundary of Capitol Reef NP	4	NS	4A	Salinity/TDS/chlorides	-	58.89
UT14060009-004	Huntington Creek-2	Huntington Creek and tributaries from Highway 10 crossing to USFS boundary	3A	NS	4C	Habitat Alterations	-	19.24
UT14060009-004	Huntington Creek-2	Huntington Creek and tributaries from Highway 10 crossing to USFS boundary	3A	NS	5	Selenium	-	19.24
UT14070002-009	Lower Muddy Creek	Muddy Creek from conflunce w/Freemont River to Ivie Creek cnfluence	3C	NS	5	Selenium	-	84.79
UT14070002-009	Lower Muddy Creek	Muddy Creek from conflunce w/Freemont River to Ivie Creek cnfluence	3C	NS	5	Temperature	-	84.79
UT14070003-003	Lower UM Creek	UM Creek and tributaries from Mill Meadow to Forsythe Reservoir	3A	NS	4A	Organic enrichment/Low DO	-	1.91
UT14070007-001	Paria River-1	Paria River from start of Paria River Gorge to headwaters	3C	NS	4C	Habitat Alterations	-	16.77
UT14070007-001	Paria River-1	Paria River from start of Paria River Gorge to headwaters	3C	NS	4A	Temperature	-	16.77
UT14070007-001	Paria River-1	Paria River from start of Paria River Gorge to headwaters	4	NS	5	Salinity/TDS/chlorides	-	16.77
UT14070007-005	Paria River-3	Paria River and tributaries from Arizona-Utah Stateline to Cottonwood Creek confluence	4	NS	5	Salinity/TDS/chlorides	-	9.23
UT14070003-002	UM Creek	Um and other tributaries to Forsyth Reservoir	3A	NS	4C	Habitat Alterations	-	21.81
UT14070005-012	Upper Escalante	Escalante River and some tributaries from Boulder Creek confluence to Birch Creek confluence	3A	NS	5	Temperature	-	26.78

Table 2.11..6. Impaired Assessment Units In The Colorado River West Watershed Management Unit.								
Assessment Unit ID	**Assessment Unit Name**	**Assessment Unit Description**	**Beneficial Use Class Impaired**	**Beneficial Use Support**	**Support Category**	**Pollutant Or Pollution**	**Source**	**Stream Miles**
UT14060009-013	Upper San Rafael	San Rafael River from Buckhorn Crossing to confluence Huntington and Cottonwood Creeks	3C	NS	4C	Habitat Alterations	-	23.3

Chapter 2.12 Colorado River Southeast Watershed Management Unit

2.12.1 Introduction

The Colorado River Southeast Watershed Management Unit includes all streams located in the U.S.G.S Hydrological Units (HUCs) listed in Table 6-1. Some of the major streams are the San Juan River, Dolores River, Mill Creek, Montezuma Creek, LaSal River, Geyser Creek and part of the Colorado River.

Table 2.12.1. U.S.G.S. Hydrological Units in the Colorado River Southeast Watershed Management Unit.

Hydrological Unit Code	Hydrological Unit Name
14010005	Colorado Headwaters/Plateau Utah
14030001	Westwater Canyon
14030002	Upper Delores
14030004	Lower Delores
14030005	Upper Colorado-Kane Springs
14070006	Lower Lake Powell
14070007	Paria
14080201	Lower San Juan-Four Corners Southeast
14080202	McElmo
14080203	Montezuma
14080204	Chinle
14080205	Lower San Juan

2.12.2 Water Quality Assessment Results

The intensive monitoring of this water shed was done from July 1, 2003 through June 30, 2004. Data collected from the ambient long term monitoring and cooperative monitoring sites were also used in making assessments. Figure 2.12.1 is a map of the designated beneficial uses assigned to the rivers and streams in this management unit. Benthic macroinvertebrate data were also used in making beneficial use assessments based upon State narrative criteria (Chapter 2.15).

2.12.2.1 Overall Beneficial Use Support —An assessment for at least one beneficial use was made for 651.3 miles. Of those assessed, 365.3 miles (56.1%) were assessed as fully supporting all the beneficial uses assessed. Non supported stream miles were 43.9% of those assessed. Figure 2.12.1 displays the beneficial use percentage assessment.

2.12.2.2 Beneficial Use Assessment By Categories—A list of the categories and the

stream miles included in each of the assessment categories is in Table 2.12.2. Figure 2.12.3 is a map of the beneficial use assessment by categories for the rivers and streams.

2.12.2.3 Individual Use Support--Table 2.12.3 lists the beneficial use support by individual beneficial use class. Six-hundred fifty-one (651) stream miles were assessed for aquatic life. Of the stream miles assessed for aquatic life, 457.9 miles (70.3%) were assessed as fully supporting and 193.4 miles (29.7%) not supporting this beneficial use. Of the stream miles assessed for agricultural use, 474.5 miles (80.0%) were assessed as fully supporting, and 118.8 miles (20.0%) were not supporting this beneficial use. For Class 1 waters (source of drinking water), 392.9 miles (e assessed. Of these, 371.0 miles (94.4%) were assessed as fully supporting, and 21.8 miles (5.5%) were assessed as not supporting this beneficial use.

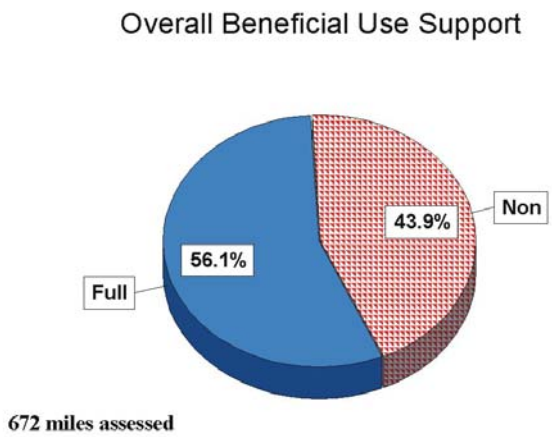


Figure 12.1. Overall Beneficial Use Support

Table 2.12.2. Stream Miles By Assessment Category – Colorado River Southeast Watershed Management Unit.		
Category	**Category Definition**	**Stream Miles**
1	All beneficial uses fully supported.	0.0
2	Beneficial uses assessed are fully supported.	365.3
3A	No data or insufficient data to make an assessment.	206.2
3B	Lakes that are not supported for one cycle only.	0.0
3C	Insufficient data to assess but an assessment plan is in place.	0.0
4A	Approved TMDL	78.9
4B	Pollution control requirements are expected to result in full beneficial use support in near future.	0.0
4C	Impaired by pollution, no TMDL required.	3.8
5	Impaired by pollutant, TMDL required.	197.9

2.12.2.4 Total Waters Impaired by Various Causes—Table 2.12.4 lists the miles of streams affected by the various causes identified as generally affecting water quality. Figures 2.12.4 lustrates the percent of stream miles affected by various causes of pollution. The causes of impairment included total dissolved solids, metals, temperature, and gross alpha. Figure 2.12.5 shows the relative percent of stream miles affected by various causes of water quality impairment.

2.12.2.5 Total Waters Impaired by Various Sources—Table 2.12.5 is a list of the various sources that impacted water quality. The percent of stream miles affected by

various sources is shown in Figure 2.12.6. The relative impact of each source is shown in Figure 2.12.7. The major sources of impairment were agricultural activities and natural sources. Resource extraction from uranium mining was the source of gross alpha contamination.

Table 2.12.3. Individual Use Support Summary Colorado River Southeast Watershed Management Unit.

Use	Size Assessed	Size Fully Supporting	Size Fully Supporting but Threatened	Size Not Supporting	Size Not Attainable
Aquatic Life	651.3	457.9	0.0	193.4	0.0
Fish Consumption	0.0	0.0	0.0	0.0	0.0
Swimming	0.0	0.0	0.0	0.0	0.0
Secondary Contact	0.0	0.0	0.0	0.0	0.0
Drinking Water	392.9	371.0	0.0	21.8	0.0
Agricultural	593.4	474.5	0.0	118.8	0.0
Total	651.3	386.2	0.0	286.0	0.0
Use					
Aquatic Life		70.3%		29.7%	
Fish Consumption		0.0%		0.0%	
Swimming		0.0%		0.0%	
Secondary Contact		0.0%		0.0%	
Drinking Water		94.4%		5.5%	
Agricultural		80.0%		20.0%	
Total		56.1%		43.9%	

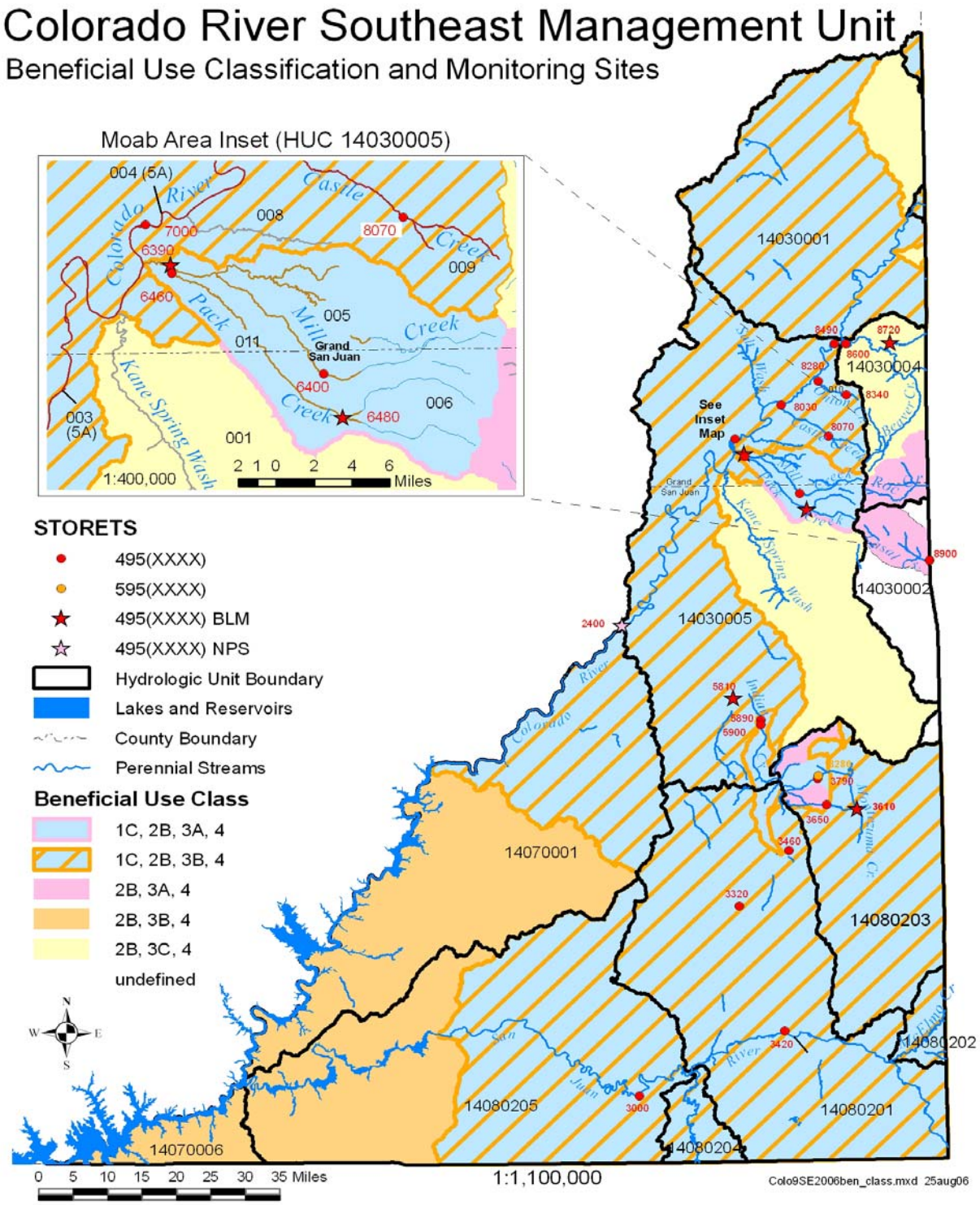


Figure 2.12.2. Beneficial use classifications – Colorado River Southeast Watershed Management Unit.

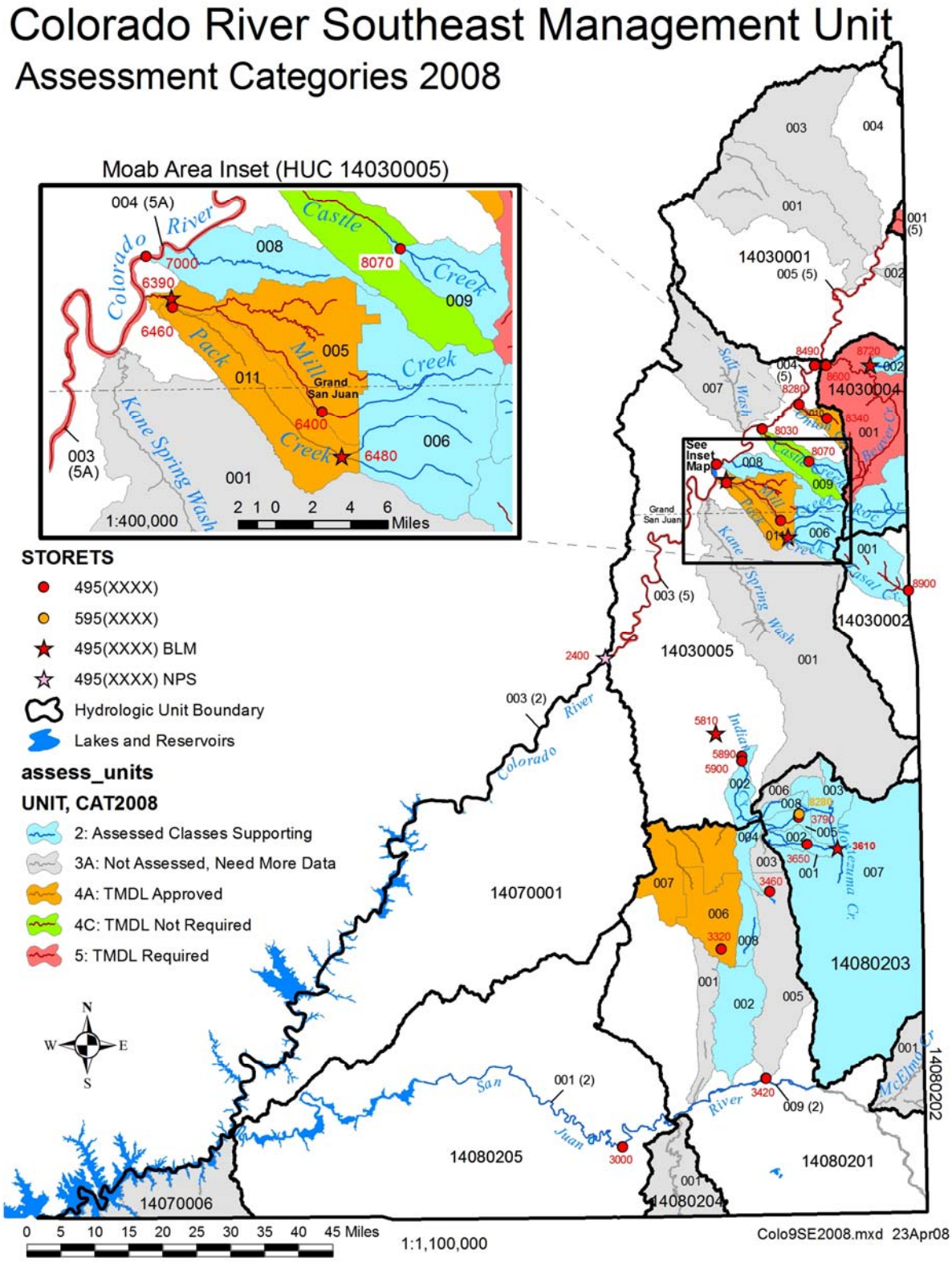


Figure 2.12.3. Beneficial use assessment by category – Colorado River Southeast Watershed Management Unit.

Table 2.12.4 Total Waters Impaired by Various Cause Categories (Stream Miles) – Colorado River Southeast Watershed Management Unit	
Cause Category	**Stream Miles**
Cause unknown	
Unknown toxicity	
Pesticides	
Priority organics	
Nonpriority organics	
Metals	193.4
Ammonia	
Chlorine	
Other inorganics	
Nutrients	
pH	
Siltation/Sediments	
Organic enrichment/low DO	31.77
Salinity/TDS/Chlorides	57.15
Thermal modifications	57.15
Flow alterations	
Other habitat alterations	
Pathogen Indicators	
Radiation	21.8
Oil and grease	
Taste and odor	
Noxious aquatic plants	
Total toxics	
Turbidity	
Exotic species	
Other (specify)	

Table 2.12.5. Total Waters Impaired by Various Source Categories (Stream Miles) – Colorado River Southeast Watershed Management Unit	
Source Category	**Stream Miles**
Industrial Point Sources	
Municipal Point Sources	
Combined Sewer Overflow	
Agriculture	57.2
Silviculture	
Construction	
Urban Runoff/Storm Sewers	
Resource Extraction	21.8
Land Disposal	
Hydromodification	
Habitat Modification	
Marinas	
Atmospheric Deposition	
Contaminated Sediments	
Unknown Source	93.5
Natural Sources	25.4
Reservoir Releases	
Recreation	
Aquaculture	
Extreme Drought	75.2
Out of State	136.2

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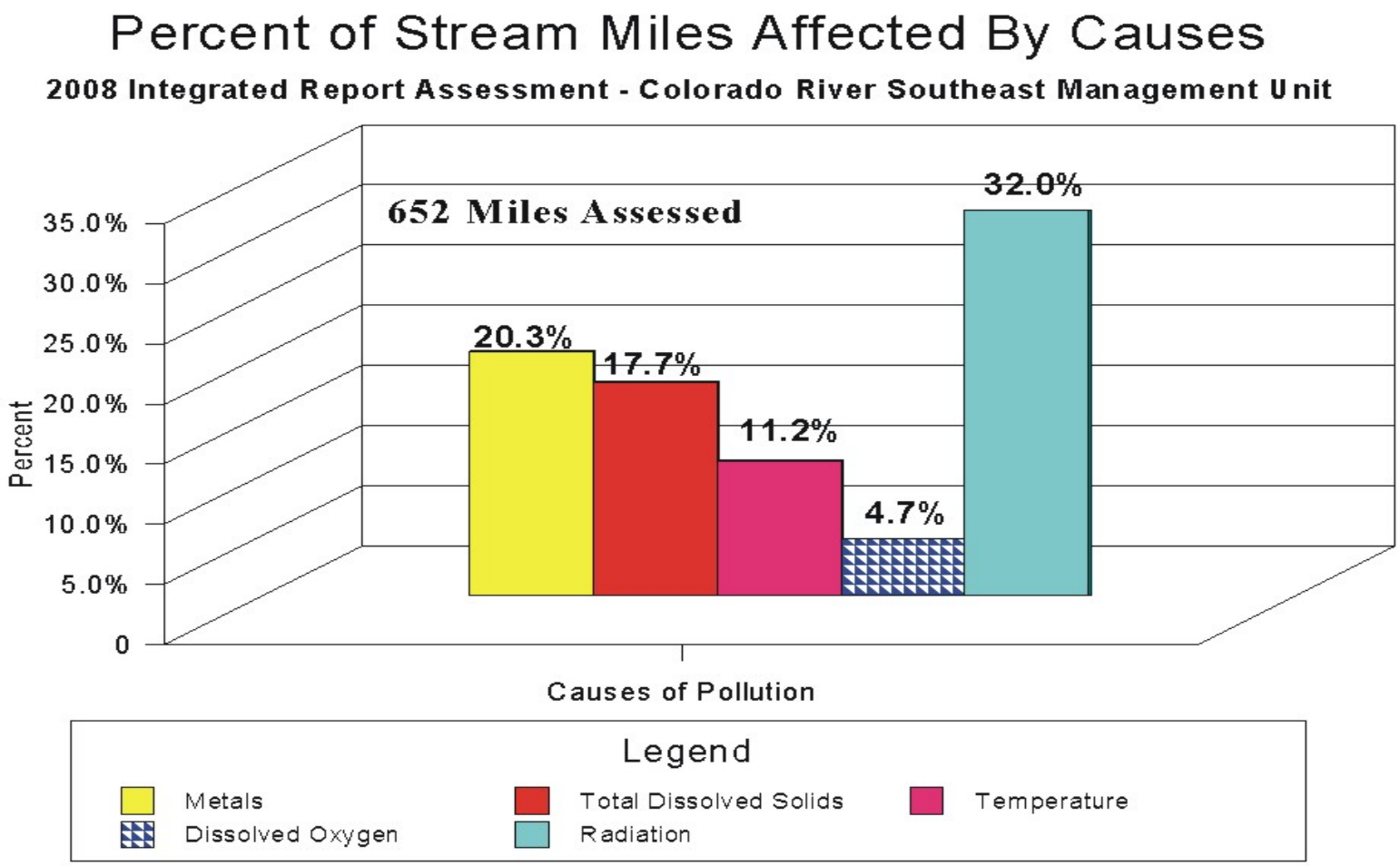


Figure 2.12.4. Percent impact by causes on stream water quality – Colorado River Southeast Watershed Management Unit.

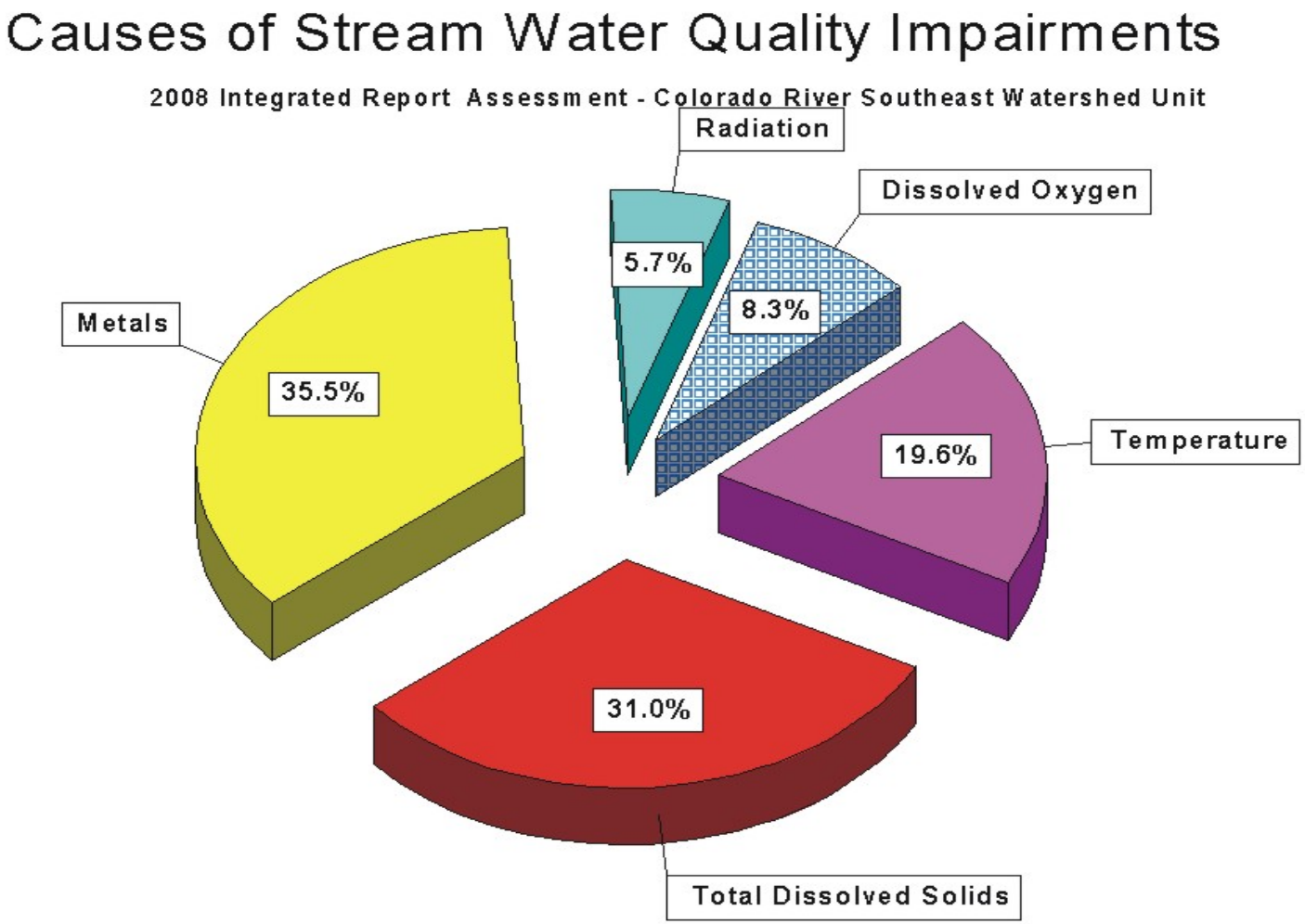


Figure 2.12.5. Relative percent contribution of causes on stream water quality – Colorado River Southeast Watershed Management Unit.

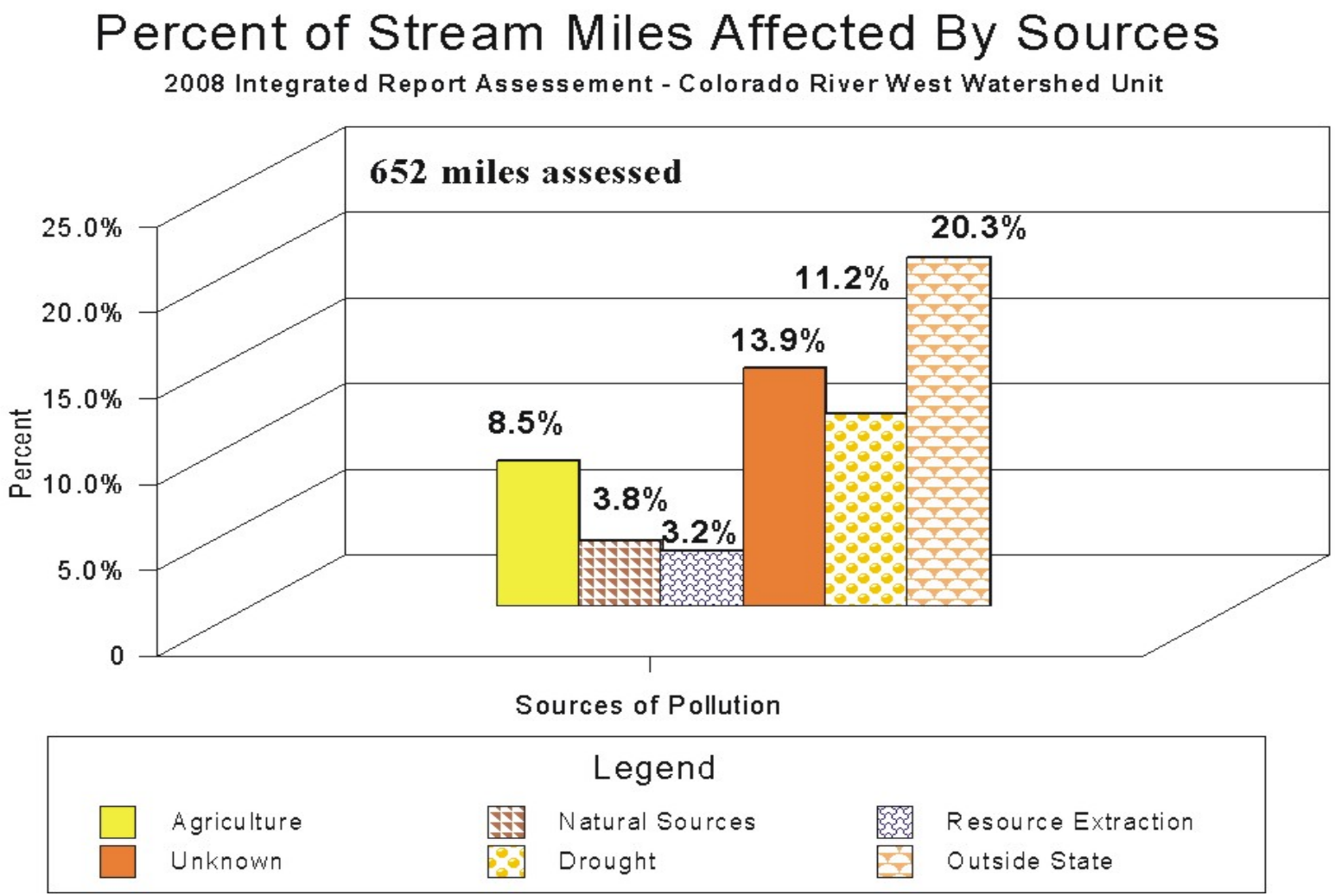


Figure 2.12.6. Percent impact by sources on stream water quality – Colorado River Southeast Watershed Management Unit.

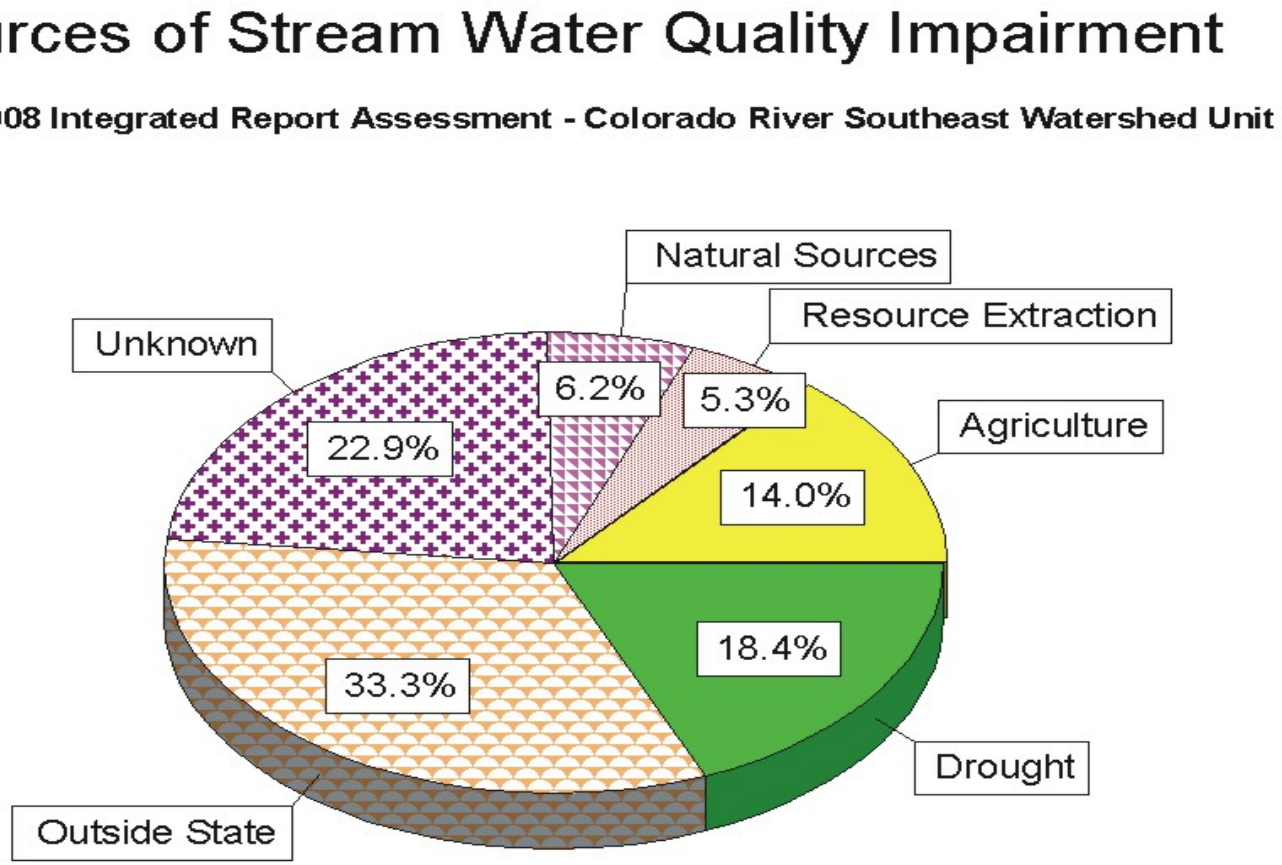


Figure 2.12.7. Relative percent contribution of sources on stream water quality – Colorado River Southeast Watershed Management Unit.

Table 2.12..6. Impaired Assessment Units In The Colorado River Southeast Watershed Management Unit.								
Assessment Unit ID	**Assessment Unit Name**	**Assessment Unit Description**	**Beneficial Use Class Impaired**	**Beneficial Use Support**	**Support Category**	**Pollutant Or Pollution**	**Source**	**Stream Miles**
UT14080201-006	Cottonwood Wash-2	Cottonwood Wash from Westwater confluence to U.S.F.S. boundary	1C	NS	4A	Radiation	-	4.63
UT14080201-007	Cottonwood Wash-3	Cottonwood Wash and tributaries within U.S.F.S. boundary	1C	NS	4A	Radiation	-	17.16
UT14030005-005	Mill Creek-1	Mill Creek and tributaries from confluence with Colorado River to U.S.F.S. boundary	4	NS	4A	Salinity/TDS/chlorides	-	31.77
UT14030004-001	Dolores River	Dolores River and tributaries (except Granite Creek) from confluence with Colorado River to headwaters	4	NS	5	Salinity/TDS/chlorides	-	61.72
UT14030005-010	Onion Creek	Onion Creek and tributaries from confluence with Colorado River to headwaters	4	NS	4A	Salinity/TDS/chlorides	-	10.17
UT14030005-011	Pack Creek	Pack Creek and tributaries except Mill Creek from confluence w/ Colorado River to USFS boundary	4	NS	4A	Salinity/TDS/chlorides	-	15.21
UT14010005-001	Colorado River-6	Colorado River from HUC 14010005/14030001 boundary to Colorado State Line	3B	NS	5	Selenium	-	3.84
UT14030001-005	Colorado River-5	Colorado River from Dolores River confluence to HUC 14010005 boundary	3B	NS	5	Selenium	-	33.90
UT14030005-003	Colorado River-3	Colorado River from Green River confluence to Moab	3B	NS	5	Selenium	-	62.69
UT14030005-004	Colorado River-4	Colorado River from Moab to HUE unit (14030005)boundary	3B	NS	5	Selenium	-	35.77
UT14030005-010	Onion Creek	Onion Creek and tributaries from confluence with Colorado River to headwaters	3B	NS	4A	Temperature	-	10.17
UT14030005-011	Pack Creek	Pack Creek and tributaries except Mill Creek from confluence w/ Colorado River to USFS boundary	3A	NS	4A	Temperature	-	15.21

2.12.14

Chapter 2.13. Great Basin Watershed Management Unit Assessment

2.13.1. Introduction

The West Desert Watershed Management Unit includes all streams located in the U.S.G.S Hydrological Units (HUCs) listed in Table 2.13.1. This management stretches from the north western portion of the state south to almost Cedar/Beaver Management Unit. There are many small streams within this unit. The larger streams are Deep Creek, Trout Creek, Grouse Creek, Pine Creek, Pole Creek, and South Junction Creek. These streams flow from the various mountain ranges into the West Desert and disappear. Some of them are diverted at the canyon mouths to be used for irrigation. Those streams in the Hydrologic Unit 17040210 flow north into the Snake River.

Table 2.13.1. U.S.G.S. Hydrological Units in the West Desert Watershed Management Unit.

Hydrological Unit Code	Hydrological Unit Name
17040210	Raft
17040211	Goose
16020301	Hamlin-Snake Valleys
16020302	Pine Valley
16020303	Tule Valley
16020304	Rush-Tooele Valleys
16020305	Skull Valley
16020306	Southern Great Salt Lake Desert
16020307	Pilot - Thousand Springs
16020308	Northern Great Salt Lake Desert
16020309	Curlew Valley
16020310	Great Salt Lake

2.13.2. Water Quality Assessment Results

This region of the state is remote, with rugged mountain ranges, and a desert. Only two streams were assessed and they were assessed using benthic macroinvertebrate collected. Trout Creek and Thomas Creek were assessed as fully supporting the Class 3A, cold water game fish, beneficial use. Pole Creek was not assessed because the benthic macroinvertebrate data were not sufficient enough to make a determination of beneficial use under the narrative standard.

The Division of Water Quality is planning to survey this area within the next two years to identify reference sites that can be used to assess more of the streams. This allows the field crews to monitor the streams once a year which will make it feasible to obtain data and make assessment for this unit.

Table 2.13.2. Individual Use Support Summary – West Desert Watershed Management Unit.					
			Size Fully		
	Size	Size Fully	Supporting	Size Not	Size Not
	Assessed	Supporting	but	Supporting	Attainable
Use			Threatened		
Aquatic Life	30.7	30.7	0.0	341.6	0.0
Fish Consumption	0.0	0.0	0.0	0.0	0.0
Swimming	0.0	0.0	0.0	0.0	0.0
Secondary Contact	0.0	0.0	0.0	0.0	0.0
Drinking Water	0.0	0.0	0.0	0.0	0.0
Agricultural	0.0	0.0	0.0	0.0	0.0
Total	30.7	30.7	0.0	0.0	0.0
Use					
Aquatic Life		100.0%		0.0%	
Fish Consumption		0.0%		0.0%	
Swimming		0.0%		0.0%	
Secondary Contact		0.0%		0.0%	
Drinking Water		0.0%		0.0%	
Agricultural		0.0%		0.0%	
Total		100.0%		0.0%	

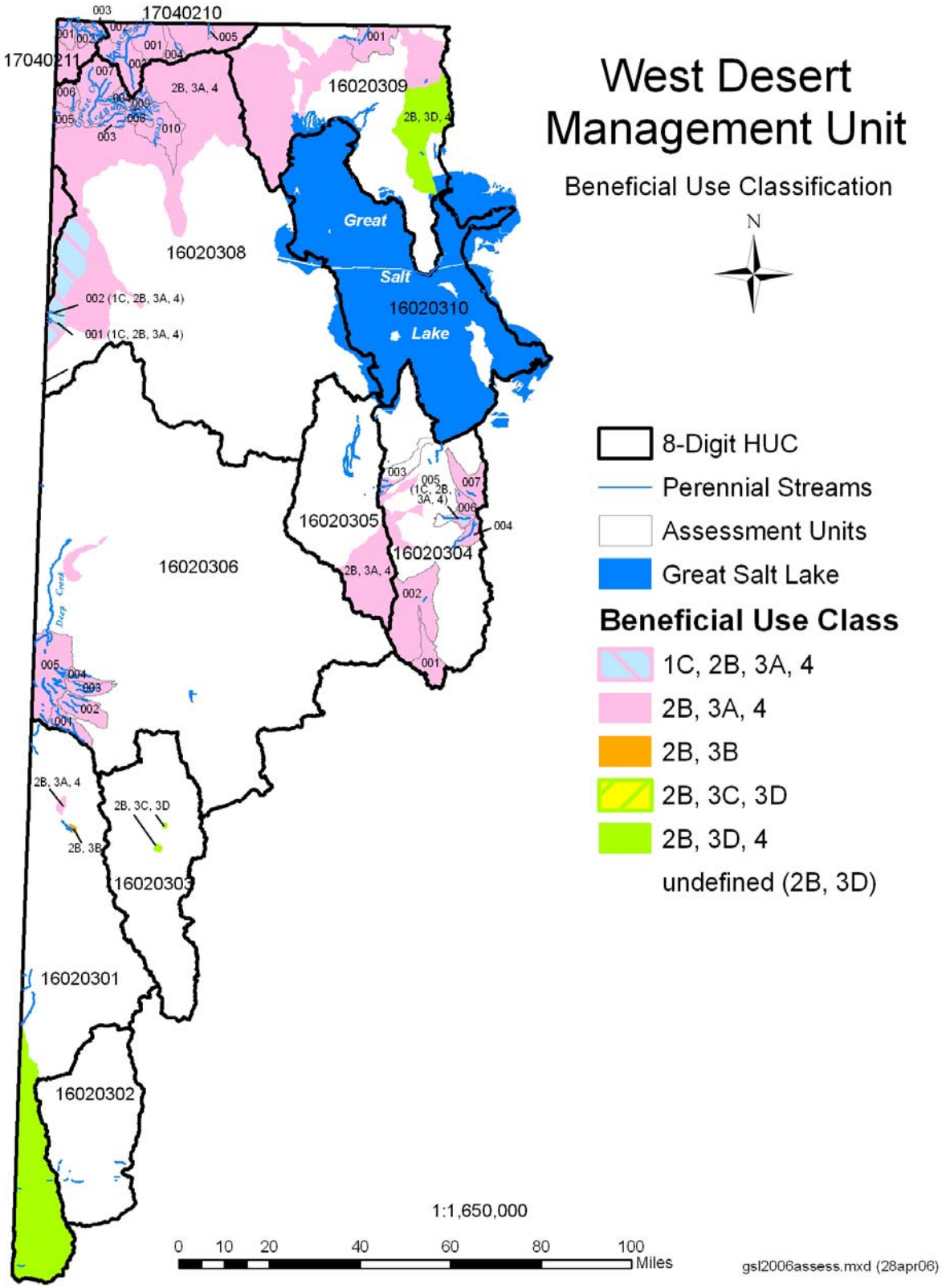


Figure 2.13.2. River and stream designated beneficial use classes – West Desesrt Watershed Management. Unit.

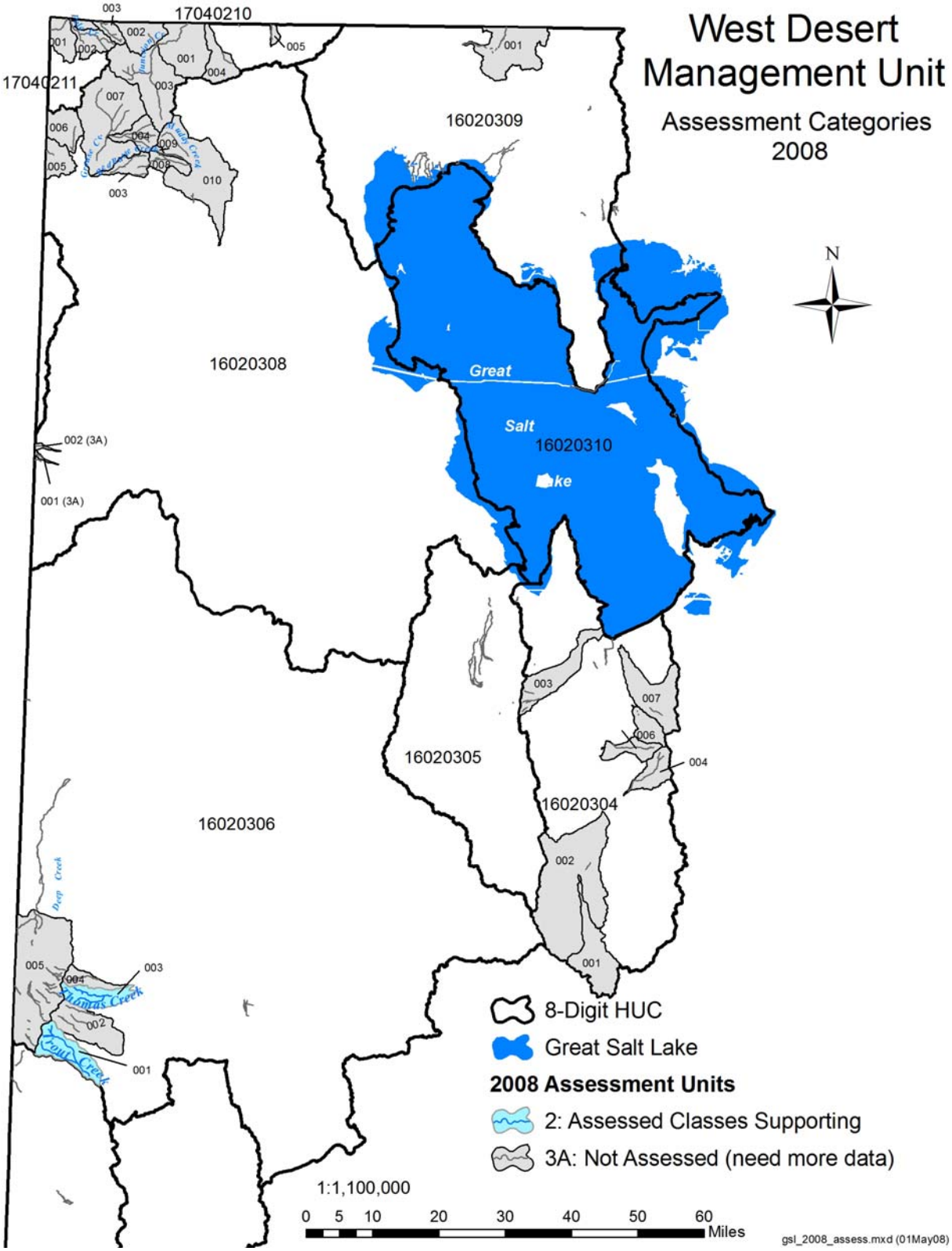


Figure 2.13.3. Beneficial use assessment by category – Cedar / Beaver Watershed Management Uni

Chapter 2.14 Lake Water Quality Assessment

2.14.1 Introduction

Lake eutrophication is a naturally occurring aging process that is often accelerated by human activities. Through a growing public awareness of this problem, Congress passed legislation in 1972 (Section 314 of the Federal Water Pollution Control Act) mandating states to inventory and classify their lakes according to trophic condition. States were initially to develop a ranking system used to prioritize the lakes for potential protective or restorative projects. This system was more recently replaced with the 1987 Clean Water Act Amendments requiring biannual 305(b) assessments and a concomitant 303(d) list of impaired waters.

Over three thousand assessment units, i.e. lakes, reservoirs, and wetlands, were identified in the initial Utah's Clean Lakes inventory. (State of Utah Clean Lakes Inventory and Classification, Volumes I & I, April 1982). Lakes selected for further study and evaluation ("significant lakes") were chosen according to the following criteria. The assessment unit is any publicly owned lake/reservoir/pond with a surface area equal to or greater than 50 acres with the following characteristics: (1) accessibility to the public is provided; (2) beneficial use status has been defined or is anticipated to protect water quality for public benefit; and (3) the lake provides important recreational benefit to the public. Marshes, springs, waterfowl management areas and intermittent lakes were not considered in the report. Exceptions in size were made in cases of high recreation use. Under these guidelines a list of 127 lakes and reservoirs was developed.

Table 2.14.1 provides a summary of the number of lakes and lake surface area in the State of Utah. Seventy-seven percent of the total surface acres of Utah's lakes are found in six lakes and reservoirs, Bear Lake, Utah Lake, Flaming Gorge Reservoir, Lake Powell, Strawberry Reservoir, and Sevier Bridge Reservoir.

Great Salt Lake (GSL) is not included in this table. Rather, DWQ is in the process of modifying the classification scheme of GSL and developing a monitoring and assessment strategy, including site specific thresholds and standards that are appropriate to each bay and associated transitional wetlands (see Part 2 Appendix 3). The Great Salt Lake was assessed as being in Category 5C, insufficient data to assess but an assessment plan is in place. The lake varies in size depending on the hydrological cycle of the streams that enter the lake.

Utah DWQ currently assesses 132 lakes and reservoirs. They include most of those previously inventoried. Changes were based on actual data collected and subsequent re-evaluation of the selection criteria for the original priority list. In addition, some new reservoirs that were created since the original assessment in 1981-1982 and other lakes assessed by the State or other agencies on a cooperative basis have also been added. Water quality assessment includes determination of Carlson's trophic state index (TSI), dissolved oxygen concentrations throughout the water column, phytoplankton species dominance, reported fish kills and water quality trend. General ambient water quality conditions of Utah's lakes and reservoirs vary greatly in relation to their respective watersheds and lake morphometry. Nutrient concentrations and trophic status range from the oligotrophic conditions of many high mountain lakes to highly

eutrophic downstream lakes such as Lower Box Creek Reservoir, Redmond Reservoir, Utah Lake, Kent's Lake and Pineview Reservoir. Other water chemical characteristics vary from extremely soft water conditions of the high Uinta lakes to highly saline conditions in reservoirs on the lower Sevier drainage such as Gunnison Bend and D.M.A.D. Reservoirs.

Many lakes and reservoirs experience problems relating to thermal stratification and subsequent depletion of dissolved oxygen (DO) in lower strata. This oxygen depletion is often linked to excessive algal production and, in some lakes, results in frequent fish kills. Many lakes and reservoirs also have aesthetic and recreational use impairment because of severe annual drawdown. Such drawdowns leave expanses of exposed lake bed and often insufficient waters for overwintering fish populations. During recent years, an EPA grant has been utilized to obtain additional water quality data to assist in the evaluation and assessment of lakes and reservoirs for this report. The initial purpose of this program was to assess newly created reservoirs and to conduct ongoing monitoring programs to reassess the lakes and reservoirs contained in the 1981-1982 Clean Lakes Inventory of the State of Utah.

Historically, one half, or about 65 lakes were sampled each year. Hence, all 132 lakes were sampled over a two-year assessment period. Sampling was performed during two visits between June and September for the year it was scheduled. More recently, additional data has been obtained during the winter period, as part of cooperative programs with other agencies, or to provide additional data for TMDL preparation. In order to meet these monitoring needs, 12 -14 lakes that were consistently oligotrophic and fully supporting were removed from the monitoring schedule during the last two assessment cycles. This process freed up enough field time to allow intensive monitoring of lakes on the TMDL schedule. This effort includes monthly sampling from June to September in order to more clearly understand important limnological factors contributing to impairment and to help determine appropriate restoration strategies. In addition, during the summer of 2002 we began a voluntary citizen monitoring program to provide additional water quality data and collect recreational usage data. Information pamphlets on subjects ranging from descriptions of nutrient loading and eutrophication to explaining our monitoring program have been distributed to popular recreational lakes and reservoirs in order to stimulate awareness of lake water quality and conditions in Utah.

Table 2.14.1. Utah Freshwater Lakes and Reservoirs by Size Class Showing Numbers, Surface Acres, and Percent of Total Lake Surface.		
Size Class (Surface Acres)	**Number of Lakes / Reservoirs**	**Total Surface Acres**
10,000 and greater	6 (0.2%)	370,905 (77.0%)
5,000 - 9,999	2 (0.07%)	15,584 (3.2%)
1,000 - 4,999	18 (0.6%)	34,119 (7.1%)
500 - 999	17 (0.57%)	12,475 (2.6%)
100 - 499	87 (2.9%)	19,890 (4.1%)
50 - 99	68 (2.3%)	4,594 (1.0%)
20 - 49	202 (6.7%)	5,871 (1.2%)
20 or less	2600 (86.7%)	18,200 (3.8%)
Total	3,000	481,638

2.14.2 Trophic Status

Carlson's Trophic State Index (TSI) has been determined since the initial classification and inventory project in 1981 to 1982. This has provided long-term trend data for most of our lakes and reservoirs.

To determine the annual TSI values, the following procedure is used:

1 - Individual TSI values for total phosphorus, secchi depth and chlorophyll-a are determined for each sampling station on the lake or reservoir.

2 - The values obtained from step one are then averaged among the two sampling visits at each of the sampling stations.

3 - An average annual summer TSI value for each lake is then calculated by averaging all the station TSI Index values for a given lake or reservoir.

4 - TSI Index values utilized in this report were calculated for each lake or reservoir by determining the average TSI value for the period in two year increment periods since 1989.

TSI values are compared to the following index values to determine current trophic state condition.

TSI Index value < 40 - Oligotrophic
TSI Index value 40 to 50 - Mesotrophic
TSI Index value 51 to 70 - Eutrophic
TSI Index value > 70 - Hypereutrophic

For future lake assessments Utah DWQ will no longer average TSI values based upon a

recommendation by Carlson (1983) and instead will rely on the chlorophyll a TSI value as the best indicator of trophic status.

Table 2.14.2 contains a summary of lake trophic status for Utah's lakes and reservoirs by study periods. Lakes that have been determined to be hypereutrophic during the various periods of study include the following waterbodies by periods: (1991-1992) Baker Dam Reservoir, DMAD Reservoir, Forsyth Reservoir, Gunnison Bend Reservoir, Johnson Reservoir, Koosharem Reservoir, Mill Meadow Reservoir, Redmond Reservoir, Rush Lake, Scofield Reservoir, Upper Enterprise Reservoir, Utah Lake, Barney Lake, Big Lake, Kents Lake, Lower Box Reservoir, Mona Reservoir, Newton Reservoir, Sevier Bridge Reservoir, Utah Lake and Willard Bay Reservoir; and (1993-94) Lower Bowns Reservoir, Rush Lake, Redmond Lake, Utah Lake, Kent's Lake, LaBaron Reservoir, Minersville Reservoir, Matt Warner Reservoir, Johnson Valley Reservoir, Newton Reservoir, Barney Reservoir and DMAD Reservoir; (1995-96) Rush Lake, Redmond Lake, Utah Lake, Kent's Lake, LaBaron Reservoir, Johnson Valley Reservoir, and Barney Reservoir; (1998-99) Koosharem Reservoir, Lower Box Reservoir, Redmond Reservoir, Rush Lake, and Utah Lake; (2000-2001) Utah Lake, Redmond Lake, Panguitch Lake, Lower Box Reservoir, Koosharem Reservoir, Kents Lake and Cook Lake; (2002-2003) Lower Box Reservoir, Rush Lake and Utah Lake. As pointed out above, about 12 lakes and reservoirs (those that consistently fully support beneficial uses and were generally oligotrophic) were not sampled during the last two assessment cycles. Donkey Reservoir, Duck Fork Reservoir, Duck Fork Reservoir, Causey Reservoir, Electric Lake, Flaming Gorge Reservoir, Hoop Lake, Lake Mary, Mirror Lake, Paradise Park Reservoir, Posey Lake, Scout Lake, Sheep Creek Reservoir, Silver Lake Flat Reservoir and Spirit Lake. Although these are still identified as fully supporting in Table 2.14.5, TSI values could not be calculated for this 06/07 cycle and therefore are not included in Table 2.14.2. Accordingly, there were a reduced number of oligotrophic lakes. However, there was an increase in the number of eutrophic lakes. During the 2006-2007 assessment cycle, only Cutler Reservoir displayed hypereutrophy.

Table 2.14.2. Trophic Status of Lakes/.

Number and Acreage of Assessed Lakes and Reservoirs.

Trophic Class	91/92		93/94		95/96		98/99		00/01		02/03		06/07	
Oligotrophic	27 (22%)	239888 (58%)	42 (32%)	290,432 (63%)	47 (36%)	285,154 (62%)	36 (28%)	288,029 (63%)	28 (21%)	50,380 (11%)	38 (29%)	52,880 (11%)	27 (22%)	97,040 (23%)
Mesotrophic	52 (42%)	21,061 (5%)	51 (39%)	46,678 (10%)	57 (44%)	59,191 (13%)	66 (52%)	63,648 (14%)	60 ((46%)	275,274 (60%)	59 (45%)	252,470 (54%)	50 (41%)	195,486 (46%)
Eutrophic	30 (24%)	31,990 (8%)	24 (19%)	22,670 (5%)	24 (19%)	116,166 (25%)	21 (16%)	11,390 (2%)	36 (27%)	36,285 (8%)	31 (24%)	65,407 (14%)	43 (36%)	124,292 (29%)
Hypereutrophic	15 (12%)	122,069 (29%)	13 (11%)	100,808 (22%)	1 (1%)	50 (-)	5 (4%)	97,500 (21%)	7 (5%)	98,703 (21%)	3 (2%)	97,030 (20.7%)	1 (1%)	7,184 (1%)
TOTALS	124	415,008	130	460,588	129	460,561	128	460,567	131	460,642	132	467,787	121	424,002

2.14.3 Control and Restoration Efforts

Several of our watersheds are known to be impaired for water quality and these are reflected in our 2008 303(d) list of impaired waters. Many of these problems were recognized several years ago and restoration efforts have been ongoing through Section 314 Clean Lakes Project grants, Section 319 grants, cooperative efforts between DWQ and other state and federal agencies and wastewater treatment plant upgrades. Best Management Practices (BMPs) that we are using to protect and restore water quality include biological and chemical removal of phosphorus in wastewater treatment plants, eliminating the discharge from animal feeding operations to tributary streams, controlling grazing and access of animals to streams, establishing riparian buffer strips adjacent to agricultural lands, restoring stream bank and slope stability, maintaining property tidiness, keeping streets and gutters clean, reducing return flows from excess irrigation, restricting excessive use of fertilizers and pesticides, and regulating off-road activities. Proper design, construction, and maintenance of sewage facilities, solid waste disposal facilities and fish cleaning stations have also been installed at popular lakes. Cooperation with other agencies, including the US Forest Service, BLM, NRCS and local conservation districts have facilitated the education of individuals using both public and private lands as to various activities that have the potential to adversely impact water quality and utilize practices that limit or control these negative impacts. Table 2.14.3 contains a listing of specific lake rehabilitation techniques that have been used in addressing problems identified in diagnostic/feasibility studies funded under Section 314 of the Clean Water Act and ongoing lake assessments.

Table 2.14.3. Lake Rehabilitation Techniques.		
Technique	**Lakes using Technique**	**Lake Acreage**
In-lake Treatments		
1. Phosphorus Precipitation/Inactivation		
2. Sediment Removal/Dredging	1	11
3. Artificial circulation to increase oxygen		
4. Aquatic Macrophyte harvesting	1	120
5. Application of aquatic herbicides		
6. Drawdown for macrophyte control		
7. Hypolimnetic aeration		
8. Sediment oxidation		
9. Hypolimnetic withdrawal of low DO water		
10. Dilution/Flushing		
11. Shading/sediment covers or barriers		
12. Destratification		
13. Sand or other filters to clarify water		
14. Food chain manipulation		
15. Biological controls	1	11
16. Fish Clean Station Installed	23	437,046
Watershed Treatments		
20. Sediment Traps/Detention ponds	2	1,368
21. Erosion control Shoreline/Streambank	7	26,565
22. Diversion of nutrient rich inflows		
23. Conservation tillage used		
24. Integrated pest management practices applied		
25. Animal waste management practices installed	6	9,850
26. Porous pavement used		
27. Redesign streets/parking lots to reduce runoff		
28. Road or skid trail management		
29. Land surface roughening for erosion control		
30. Riprap installation	2	4,063
31. Unspecified BMPs installed	9	2,990
32. Riparian Fencing	8	12,924
33. Diversion structures installed	1	2,015
34. Checkdams or stream structures	6	9,850
35. Reseeding areas for erosion control	6	9,850
36. Streambank stabilization using vegetative controls	6	12,924
37. Wetland treatment of inflow waters	1	11
Other Lake Protection/Restoration Efforts		
40. Local Lake Management Program in place	3	168,540
41. Public Information/Education Program	21	141,288
42. Local Ordinance control to protect lakes	3	4,063
43. Point Source Controls	2	4,359
44. Municipal sewer system developed	3	3,252

Watershed management plans and TMDLs (Total Maximum Daily Load) are currently being developed to address the unique problems and conditions identified for a particular lake or reservoir. In addition, wherever point sources are identified in a watershed that are impacting water quality, appropriate steps are being taken to control the discharge of contaminants under the NPDES and UPDES permitting process. Clean Lakes Program Phase I studies were completed on Scofield Reservoir, Panguitch Lake, Deer Creek Reservoir, Bear Lake, Pineview Reservoir, Salem Pond, Minersville Reservoir, Otter Creek Reservoir, Navajo Lake, Mantua Reservoir, Pelican Lake, Hyrum Reservoir, East Canyon Reservoir and Utah Lake. Phase I lake restoration projects were conducted on four of these assessment units (Panguitch Lake, Scofield Reservoir, Deer Creek Reservoir and Salem Pond). For specific details on Clean Lakes and Section 319 Projects please refer to the summary listed in Table 2.14.4.

Table 2.14.4. Listing of Phase II and Section 319 Projects for Lake Water Quality Control.

Name of Lake Project	Date Completed	Type	Federal Funding	Problems	Rehabilitation Techniques
Minersville Reservoir	1991-1998	319	$ 889,120	Eutrophication	21,25,31,32,35,36,41
Hyrum Reservoir	1991-1995	319	$1,582,215	Eutrophication	10,16,21,25,31,32,35,36,41
Otter Creek Reservoir	1991-1998	319	$682,000	Eutrophication	16,21,25,31,32,35,36,41
Echo	1992-1998	319	$2,050,6000	Eutrophication	16,21,25,31,32,35,41
Scofield Reservoir	1992	Phase II	$120,000	Watershed Erosion	16,21,30,32,33,34,35,36,41,42,44
Panguitch Lake	1989	Phase II	$ 95,925	Watershed Erosion	16,20,21,30,32,34,35,36,41,42
Deer Creek Reservoir	1992	Phase II	$328,393	Agricultural Wastes	20,21,25,29,31,40,41,42,43
Salem Pond	1995	Phase II	$ 95,000	Macrophytes, Depth	2,15,37,41,
Decker Lake		Phase II	$1,000,000	Sedimentation	2

2.14.4 Impaired and Threatened Lakes

Several factors were considered in the assessment for beneficial use support. The monitoring program for lakes and reservoirs is designed to provide basic water quality information and evaluate algal productivity during the summer period. Additional winter monitoring may be conducted to evaluate dissolved oxygen deficiencies as indicated by the summer monitoring. Water quality standards are evaluated to assess impairment for waters classified as Class 2 (recreation), Class 3 (aquatic life), and Class 4 (agriculture). The assessment includes water column profiles of dissolved oxygen, pH, and temperature using a multi-probe sensor. Values for these parameters are measured at 1-meter intervals throughout the water column and evaluated according to current 305(b) guidelines. A comparison of water column values with State standards proceeds as follows. For any one pollutant or stressor, exceedence of standards in less than or equal to 10 percent of measurements, a designation of fully supporting is assigned. For any one pollutant or stressor, criteria exceeded in greater than 10 percent are assessed as not supporting. For any one pollutant or stressor, criteria exceeded in greater than 25 percent of measurements a designation of not supporting is assigned. An exception to these guidelines has been provided for dissolved oxygen. Exceedance criteria for dissolved oxygen have been defined using the 1 day minimum dissolved oxygen concentration of 4.0 mg/L. State standards account for the fact that anoxic or low dissolved oxygen may exist in the bottom of deep reservoirs and therefore, the dissolved oxygen standard is applied as follows. When the concentration is above 4.0 mg/L for greater than 50% of the water column depth, a fully

supporting status is assigned. When 25-50% of the water column dissolved oxygen is above 4.0 mg/L, it is designated as not supporting the fisheries beneficial use.

Having determined support status for individual pollutants or stressors, an overall use designation was determined based on a combination of the individual pollutant or stressor support designations. A “fully supporting” status was assigned when all of the basic criteria (dissolved oxygen, pH and temperature) were found to be fully supporting and a “not supporting” status was assigned to a waterbody when at least two of the basic criteria were found to be not supportive.

Next there is a modification of the initial support status through an evaluation of the trophic state index (TSI), winter dissolved oxygen conditions with reported fish kills, and whether Cyanobacteria (blue green algae) dominate the phytoplankton community. This evaluation, along with best professional judgment, could shift initial support status ranking downward if two of the three criteria indicate that there is impairment to the water quality.

A final determination to list the waterbody is made through an evaluation of assessment trends since 1989. Since that time, we have incorporated the hydrology and seasonal variations associated with lakes and reservoirs. In general, if an assessment unit exhibits a consistent status ‘not supporting’, it is added to the 303(d) list. Lakes that exhibit a mixture of not supporting and fully supporting conditions over a period of time are not listed until two consecutive assessment cycles demonstrate impairment, as well as a long-term increasing trend in TSI values, low winter dissolved oxygen, or increased densities of Cyanobacteria before we list the waterbody as impaired.

Table 2.14.5 presents summary data for each of the 132 lakes and reservoirs. Table 2.14.6 lists the total number in each support status. Of the 467,826 surface acres evaluated 68.5 % were found supporting their designated uses and 31.5% were not supporting the beneficial uses. Five lakes that were assessed as impaired for a second consecutive assessment cycle and are therefore new additions to Category 5. These include: Lower Bowns Reservoir, Monticello Lake, Rockport Reservoir, Starvation Reservoir and Wide Hollow Reservoir. Lakes that were assessed as impaired for this cycle only and thus will be listed in Category 3B include: Big Sand Wash Reservoir, Blanding City No. 4, and Little Creek Reservoir. Tabulation by individual lakes indicates that for the 132 lakes assessed, 62% were fully supporting, and 38% were not supporting. It should be noted that the biological data used to modify the initial conventional assessment (winter dissolved oxygen and fish kills) may have been collected prior to the data summary period (2006-2007) for this report. Table 2.14.7 summarizes.

Table 2.14.5. Summary of Individual Lake Beneficial Use Support																
Lake Description	**Acres**	**Assessment Cycle**						**Overall Support**		**303d list**	**Conventional Parameters DO, Temp, pH (2008)**	**Assess-ment Category**	**Total P > 0.025 mg/L Indicator**	**TSI >50**	**Winter DO/ Fish Kills**	**Cyano-bacteria present**
		1998	**2000**	**2002**	**2004**	**2006**	**2008**	**FS**	**NS**							
Anderson Meadow Reservoir	8	FS	FS	FS	FS	FS	FS	8			FS	2				Y
Ashley Twin Lakes	27	ND	FS	FS	FS	FS	FS	27				2				N
Baker Dam Reservoir	63	NS	PS	PS	PS	PS	PS		63	X	NS-DO	5	Y	Y		Y
Barney Reservoir	19	PS	FS	PS	FS	FS	FS	19			FS	2	Y	Y		Y
Bear Lake	69,760	FS	FS	FS	FS	FS	FS	69760			FS	2				N
Beaver Meadow Reservoir	5	FS	FS	FS	FS	FS	FS	5			FS	2				N
Big East Lake	23	PS	PS	PS	PS	PS	PS		23	X	NS- DO,pH	5		Y		Y
Big Sand Wash Reservoir	390	PS	FS	FS	PS	FS	PS		390		NS-DO	3B				Y
Birch Creek Reservoir #2	63	PS	FS	FS	PS	PS	FS	63			FS	2				N
Blanding City Reservoir#4	32	PS	FS	FS	PS	PS	PS		32		NS-T	3B				N
Bridger Lake	21	PS	PS	PS	PS	PS	PS		21	TMDL Completed	NS-DO	4			DO	Y
Brough Reservoir	150	NS	PS	PS	PS	NS	PS		150	X	NS-DO	4		Y		Y
Browne Reservoir	54	PS	PS	PS	FS	FS	FS		54	X	FS	4	Y	Y		Y
Butterfly Lake	5	FS	FS	FS	FS	FS	FS	5			FS	2				Y
Calder Reservoir	99	NS	PS	PS	PS	NS	PS		99	TMDL Completed	NS-DO	4	Y	Y	DO/FK	Y
Causey Reservoir	142	PS	FS	FS	FS	FS	FS	142			FS	2				N
China Lake	47	NS	NS	NS	FS	FS	PS		47	TMDL Completed	NS-DO	4			DO/FK	Y
Cleveland Reservoir	185	PS	FS	FS	FS	FS	FS	185			FS	2				Y
Cook Lake	9	PS	FS	PS	FS	FS	FS		9		FS	2	Y	Y		ND

Table 2.14.5. Summary of Individual Lake Beneficial Use Support																
Lake Description	**Acres**	**Assessment Cycle**						**Overall Support**		**303d list**	**Conventional Parameters DO, Temp, pH (2008)**	**Assess-ment Category**	**Total P > 0.025 mg/L Indicator**	**TSI >50**	**Winter DO/ Fish Kills**	**Cyano-bacteria present**
		1998	**2000**	**2002**	**2004**	**2006**	**2008**	**FS**	**NS**							
Currant Creek Reservoir	305	FS	FS	FS	FS	FS	FS		305		FS	2				Y
Cutler Reservoir	7,184		PS	PS	FS	FS	FS		7,184	X	NS-DO	5	Y			
Dark Canyon Lake	6	PS	FS	FS	FS	FS	FS		6		FS	2				ND
Deer Creek Reservoir	2,965	PS	PS	PS	FS	FS	PS		2965	TMDL Completed	NS- DO,T	4	Y	N		Y
DMAD Reservoir	1,199	FS	FS	FS	FS	FS	FS		1199		FS	2		Y		Y
Donkey Reservoir	40	FS	FS	FS	FS	FS	FS		40		FS	2				N
Duck Fork Reservoir	47	PS	FS	FS	FS	FS	FS		47		FS	2	Y	Y	DO	N
East Canyon Reservoir	173	NS	NS	NS	FS	NS	NS		173	TMDL Completed	NS- DO	4	Y	Y		Y
East Park Reservoir	684	FS	PS	FS	FS	FS	FS		684		FS	2				Y
Echo Reservoir	1,394	PS	PS	PS	FS	FS	NS		1394	X	NS- DO	5	Y	Y		Y
Electric Lake	425	PS	FS	FS	FS	FS	FS		425		FS	2				Y
Fairview Reservoir #2	105	PS	FS	FS	FS	FS	FS		105		FS	2				N
Ferron Reservoir	55	PS	FS	FS	FS	PS	FS		55		FS	2				N
Fish Lake	2,500	PS	FS	FS	FS	FS	FS		2500		FS	2				N
Flaming Gorge Reservoir	42,020	FS	FS	FS	FS	FS	FS		42020		FS	2				Y
Forsyth Reservoir	158	PS	PS	PS	PS	PS	PS		158	X	NS-pH	4		Y		N
Grantsville Reservoir	88	FS	FS	FS	FS	FS	FS	88			FS	2				Y
Gunlock Reservoir	266	PS	PS	PS	PS	PS	PS		266	X	NS- DO	4	Y			Y
Gunnison Bend Reservoir	706	FS	FS	FS	FS	FS	FS	706			FS	2		Y		N
Gunnison Reservoir	1,287	PS	FS	FS	FS	FS	FS	1287			FS	2	Y			N

Table 2.14.5. Summary of Individual Lake Beneficial Use Support																
Lake Description	**Acres**	**Assessment Cycle**						**Overall Support**		**303d list**	**Conventional Parameters DO, Temp, pH (2008)**	**Assess-ment Category**	**Total P > 0.025 mg/L Indicator**	**TSI >50**	**Winter DO/ Fish Kills**	**Cyano-bacteria present**
		1998	**2000**	**2002**	**2004**	**2006**	**2008**	**FS**	**NS**							
Hoop Lake	162	FS	FS	FS	FS	FS	FS	162			FS	2				Y
Hoover Lake	17	FS	FS	FS	FS	FS	FS	17			FS	2				Y
Huntington Lake North	225	PS	FS	FS	FS	FS	FS	225			FS	2				N
Huntington Reservoir	115	PS	FS	FS	FS	FS	FS	115			FS	2				N
Hyrum Reservoir	438	NS	PS	PS	PS	NS	FS	438		TMDL Completed	FS	4				N
Joes Valley Reservoir	1,183	FS	FS	FS	FS	FS	FS	1183			FS	2				N
Johnson Valley Reservoir	285	PS	PS	PS	PS	PS	FS	285		TMDL Completed	FS	4	Y	Y	DO	Y
Jordanelle Reservoir	3,068	FS	FS	FS	FS	FS	FS	3068			FS	2				N
Kens Lake	86	NS	PS	PS	PS	FS	PS		86	TMDL Completed	insufficient data	4				N
Kents Lake	26	NS	PS	PS	PS	PS	FS	26		TMDL Completed	FS	4	Y	Y		N
Kolob Reservoir	335	PS	FS	PS	PS	FS	FS	335			FS	2	Y			
Koosharem Reservoir	310	PS	PS	PS	PS	NS	NS		310	TMDL Completed	NS pH	4	Y	Y		Y
Labaron Reservoir	24	NS	NS	NS	NS	PS	FS	24		TMDL Completed	FS	4			DO	Y
Lake Mary	23	PS	FS	FS	FS	FS	FS	23			FS	2				N
Lake Powell	162,760	FS	FS	FS	FS	FS	FS	162760			FS	1				ND
Little Creek Reservoir	65	PS	FS	FS	FS	FS	PS		65		NS-pH	3B				Y
Little Dell Reservoir	249	PS	FS	FS	FS	FS	FS	249			FS	2				Y
Lloyds Reservoir	104	PS	FS	FS	PS	PS	FS	104			insufficient data	2				Y
Long Park Reservoir	60	FS	FS	FS	FS	FS	FS	60			FS	2				Y
Lost Creek Reservoir	52	FS	FS	FS	FS	FS	FS	52			FS	2				N

Table 2.14.5. Summary of Individual Lake Beneficial Use Support																
Lake Description	**Acres**	**Assessment Cycle**						**Overall Support**		**303d list**	**Conventional Parameters DO, Temp, pH (2008)**	**Assess-ment Category**	**Total P > 0.025 mg/L Indicator**	**TSI >50**	**Winter DO/ Fish Kills**	**Cyano-bacteria present**
		1998	**2000**	**2002**	**2004**	**2006**	**2008**	**FS**	**NS**							
Lower Bowns Reservoir	90	PS	FS	FS	PS	PS	PS		90	X	NS-pH	5	Y			Y
Lower Box Reservoir	50	NS	PS	PS	PS	NS	PS		50	TMDL Completed	NS-pH	4	Y	Y		Y
Lower Gooseberry Reservoir	57	PS	PS	PS	PS	PS	FS	57		X	FS	5	Y		DO	Y
Lyman Lake		NS	PS	PS	PS	PS	PS		27	TMDL Completed	NS-DO	4			DO	Y
Manning Meadow Reservoir	59	NS	PS	PS	PS	PS	PS		59	X	NS- DO	5	Y	Y	DO/FK	N
Mantua Reservoir	554	NS	PS	PS	PS	NS	NS		554	TMDL Completed	NS -pH,	4	Y			Y
Marsh Lake	38	NS	PS	PS	PS	PS	PS		38	TMDL Completed	NS- DO	4			DO/FK	Y
Marshall Reservoir	18	PS	FS	PS	PS	PS	FS	18			FS	2			DO/FK	Y
Matt Warner Reservoir	433	NS	NS	NS	FS	NS	NS		433	TMDL Completed	NS-pH	4	Y	Y	DO/FK	N
Meeks Cabin Reservoir	477	FS	FS	FS	FS	FS	FS	477			FS	2				N
Mill Hollow Reservoir	15	PS	PS	PS	PS	PS	PS		15	X	NS- pH	5	Y	Y		Y
Mill Meadow Reservoir	156	PS	PS	PS	PS	PS	PS			TMDL Completed	NS- pH	4	Y	Y		Y
Miller Flat Reservoir	65	FS	FS	FS	FS	FS	FS				FS	2				Y
Millsite Reservoir	435	PS	FS	FS	FS	FS	FS				FS	2				N
Minersville Reservoir	990	NS	PS	PS	PS	PS	FS			TMDL Completed	FS	4		Y		N
Mirror Lake	50	PS	PS	PS	FS	FS				TMDL Completed	FS	4	Y		DO	Y
Mona Reservoir	1,110	FS	FS	FS	FS	PS	FS				FS	2				N
Monticello Lake	3	FS	FS	FS	FS	PS	PS				NS-pH*	5				N
Moon Lake	768	FS	FS	FS	FS	FS	FS				FS	2				N

Table 2.14.5. Summary of Individual Lake Beneficial Use Support																
Lake Description	**Acres**	**Assessment Cycle**						**Overall Support**		**303d list**	**Conventional Parameters DO, Temp, pH (2008)**	**Assess-ment Category**	**Total P > 0.025 mg/L Indicator**	**TSI >50**	**Winter DO/ Fish Kills**	**Cyano-bacteria present**
		1998	**2000**	**2002**	**2004**	**2006**	**2008**	**FS**	**NS**							
Navajo Lake	714	PS	PS	PS	PS	NS	PS			X	insufficient data	4			DO/FK	NA
Newcastle Reservoir	163	NS	NS	NS	PS	PS	PS			X	NS-DO, T	5		Y		N
Newton Reservoir	350	NS	NS	NS	PS	PS	PS			TMDL Completed	NS-DO	4	Y	Y		Y
Nine Mile Reservoir	197	NS	NS	NS	NS	NS	PS			X	NS-pH	5	Y	Y		N
Oak Park Reservoir	382	FS	FS	FS	FS	FS	FS				FS	2				N
Otter Creek Reservoir	2,520	PS	NS	PS	PS	PS	PS			TMDL Completed	NS- DO	4	Y	Y		Y
Palisades Lake	66	PS	PS	PS	PS	PS	FS				FS	2	Y			N
Panguitch Lake	1,248	NS	PS	PS	PS	NS	NS		1248	TMDL Completed	NS-pH, NS-DO	4	Y	Y		Y
Paradise Park Reservoir	143	FS	FS	FS	FS	FS	FS				FS	2				N
Pelican Lake	1,680	PS	FS	PS	PS	NS	NS		1680	X	NS pH	5	Y		FK	Y
Pine Lake	77	PS	FS	PS	PS	PS	FS	77			FS	2				N
Pineview Reservoir	2,874	PS	PS	PS	PS	NS	PS		2,874	TMDL Completed	NS-DO	4	Y			Y
Piute Reservoir	2,508	PS	PS	PS	PS	PS	FS		2,508	X	NS-TP	5	Y	Y		Y
Porcupine Reservoir	190	PS	PS	PS	PS	FS	FS		190	X	FS	2	Y			N
Posey Lake	20	PS	FS	FS	FS	FS	FS	20			FS	2	Y			N
Puffer Lake	65	NS	PS	PS	PS	PS	FS	65		TMDL Completed	FS	4				Y
Quail Creek Reservoir	590	PS	FS	FS	FS	FS	FS	590			FS	2				N
Recapture Reservoir	265	PS	PS	PS	PS	PS	PS		265	X	NS-DO	5				N
Red Creek Reservoir	142	PS	FS	FS	FS	FS	FS	142			FS	2				Y
Red Creek Reservoir (Iron)	39	NS	NS	NS	NS	PS	PS		39	X	NS- DO	5	Y	Y	DO	N

Table 2.14.5. Summary of Individual Lake Beneficial Use Support																
Lake Description	**Acres**	**Assessment Cycle**						**Overall Support**		**303d list**	**Conventional Parameters DO, Temp, pH (2008)**	**Assess-ment Category**	**Total P > 0.025 mg/L Indicator**	**TSI >50**	**Winter DO/ Fish Kills**	**Cyano-bacteria present**
		1998	**2000**	**2002**	**2004**	**2006**	**2008**	**FS**	**NS**							
Red Fleet Reservoir	520	FS	PS	PS	PS	PS	NS		520	X	NS -DO	5		N		Y
Redmond Lake	160	PS	FS	FS	FS	FS	FS	160			FS	2		Y		N
Rex's Reservoir	46	PS	FS	FS	FS	FS	FS	46			FS	2				N
Rockport Reservoir	1,189	FS	FS	FS	FS	NS	PS		1189		NS-DO	5				Y
Rush Lake	80	PS	FS	FS	FS	FS	FS	80			FS	2	Y	Y		N
Salem Pond	11	FS	FS	FS	FS	FS	FS	11			FS	2				N
Scofield Reservoir	2,815	PS	PS	PS	PS	FS	FS	2815		TMDL Complete	FS	4	Y			Y
Scout Lake	18	FS	FS	FS	FS	FS	FS	18			FS	2				N
Settlement Canyon Res	315	FS	FS	FS	FS	FS	FS	315			FS	2				N
Sevier Bridge Reservoir	10,905	FS	FS	FS	FS	FS	FS	10905			FS	2				Y
Sheep Creek Reservoir	86	PS	FS	FS	FS	FS	FS	86			FS	2				Y
Silver Lake Flat Reservoir	54		FS	FS	FS	FS	FS	54			FS	2				N
Smith and Morehouse Res	197	PS	FS	FS	FS	FS	FS	197			FS	2				N
Spirit Lake	41	PS	PS	PS	FS	FS		41			FS	2				N
Stansbury Lake	120	PS	FS	FS	FS	FS	FS	120			FS	2				N
Starvation Reservoir	2,760	PS	FS	PS	PS	PS	PS		2760	X	NS- DO	5	Y	Y		Y
Stateline Reservoir	288	FS	FS	FS	FS	FS	FS	288			FS	2				N
Steinaker Reservoir	829	PS	PS	PS	PS	PS	PS		829	X	NS-DO	5				Y
Strawberry Reservoir	17,160	PS	PS	PS	PS	PS	PS		17160	TMDL Completed	NS- DO	4	Y		DO	Y
Three Creeks Reservoir	57	PS	FS	FS	FS	PS	FS	57			FS	2				Y

Table 2.14.5. Summary of Individual Lake Beneficial Use Support																
Lake Description	**Acres**	**Assessment Cycle**						**Overall Support**		**303d list**	**Conventional Parameters DO, Temp, pH (2008)**	**Assess-ment Category**	**Total P > 0.025 mg/L Indicator**	**TSI >50**	**Winter DO/ Fish Kills**	**Cyano-bacteria present**
		1998	**2000**	**2002**	**2004**	**2006**	**2008**	**FS**	**NS**							
Tibble Fork Reservoir	13	FS	FS	FS	FS	FS	FS	13			FS	2				N
Tony Grove Reservoir	25	NS	NS	NS	NS	PS	PS		25	X	NS- DO	5	Y		FK	Y
Trial Lake	98	FS	FS	FS	FS	FS	FS	98			FS	2				N
Tropic Reservoir	180	PS	FS	FS	FS	FS	FS	180			FS	2				N
Upper Enterprise Reservoir	200	NS	FS	NS	NS	NS	FS	200			FS	2	Y			Y
Upper Stillwater Reservoir	252	FS	FS	FS	FS	FS	FS	252			FS	2				Y
Utah Lake	96,900	PS	PS	PS	PS	PS	PS		96900	X	FS	5	Y	Y		Y
Wall Lake	61	FS	FS	FS	FS	FS	FS	61			FS	2				N
Washington Lake	94	FS	FS	FS	FS	FS	FS	94			FS	2				N
Whitney Reservoir	188	PS	FS	FS	FS	FS	FS	188			FS	2				Y
Wide Hollow Reservoir	145	NS	FS	NS	NS	NS	NS		145	X	NS-pH	5	Y			N
Willard Bay Reservoir	10,000	PS	FS	FS	FS	FS	FS	10000			FS	2	Y			Y
Woodruff Creek Reservoir	90	PS	FS	FS	FS	FS	FS	90			FS	2				Y
Yankee Meadow Reservoir	5	NS	PS	PS	PS	PS	PS		5	X	NS-pH*	5		Y	FK	N

Degree of Use Support	Number	Acreage	Percent Support By Lake Numbers	Percent Support by Lake Acreage
Fully supported:	82	320,631	62%	68.5%
Threatened:	0	0	0.0%	0.0%
Not supporting:	58	147,195	38%	31.5%
Total Size Assessed:	132	0	100%	!00%

~~Table 2.14.7. Individual Use Support Summary (Acres).~~

~~Use~~	~~Supporting~~	~~Supporting but Threatened~~	~~Partially Supporting~~	~~Not Supporting~~	~~Not Attainable~~	~~Unassessed~~
~~Fish Consumption~~		~~0~~	~~0~~	~~0~~	~~0~~	~~460,642~~
~~Aquatic Life Support~~	~~316,810~~	~~0~~	~~148,570~~	~~2,727~~	~~0~~	~~0~~
~~Shellfishing~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~467,787~~
~~Swimming~~	~~162,760~~			~~0~~	~~0~~	~~305,027~~
~~Secondary Contact~~	~~162,760~~			~~0~~	~~0~~	~~305,027~~
~~Drinking Water Supply~~	~~252,643~~	~~0~~	~~0~~	~~0~~	~~0~~	~~236,194~~
~~Agriculture~~	~~370,887~~	~~0~~	~~96,900~~	~~0~~	~~0~~	~~0~~

Use	Supporting	Supporting but Threatened	Not Supporting	Not Attainable	Unassessed
Fish Consumption		0	0	0	460,642
Aquatic Life Support	316,810	0	151,297	0	0
Shellfishing	0	0	0	0	467,787
Swimming	162,760		0	0	305,027
Secondary Contact	162,760		0	0	305,027
Drinking Water Supply	252,643	0	0	0	236,194
Agriculture	370,887	0	96,900	0	0

the use support by classification. Tables 2.14.8 and 2.14.9 summarize the various cause and source categories for those lakes that are not supporting their designated uses. Utah DWQ will continue to conduct reconnaissance level investigations on several lakes and reservoirs in the future in cooperation with other partner agencies including but not limited to the following: Strawberry Reservoir, Lake Powell, and Flaming Gorge Reservoir. However, all of these studies will depend on available time and resources

2.14.5 Acid Effects on Lakes

Since this report came out, the Acid Deposition Technical Advisory Committee has been relatively inactive. In 1986, the Acid Deposition Technical Advisory Committee recommended that reconnaissance surveys be conducted in areas considered potentially sensitive to acid deposition. In response to this recommendation, a cooperative agreement involving private individuals, private industries, and several State and Federal agencies was developed and

approved. This agreement organized efforts to sample selected streams and lakes in ten different mountain ranges in Utah during the summer of 1987. The water chemistry data were then used to determine the Acid Neutralizing Capacity (ANC) of the sampled lakes and streams and their sensitivity to acid deposition. Generally, it was concluded that several of the high lakes in the State, were susceptible to acid precipitation due to their low buffering capacities but at the moment, none were actually affected by acid deposition.

Table 2.14.8. Total Size of Lake Assessment Units Not Fully Supporting Uses Affected By Various Cause Categories (Acres).			
Cause Categories Threatened	**Major Impact**	**Moderate Impact**	**Minor Impact**
Cause Unknown			
Unknown Toxicity			
Pesticides			
Priority Organics	---	---	---
Nonpriority Organics	---	---	---
Metals	0	0	0
Ammonia	0	0	0
Chlorine	---	---	---
Other Inorganics	0	0	0
Nutrients	140,431	3,928	0
pH	0	5704	0
Siltation	113,540	22,053	0
Organic Enrichment / DO	107,849	133,247	0
Salinity / TDS / Chlorine	96,900	0	0
Thermal Modification	0	0	0
Flow Alteration	---	---	—
Habitat Alteration	*	*	
Pathogen Indicators	0	1,000	0
Radiation	---	---	—
Oil and Grease	0	0	0
Suspended Solids	97,185	0	0
Noxious Aquatic Plants	102,922	754	—
Total Toxics	---	---	—
Turbidity	---	---	—
Exotic Species	---	---	—
Filling and Draining	11,465	5,915	---

Table 2.14.9. Total Size of Lake Assessment Units Not Fully Supporting Uses Affected By Various Source Categories (acres).			
Source Categories Threatened	**Major Impact**	**Moderate impact**	**Minor Impact**
Industrial Point Sources	97,892	0	0
Municipal Point Sources	106,205	2,965	0
Agriculture	16,796	120,613	0
Silviculture	0	990	0
Construction	4,295	103,225	0
Runoff / Storm Sewers	101,437	0	0
Resource Extraction	0	173	0
Land Disposal	0	0	0
Hydromodification	110,828	21,472	0
Habitat Modification			
Marinas	0	0	0
Atmospheric Deposition	0	0	0
Contaminated Sediments	0	0	0
Unknown Source	---	---	---
Natural Source	---	---	---

Table 2.14.10. Summary of Total Lake Assessment unit Size Affected by Toxics.		
Assessment unit Type / Unit	**Size Monitored For Toxics**	**Size With Elevated Levels of Toxics**
Lake (Acres)	467,787	0

2.14.6 Toxic Effects on Lakes

One hundred twenty lakes/reservoirs were assessed for toxic metals during this reporting cycle (Table 2.14.10). Because of the association of metal solubility with decreasing reduction/oxidation potential at the sediment-water interface, samples were collected approximately 0.5 m above the bottom of the lake or reservoir to detect the maximum concentration within the lake. Resulting data were compared to numeric standards for the protection of aquatic life.

This monitoring would also evaluate the potential for uptake of toxic metals into the food chain initiated by benthic organisms. Hence, this type of sampling is used as a screening tool and additional water column sampling would be performed to identify the frequency of exceedence and subsequent impairment. Although some tributary stream segments have been identified as impaired with various toxic metals, no lake samples contained metal concentrations above the chronic water quality standards.

Notwithstanding these results for water quality, there are some reservoirs for which DWQ and the Utah Department of Health have issued fish consumption advisories. These include Lake Powell, Baker Dam, Causey, Deer Creek, East Canyon, Gunlock, Hyrum, Joes Valley, Jordanelle, Lower Bowns, Minersville, Newcastle, Otter Creek, Panguitch, Scofield, Strawberry Wide Hollow, Willard Bay, Piute, Porcupine, and Yuba Reservoirs and Bear Lake, Huntington Lake and Kens Lake. These advisories are based on EPA's recommended tissue concentrations of 0.3 ppm and not on FDA recommended maximum concentrations of 1.0 ppm. DWQ has decided to list waterbodies as impaired for mercury if tissue concentrations exceed 1.0 ppm. DWQ is continuing to monitor these reservoirs and to check fish tissue concentrations in the remaining 132 priority lakes.

2.14.7 Trends in Lake Water Quality

Table 2.14.11 summarizes the trends in water quality of those lakes assessed under the Lake Water Quality Assessment program. The 1981 data represents eighty-nine lakes and reservoirs where comparable data existed from the original inventory and classification study that completed in 1982. These data represent a comparison of lakes and reservoirs monitored during the last seven cycles of the study (1989-1990, 1991-1992, 1993-1994, 1995-1996, 1997-1999, 2000-2001 and 2002-2003). Carlson TSI values for each assessment unit were compared to values obtained during previous periods of study for comparative lakes or reservoirs (Table 2.14.12). Unknown values were due to data not available at the time of assessment or the reservoir was dry. The initial data period contains the information collected for the Clean Lakes Inventory for Utah in 1982. It should be noted that the 1982 data set in many cases is limited to total phosphorus and Secchi depth data or only one of the two. Chlorophyll *a* data is very limited during that study period. Trends for water quality were then determined from these comparisons. A TSI value comparison yielding a variation of ≤ 5 indicated a stable trend. A TSI value comparison yielding an increase of more than 5 is reported as a degrading condition. A TSI value comparison yielding a decrease of more than 5 is reported as an improving condition.

Table 2.14.11. Trends in Water Quality of Lakes and Reservoirs.

	Number of Lakes							Number of Acres						
Trend	**1991 1992**	**1993 1994**	**1995 1996**	**1997-1999**	**2000-2001**	**2002-2003**	**2006-2007**	**1991 1992**	**1993 1994**	**1995 1996**	**1997-1999**	**2000-2001**	**2002-2003**	**2006-2007**
Improve	24 24%	40 31%	32 25%	16 12%	8 6%	35 27%	32 24%	177,785 45%	55,302 13%	10,254 2%	4,525 1%	42,583 9%	89,718 19%	168,569 36%
Stable	49 52%	70 54%	88 68%	72 55%	78 60%	44 33%	30 23%	204,223 51%	356,097 85%	449,631 98%	436,533 95%	346,863 75%	299,940 64%	174,150 37%
Degrade	23 24%	15 12%	8 6%	39 30%	5 4%	37 28%	70 53%	15,251 4%	6,759 2%	670 ---	19,455 4%	71,208 15%	75.880 16%	124,702 26%
Unknown		5 4%	1 1%	4 3%	12 9%	16 12%	12 0.3%		4,2430 1%	6 ---	129 ---	849 2%	2,288 0.5%	1,583 0.3%
Assessed for Trends	95	130	128	131	131	132	120	397,259	460,588	460,561	460,642	460,642	467,787	465,883

Table 2.14.12. Utah Reservoir / Lake Monitoring List and TSI Evaluation.									
	TSI Index								Surface Area
Lake / Reservoir	1989-90	1991-92	1993-94	1995-96	1997-99	1999-01	2002-03	2006-07	(Acres)
Anderson Meadow Reservoir	52.69	50.18	43.87	46.99	44.28	35.5	46.85	47.58	8
Ashley Twin Lakes			41.52		39.16	35.01	NA	NA	27
Baker Dam Reservoir	62.33	50.42	46.25	50.9	50.67	41.71	50.29	62.06	63
Barney Lake		61.46	60.7	62.56	50.23	50.17	46.88	58.2	19
Bear Lake	37.57	32.36	32.73	29.62	34.45	45.05	29.53	32.8	69,760
Beaver Meadow Reservoir			45.98	44.28	49.44	47.44	36.31	NA	5
Big East Lake	52.42	48.32	41.48	40.58	42.11	47.72	NA	50.36	23
Big Sand Wash Reservoir	46.11	45.28	38.97	39.02	41.48	48.43	32.71	NA	390
Birch Creek Reservoir #2	52.35	47.4	49.07	36.59	45.12	44.32	53.01	44.39	63
Blanding Reservoir #4	48.4		46.74	35.83	39.8	29.85	37.16	37.26	32
Bridger Lake		46.72	51.82	46.94	46.12	44.82	43.07	47.71	21
Brough Reservoir			44.74	41.64	41.23	NA	48.64	48.91	150
Browne Lake	40.27	45.31	47.02	50.2	50.95	NA	51.08	47.41	54
Butterfly Lake	40.71	35.99	77.79	37.14	44.19	33.5	38.05	49.24	5
Calder Reservoir		54.14	59.49	59.54	58.85	57.78	54.51	59.78	99
Causey Reservoir	43.23	38.79	43.41	38.15	33.64	NA	NA	NA	142
China Lake		45.59	34.87	45.09	48.51	43.83	44.72	54.26	47
Cleveland Reservoir	41.66	51.61	42.75	35.57	46.87	46.87	39.35	50.28	185
Cook Lake	44.01	48.18	44.42	46.38	ND	49.36	NA	48.46	9
Cutler Reservoir							54.52	71.49	7,184
Currant Creek Reservoir	44.15	42.03	38.26	40.72	44.03	45.18	31.95	42.26	305
Dark Canyon Lake			40.2		ND	NA	NA	NA	6
Deer Creek Reservoir	47.79	47.04	43.14	42.58	43.64	42.24	38.76	47.61	2,965
DMAD Reservoir	65.29	57.34	60.55	56.99	56.34	52.55	50.36	57.9	1,199
Donkey Reservoir	48.64	44.57	44.16	41.82	42.29	40.19	34.98	NA	40
Duck Fork Reservoir		39.75	28.05	37.51	42.89	39.96	NA	NA	47
East Canyon Reservoir	48.7	52.82	49.59	48.42	43.72	46.48	46.24	43.25	173
East Park Reservoir		48.35	41.41	45.98	47.18	44.48	37.04	45.48	684
Echo Reservoir		39.07	41.8	45.16	39.19	50.67	51.14	46.03	1,394
Electric Lake Reservoir	39.43	49.74	43.92	40.23	44.13	48.19	40.34	NA	425
Fairview Reservoir	52.72	38.92	39.25	33.76	38.43	33.44	42.67	49.7	105
Ferron Reservoir	43.37	39.86	35.47	31.82	39.92	40.41	45.2	41.18	55
Fish Lake	41.26	40.26	33.59	34.39	34.49	35.77	35.92	34.77	2500
Flaming Gorge Reservoir	42.75		36.47	37.32	39.61	31.93	35.82	NA	42,020
Forsyth Reservoir	61.88	52.76	56.87	49	55.33	50.75	46.4	49.59	158

Table 2.14.12. Utah Reservoir / Lake Monitoring List and TSI Evaluation.									
	TSI Index								Surface Area
Lake / Reservoir	1989-90	1991-92	1993-94	1995-96	1997-99	1999-01	2002-03	2006-07	(Acres)
Grantsville Reservoir	43.63	49.09	46.47	41.11	49.56	45.28	40.91	42.71	88
Gunlock Reservoir	42.47	42.31	47.41	42.61	40.15	38.81	42.65	53.7	266
Gunnison Bend Reservoir	63.04	62.38	55.04	54.03	58.08	53.56	57.2	53.2	706
Gunnison Reservoir	61.41	63.96	56.81	55.24	47.71	54.27	48.5	57.86	1,287
Hoop Lake	57.44	49.8	59.27	49.34	47.48	NA	39.12	NA	162
Hoover Lake	40.22	38.72	36.26	35.72	39.5	41.81	49.2	43.34	17
Huntington Lake North	37.39	44.81	37.63	35.34	43.61	46.04	30.92	34.85	225
Huntington Reservoir		46.5	43.78	32.64	40.39	36.32	40.99	42.22	115
Hyrum Reservoir	45.84	43.07	44.03	43.59	45.96	47.81	45.82	38.91	438
Joes Valley Reservoir	30.85	34.55	32.35	37.05	43.72	40.64	34.91	49.53	1183
Johnson Reservoir	63.77	68.04	65.18	63.63	58.38	60.42	64.47	60.45	285
Jordanelle Reservoir			44.64	43.68	43.12	40.56	42.6	44.54	3068
Kens Lake	56.81	44.01	45.01	36.31	38.83	42.51	40.7	39.55	86
Kents Lake		69.06	67.12	63.92	58.13	77.95	63.2	58.64	26
Kolob Reservoir	41.53	47.82	45.06	43.52	35.3	34.82	31.7	41.11	335
Koosharem Reservoir	73.87	55.4	65.86	56.97	64.73	56.53	51.64	57.19	310
Labaron Reservoir		51.05	65.47	60.04	46.87	56.23	46.94	55.73	24
Lake Mary	42.18	51.43	33.5	41.74	32.32	39.16	38.32	NA	23
Lake Powell	42.47	36.58	35.13	35.07	E 35.10	NA	39.5	38.53	162,760
Little Creek Reservoir	45.14	37.51	40.41	36.39	42.04	30.06	NA	43.18	65
Little Dell Reservoir			36.84	33.35	42	NA	NA	NA	249
Lloyds Reservoir	49.11	42.58	47.02	35.64	38.24	35.99	32.62	51.95	104
Long Park Reservoir		44.84	45.49	41.99	DRY	DRY	34.43	48.21	60
Lost Creek Reservoir	39.53	46.18	35.17	39.26	36.97	29.56	36.93	NA	52
Lower Bowns Reservoir	50.05	41.31	47.18	48.35	40.72	40.21	44.01	56.09	90
Lower Box Reservoir		77.07	74.78	73.03	64.57	66.29	64.12	60.79	50
Lower Gooseberry Reservoir	45.69	44.26	40.82	40.31	46.12	45.08	37.51	44.9	57
Lyman Lake		37.74	31.21	34.92	32.96	31.82	47.88	41.33	27
Manning Meadow Reservoir		54.37	50.17	49.58	52.78	NA	51.83	54.39	59
Mantua Reservoir	54.93	58.05	59.56	55.13	48.21	45.21	38.71	51.39	554
Marsh Lake	28.14	34.36	30.42	30.9	37.46	40.51	31.27	41.95	38
Marshall Lake	36.27	29.51	31.77	31.27	38.83	27.56	31.08	37.43	18
Matt Warner Reservoir		53.35	61.26	55.76	57.28	52.63	54.44	58.23	433
Meeks Cabin Reservoir	47.13	42.42	40.19	39.89	44.13	45.93	32.03	42.31	477
Mill Hollow Reservoir	47.24	47.79	47.42	46.63	56.95	55.27	45.41	49.04	15
Mill Meadow Reservoir	67.06	69.15	55.75	59.74	50.48	55.66	46.26	62.59	156

Table 2.14.12. Utah Reservoir / Lake Monitoring List and TSI Evaluation.									
	TSI Index								Surface Area
Lake / Reservoir	1989-90	1991-92	1993-94	1995-96	1997-99	1999-01	2002-03	2006-07	(Acres)
Millers Flat Reservoir		40.84	42.35	32.74	37.92	32.46	NA	39.64	65
Millsite Reservoir	35.07	41.46	35.19	37.42	45.85	55.81	30.97	40.39	435
Minersville Reservoir	59.98	56.23	66.48	56.29	56.33	53.2	50.78	61.03	990
Mirror Lake	38.23	39.95	31.69	37.91	42.78	40.77	38.3	NA	50
Mona Reservoir		66.1	57.58	44.4	49.08	39.77	52.95	44.71	1,110
Moon Lake	46.79	38.08	37.42	41.15	43.93	42.53	32.8	39.87	768
Monticello Lake		46.71	45.46	45.08	36.12	38.92	NA	39.88	3
Navajo Lake	34.03	35.41	39.71	41.15	39.93	42.58	36.08	36.05	714
New Castle Reservoir	48.12	53.92	41.78	47.5	54.15	47.22	58.62	62.34	163
Newton Reservoir	53.81	60.67	60.82	47.96	51.68	42.5	58.94	62.86	350
Nine Mile Reservoir	45.2	59.42	53.1	44.72	52.49	M 36.65	53.13	46.07	197
Oak Park Reservoir	48.61	47.89	42.44	44.79	45.46	46.26	42.08	33.46	382
Otter Creek Reservoir	57.44	43.54	55.23	59.19	55.59	55.15	61.12	45.41	2520
Palisade Reservoir	45.73	58.86	39.61	38.17	40.42	40.72	48.41	47.98	66
Panguitch Lake	54.25	50.56	52.67	49.56	50.81	61.63	45.91	59.3	1248
Paradise Park Lake		40.49	36.97	38.66	44.06	48.12	37.95	NA	143
Pelican Lake	44.5	38.71	47.06	41.24	38.17	34.72	46.42	37.35	1,680
Pine Lake	44.14	34.48	19.66	30.64	42.04	53.1	39.42	30.39	77
Pineview Reservoir		58.31	39.97	42.5	46.58	41.3	52.04	51.61	2,874
Piute Reservoir	57.18	54.45	45.54	47.99	55.31	56.48	51.47	50.94	2,508
Porcupine Reservoir	38.05	40.09	38.44	37.45	46.23	42.87	40.29	40.58	190
Posey Lake	46.29	45.82	38.82	32.59	42.87	42.87	32.81	NA	20
Puffer Lake	49.1	36.16	38.44	38.8	49.62	49.62	39.77	46.07	65
Quail Creek Reservoir	38.38	40.35	26.15	29.56	34.83	37.91	29.8	33.2	590
Recapture Creek Reservoir	45.61	49.16	44.5	35.56	40.64	39.75	34.43	45.76	265
Red Creek Reservoir (Iron)		53.14	57.3	40.22	52.81	47.57	51.2	56.24	39
Red Creek Reservoir		57.73	54.12	53.55	36.72	41.99	44.78	42.22	142
Red Fleet Reservoir	42.35	40.47	41.02	45.98	40.24	NA	37.89	43.5	520
Redmond Reservoir	68.68	75.03	70.71	67.34	63.44	69.88	64.63	69.81	160
Rexs Reservoir		45.8	50.21	48.29	43.17	49.49	NA	63.06	46
Rockport Reservoir	43.88	42.98	41.78	45.48	40.76	30.85	47.93	64.13	1,189
Rush Lake	60.83	78.55	72.37	60.64	64.29	61.82	64.95	50.83	80
Salem Pond	45.89	50	39.81	45.89	44.76	M 38.57	42.1	53.9	11
Scofield Reservoir	62.69	55.77	53.22	41.69	45.08	45.95	44.06	51.75	2,815
Scout Lake		58.05	38.43	31.75	38.7	34.3	44.75	NA	18
Settlement Canyon Reservoir	39.65	47.94	40.84	42.54	47.43	36.25	43.52	41.76	315
Sevier Bridge Reservoir	54.4	63.95	52.19	48.24	48.66	44.35	56.38	49.73	10,905
Sheep Creek Reservoir		45.87	46.1	40.85	37.79	31.37	43.91	NA	86

Table 2.14.12. Utah Reservoir / Lake Monitoring List and TSI Evaluation.									
	TSI Index								Surface Area
Lake / Reservoir	1989-90	1991-92	1993-94	1995-96	1997-99	1999-01	2002-03	2006-07	(Acres)
Silver Lake Flat Reservoir					41.94	NA	NA	NA	54
Smith and Morehouse Reservoir	44.34	45.96	34.39	37.31	38.13	40.3	43.03	39.72	197
Spirit Lake	44.43	45.18	50.21	40.81	48.05	46.04	45.57	NA	41
Stansbury Lake	55.77	57.22	58.31	49.55	49.27	49.41	60.07	52.36	120
Starvation Reservoir	54.86	41.45	36.66	40.14	39.16	39.1	42.51	42.55	2,760
Stateline Reservoir	46.29	39.66	41.41	40.74	41.79	45.21	33.18	42.54	288
Steinaker Reservoir	35.01	40.33	33.72	34.82	38.24	37.37	36.7	40.38	829
Strawberry Reservoir	55.6	53.47	48.43	45.68	45.87	48.18	43.99	36.94	17,160
Three Creeks Reservoir		50.83	57.32	54.09	49.92	42.37	63.07	57.21	57
Tibble Fork Reservoir	28.48	42.92	44.39	41.77	38.32	39.85	36.13	48.16	13
Tony Grove Lake	40.76	33.52	35.26	33.89	41.93	40.47	35.96	NA	25
Trial Lake	42.92	37.95	39.51	35.22	43.21	48.27	46.03	NA	98
Tropic Reservoir	47.71	36.75	39.12	29.08	38.33	35.67	30.16	33.21	180
Upper Enterprise Reservoir	73.65	58.37	54.18	54.41	44.15	44.15	53.13	58.23	200
Upper Stillwater Reservoir	39.21	38.93	25.21	35.16	38.17	39.76	32.62	37.27	252
Utah Lake	69.35	67.67	67.59	64	67.9	70.08	69.19	65.55	96,900
Wall Lake		31.83	39.18	28.98	37.94	26.55	40.21	34.44	61
Washington Lake		41.59	40.73	39.55	39.78	31.12	39.44	39.64	94
Whitney Reservoir	40.11	56.88	37.21	40.63	37.72	NA	NA	40.56	188
Wide Hollow Reservoir	46.33	43.91	47.59	40.58	40.62	DRY	DRY	38.92	145
Willard Reservoir		62.84	47.68	52.66	47.43	45.92	55.86	56.62	10,000
Woodruff Creek Reservoir	40.92	48.6	43.14	42.37	45.11	NA	31.88	NA	90
Yankee Meadows Reservoir		50.19	54.09	52.84	49.4	56.48	53.55	51.18	5

2.14.8 Assessment Categories

The use of assessment categories that more accurately reflect the need and progress of TMDL development has been initiated for the 2004 303(d) list and the 305(b) assessment report. Tables 2.14.13 through 2.14.17 list these categories for Utah's lakes and reservoirs. As stated above, several of Utah's lakes and reservoirs vary between fully and not supporting their beneficial uses. As such, DWQ requires the results of two consecutive assessment cycles as either fully or not supporting in order to list or delist a lake or reservoir as supporting beneficial uses. Sub-category 3B (Table 1-6-18) was added to track such lakes or reservoirs in this process.

Table 2.14.13. Category 1 - All Designated Uses Are Met.

Watershed Management Unit	Assessment Unit ID	Lake Name	Beneficial Use Classes Assessed	Lake Acres
Colorado River Southeast	UT-L-14070006-001	Lake Powell	1C,2A,2B,3B,4	162,700

Figure 2.14.1 is a map of the beneficial use assessment categories excluding Category 3, lakes not assessed.

Table 2.14.16 lists the lakes and reservoirs that have undergone TMDL analysis and subsequently have a TMDL completed for some pollutants or have been removed from the 5A list because they are currently meeting standards.

Table 2.14.14. 2008 Category 4 – Total Maximum Daily Load Analyses Completed and Approved By EPA

Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Beneficial Use Class	Pollutant TMDL Completed	Beneficial Use Support	Lake Acreage	Date TMDL Approved	Comments
Bear River	UT-L-16010203-005	Hyrum Reservoir	3A	TP,DO	PS	438	9/9/2002	
Cedar / Beaver	UT-L-16030007-011	Minersville Reservoir	3A	TP,DO	PS	990	9/1/2000	
Cedar / Beaver	UT-L-16030007-022	Kents Lake	3A	TP,DO	PS	26	9/1/2000	
Cedar / Beaver	UT-L-16030007-027	LaBaron Lake	3A	DO	NS	24	9/1/2000	
Cedar / Beaver	UT-L-16030007-028	Puffer Lake	3A	DO	PS	65	9/1/2000	
Colorado River Southeast	UT-L-14030005-004	Kens Lake	3A	Temperature*	PS	86		Site Specific Temperature developed
Colorado River West	UT-L-14060007-005	Scofield Reservoir	3A	TP,DO	PS	2,815	9/1/2000	
Colorado River West	UT-L-14070003-010	Johnson Valley Reservoir	3A	DO	PS	285	9/27/2002	
Colorado River West	UT-L-14070003-015	Mill Meadow Reservoir	3A	TP	PS	156	9/27/2002	
Colorado River West	UT-L-14070003-019	Forsyth Reservoir	3A	TP,DO	PS	158	9/27/2002	

Table 2.14.14. 2008 Category 4 – Total Maximum Daily Load Analyses Completed and Approved By EPA								
Watershed Management Unit	**Assessment Unit ID**	**Assessment Unit Name**	**Beneficial Use Class**	**Pollutant TMDL Completed**	**Beneficial Use Support**	**Lake Acreage**	**Date TMDL Approved**	**Comments**
Jordan River / Utah Lake	UT-L-16020203-001	Deer Creek Reservoir	3A	DO,TEMP	PS	2,965	9/9/2002	Delisted for Temperature 5/2/03
Uinta Basin	UT-L-14040106-019	Browne Lake	3A	DO	PS	54	2/19/2003	
Weber River	UT-L-16020102-020	East Canyon Reservoir	3A	TP,DO	NS	173	9/27/2002	
Weber River	UT-L-16020102-014	Pineview Reservoir	3A	TP,DO	PS	2,874	12/9/2002	
Sevier	UT-L-16030002-011	Koosharem Reservoir	3A	TP	PS	310	8/4/2006	
Uinta	UT-L-14060004-001	Strawberry Reservoir	3A	TP, DO	PS	17,160	7/9/2007	
Uinta	UT-L-14040106-034	Calder Reservoir	3A	TP,DO	NS	99	7/9/2007	
Bear River	UT-L-16010202-013	Newton Reservoir	3A	TP,DO	NS	350	6/24/2004	
Uinta	UT-L-14060003-011	Matt Warner Reservoir	3A	TP,DO	PS	433	7/9/2007	pH exceedence should be mitigated with P reduction .
Sevier	UT-L-16030002-004	Otter Creek Reservoir	3A	TP,Temp*	PS	2,520	8/4/2006	*Temp naturally occurring
Sevier	UT-L-16030001-006	Panguitch Lake	3A	TP,DO	PS	1,248	High	4/1/2004

Table 2.14.15. Category 5 - Lakes Needing Total Maximum Daily Load Analysis.						
Watershed Management Unit	**Assessment Unit ID**	**Assessment Unit Description**	**Beneficial Use Class**	**Lake Acreage**	**Pollutant**	**Targeted For TMDL**
Bear River	UT-L-16010202-002	Cutler Reservoir	3B	7,184	TP,DO	7/1/2008
Bear River	UT-L-16010203-012	Tony Grove Lake	3A	25	TP,DO,pH	4/1/2010
Cedar/Beaver	UT-L-16030006-019	Red Creek Reservoir (Iron Co)	3A	39	DO	4/1/2008
Colorado River Southeast	UT-L-14080201-007	Recapture Reservoir	3A	17	DO	4/1/2008
Colorado River West	UT-L-14060007-004	Lower Gooseberry Reservoir	3A	57	DO,pH	4/8/2008
Jordan River / Utah Lake	UT-L-16020203-004	Mill Hollow Reservoir	3A	15	TP,pH	4/1/2008
Jordan River / Utah Lake	UT-L-16020201-004	Utah Lake	3B	96,900	TP,TDS	4/1/2010
Jordan River / Utah Lake	UT-L-16020202-002	Big East Lake	3A	23	DO	4/1/2008
Lower Colorado River	UT-L-15010008-001	Gunlock Reservoir	3B	266	TP,DO	9/20/2004
Lower Colorado River	UT-L-15010008-008	Baker Dam Reservoir	3A	63	TP,DO	9/20/2004
Sevier River	UT-L-16030001-001	Navajo Lake	3A	714	DO	Delisted in 2004
Sevier River	UT-L-16030001-011	Piute Reservoir	3A	2,508	TP	4/1/2008
Sevier River	UT-L-16030002-004	Otter Creek Reservoir	3A	2,520	TP	8/4/2006
Sevier River	UT-L-16030002-005	Lower Box Creek	3A	50	TP,DO	8/4/2006

Table 2.14.15. Category 5 - Lakes Needing Total Maximum Daily Load Analysis.						
Watershed Management Unit	**Assessment Unit ID**	**Assessment Unit Description**	**Beneficial Use Class**	**Lake Acreage**	**Pollutant**	**Targeted For TMDL**
Sevier River	UT-L-16030002-011	Koosharem Reservoir	3A	310	TP	8/4/2006
Sevier River	UT-L-16030003-006	Manning Meadow Reservoir	3A	59	TP,DO	4/7/2010
Sevier River	UT-L-16030004-001	Ninemile Reservoir	3A	197	TP,DO,pH	4/1/2008
Sevier River	UT-L-16030006-008	Newcastle Reservoir	3A	163	TP,DO	4/1/2008
Sevier River	UT-L-16030006-017	Yankee Meadow Reservoir	3A	53	DO	4/1/2008
Uinta	UT-L-14060001-001	Pelican Lake	3B	1,680	pH,	4/1/2012
Uinta	UT-L-14060001-002	Brough Reservoir	3A	128	DO	4/8/2008
Uinta	UT-L-14060002-004	Steinaker Reservoir	3A	829	Temp*, DO(added)	4/1/2008
Uinta	UT-L-14060002-006	Red Fleet Reservoir	3A	520	DO	4/1/2008
Uinta	UT-L-14040107-004	Bridger Lake	3A	288	DO	Delisting requested
Uinta	UT-L-14040107-006	China Lake	3A	47	DO,Temp	Delisting requested
Uinta	UT-L-14060003-002	Lyman Lake	3A	27	DO	Delisting requested
Uinta	UT-L-14040107-003	Marsh Lake	3A	38	DO	Delisting requested
Weber River	UT-L-16020101-001	Echo Reservoir	3A	1,394	TP,DO	7/1/2008
Colorado River West	UT-L-14070003-044	Lower Bowns Reservoir	3A	90	pH	New
Colorado River Southeast	UT-L-14080203-002	Monticello Lake	3A	3	pH	New
Weber River	UT-L-16020101-002	Rockport Reservoir	3A	1,189	DO	New
Uinta	UT-L-14060004-006	Starvation Reservoir	3A	2,760	DO	New
Colorado River West	UT-L-14070005-011	Wide Hollow Reservoir	3A	145	pH	New
* Assessment currently being performed to determine whether temperature impairment is natural.						

Table 2.14.16. Category 4 and Category 5 - Lake and Reservoir Approved TMDLs for Some But Not All Pollutants Assessment Units Meeting Standards.								
Watershed Management Unit	**Assessment Unit ID**	**Assessment Unit Name**	**Assessment Unit Description**	**Assessment Use Class**	**Lake Acres**	**Beneficial Use Support**	**Pollutant**	**Justification for Change**
Some But Not All TMDLs Completed								
Bear River	UT-L-16010204-033	Mantua Reservoir	Mantua Reservoir	3A	554	PS	,pH	TMDL for TP, DO approved 9/1/2000
Assessment Unit Meeting Standards								
Uinta	UT-L-14060003-006	Mirror Lake	Mirror Lake	3A	50	PS	DO	Delisted

Table 1-6-17. Category 3B. Lakes not fully supporting beneficial uses for 2008 but will not be listed until two consecutive assessment cycles demonstrate impairment.						
Assessment Unit ID	**Lake Name**	**Beneficial Use Class**	**Lake Acreage**	**Beneficial Use Support**	**Pollutant**	**Comments**
UT-L-16010101-007	Little Creek Reservoir	3A	65	NS	pH	
UT-L-14060003-230	Big Sand Wash Reservoir	3A	390	NS	DO	
UT-L-14080201-002	Blanding City Reservoir	3A	32	NS	Temp	Heat budget will be calculated to determine if temp exceedence is naturally caused

Table 2.14.8 Lake Beneficial Use Assessment By Category – Lake Acreage.		
Category	**Category Definitions**	**Stream Miles**
1	All beneficial uses fully supported.	162,700
2	Beneficial uses assessed are fully supported.	156,919
3A	No data or insufficient data to make an assessment.	336.6
3B	Lakes that are not supported for one cycle only.	0.0
3C	Insufficient data to assess but an assessment plan is in place.	1,088,000
4A	Approved TMDL	28,814
4B	Pollution control requirements are expected to result in full beneficial use support in near future.	0.0
4C	Impaired by pollution, no TMDL required.	0.0
5	Impaired by pollutant, TMDL required.	121,149

2.14.29

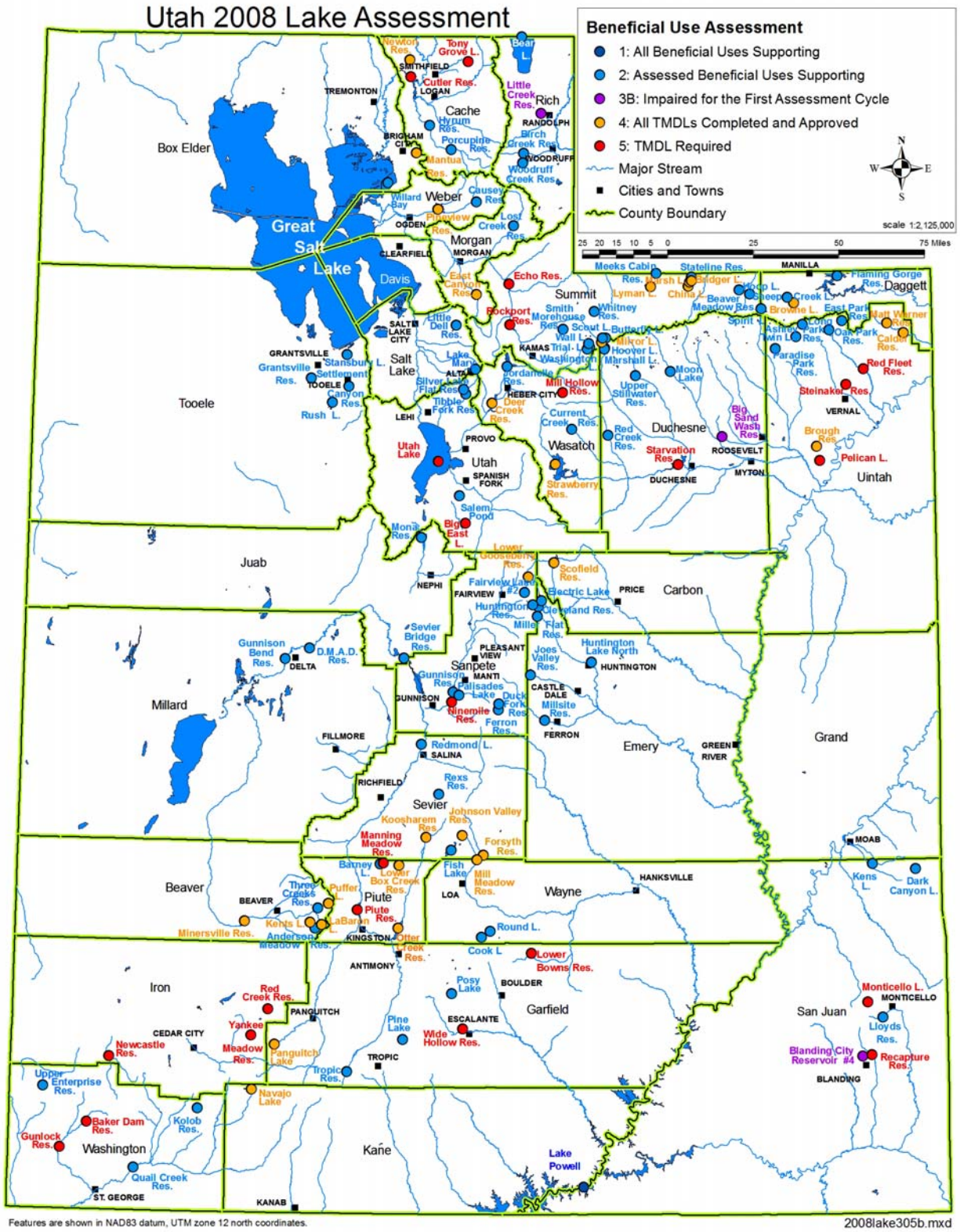


Figure 2.14.1. Lake Beneficial Use Assessment By Category.

2.14.31

Chapter 2.15 Biological Beneficial Use Support Assessment Procedure

2.15.1. Introduction

Utah's biological beneficial uses require the protection of fish (e.g., cold- or warm-water species) and the organisms upon which they depend. In the past, DWQ has assessed these beneficial uses with water chemistry samples and associated standards, which are assumed to be protective of aquatic organisms. However, DWQ has recently developed an empirical model that allows us to directly assess attainment of biological beneficial uses by quantifying the 'health' of macroinvertebrate assemblages. Measuring biological communities directly has the advantage that it integrates the combined effects of all pollutants, which allows a direct examination of how pollutants are interacting to affect the condition of a stream ecosystem. (Karr, 1981). Moreover, because aquatic macroinvertebrates spend the majority of their life in aqueous ecosystems, they are capable of integrating the effects of stressors over time, providing a measure of past, transient conditions (Karr and Dudley, 1981).

Biological assessments are most often conducted by comparing the biological assemblage observed at any given site with the composition expected in the absence of human-caused disturbance. Ideally, these comparisons would be made using historical data to measure the extent to which a contemporary biological community has been altered. However, in most cases historical data are not available. As a result, biological conditions representing an absence of human-caused stress are typically set using reference sites as controls, or benchmarks, to establish the biological condition expected in the absence of human-caused disturbance. The biological integrity of sites can then be evaluated by comparing the biological composition observed at a site against a subset of physically similar reference sites. Collectively, such comparisons are referred to as biological assessments.

In practice, reference sites are selected to represent the best available condition for streams with similar physical and geographical characteristics (see Hughes et al 1986, Suplee et al. 1995, and the Western Center for Monitoring and Assessment of Freshwater Ecosystems website http://www.cnr.usu.edu/wmc for more details). As reference sites are selected for water quality programs, their overall condition varies regionally depending upon the history of human occupation. For example, Utah's mountain reference sites are generally more pristine than those in our valleys. As a result, benchmarks are higher in areas of the state that are less developed than those with larger populations.

Practically speaking, biological assessments require a single index that quantifies the biological integrity, or biological beneficial use support, of stream and river segments. Data obtained from biological collections are complex with hundreds of species found throughout Utah that vary both spatially and temporally in presence/absence and relative abundance. Similarly, the physical template, upon which biota depends also varies considerably among streams. A robust index of biological integrity must simultaneously account for naturally occurring physical and biological variability and summarize these conditions with a single, easily interpretable number.

2.15.2. River Invertebrate Prediction and Classification System (RIVPACS) Models

For Utah's streams, DWQ has chosen to use the RIVPACS (River Invertebrate Prediction and Classification System) model approach (Wright 1995) to quantify biological integrity. RIVPACS-based methods for conducting biological assessments were initially developed in Great Britain (Wright, 1995) and have subsequently been used in numerous biological assessment programs worldwide. To quantify biological condition, RIVPACS models compare the list of taxa (the lowest practical taxonomic resolution to which taxonomic groups are identified) that are observed (O) at a site to the list of taxa expected (E) in the absence of human-caused stress. Predictions of E are obtained empirically from reference sites that together are assumed to encompass the range of ecological variability observed among streams in the region where the model was developed. In practice, these data are expressed as the ratio O/E, the index of biological integrity.

Interpretation of RIVPACS models requires an understanding of the O/E ratio. In essence, O/E quantifies loss of biodiversity. It is not a measure of raw taxa richness since O is constrained to include only those taxa that the model predicted to occur at a site. The fact that O/E only measures losses of native taxa is an important distinction because the stream ecological template changes in response to human-caused disturbance and taxa richness can actually increase as conditions become more advantageous to taxa that are more tolerant of the degraded condition. Despite the mathematical complexities of model development, O/E is easily interpreted as it simply represents the extent to which taxa have become locally extinct as a result of human activities. For example, an O/E ratio of 0.40 implies that, on average, 60% of the taxa have become locally extinct as a result of human-caused alterations to the stream.

O/E has some very useful properties as an index of biological condition. First, it has an intuitive biological meaning. Species diversity is considered the ecological capital on which ecosystem processes depend; thus, O/E can be easily interpreted by researchers, managers, and the public and policy makers. Second, O/E means the same thing everywhere, which allows direct and meaningful comparisons throughout the state (Figure 1). This is particularly important for Utah, where streams vary considerably from high-altitude mountain environments to the arid desert regions of the state. Third, its derivation and interpretation does not require knowledge of stressors in the region. Finally, the value of O/E provides a quantitative measure of biological condition.

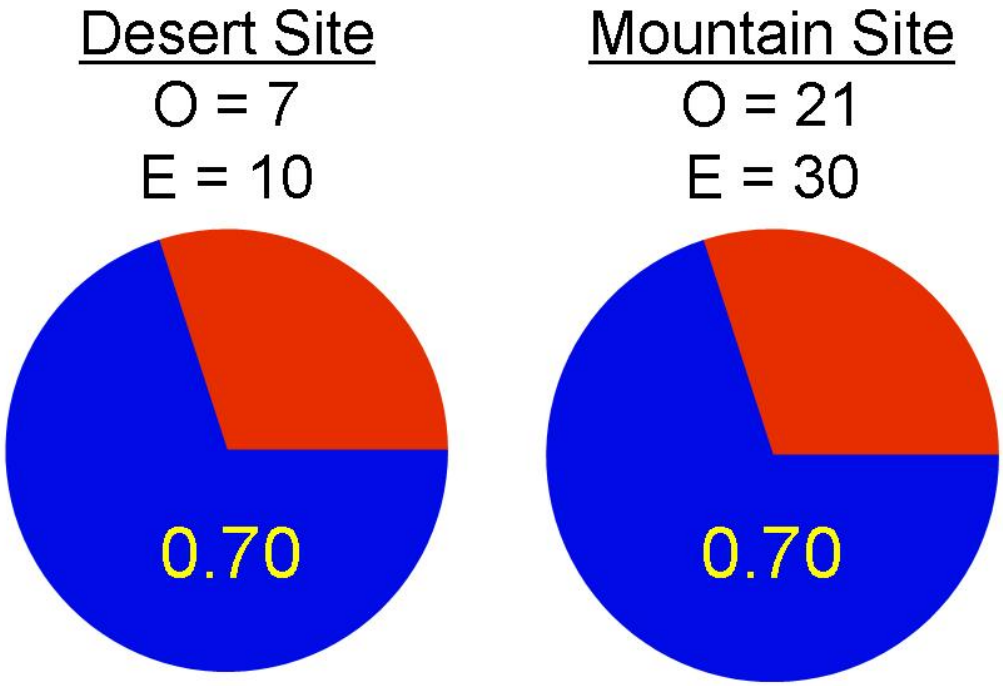


Figure 2.15.1. A hypothetical example of O/E as a standardization of biological assessments in different natural environments using numbers of taxa of benthic macroinvertebrates. In the desert site, 7 taxa were observed with an expected number (based on reference) of 10 taxa. Thus, the Observed/ Expected score was .70 or a loss of 30% of the taxa expected at the site. The same O/E score can be obtained but represent different expectations for taxa richness.

2.15.3. Model Construction and Performance

The River Invertebrate Prediction and Classification System (RIVPACS) is a classification of freshwater sites based on macroinvertebrate fauna that was first derived in 1977. In the early 1970's scientists and water managers recognized a need to understand the links between the ecology of running waters and their macroinvertebrate communities. This began some of the very early biological assessment work in Europe. A four-year project was initiated to create a biological classification of unpolluted running waters in Great Britain based on the macroinvertebrate fauna (Furse et al., 1984, Wright 1995, Clarke et al., 1996, Moss et al., 1999). Over the past 30 years, equivalent RIVPACS models have been developed for aquatic ecosystems throughout the world including Australia (Metzeling et al., 2002, Marchant and Hehir, 2002, Davies et al., 2000) and Indonesia (Sudaryanti et al., 2001). In the United States scientists have developed RIVPACS models to assess the biological integrity of the country's aquatic habitats (Hawkins et al., 2000, Hawkins and Carlisle, 2001). Most recently many western states have adapted the RIVPACS model to determine beneficial uses of aquatic life in the rivers of the state. These states include Colorado (Paul et al., 2005), Montana (Feldman, 2006, Jessup et al., 2006) and Wyoming (Hargett et al., 2005).

Construction of a RIVPACS model for Utah involved developing, testing, evaluating, and reworking dozens of models to obtain the most robust model possible. Details of model development procedures can be found elsewhere (Wright et al. 1993, Wright 1995, Clarke et al., 1996, Moss et al. 1999). Here we provide a brief summary so that Utah's model results and subsequent assessments can be more easily understood.

As previously mentioned, predictions of E are obtained empirically from reference site collections made throughout Utah. Reference sites were selected using the Best Professional Judgment (BPJ) of DWQ scientists, who were asked to identify sites that they believed represented the best condition available for streams in different biogeographical settings throughout Utah. The initial list of candidate reference sites was then rated independently by different scientists familiar with the streams. In the final analysis, only those reference sites where there was a consensus that the sites represented best available conditions were used in model development.

Some of the calculations involved in obtaining E are complex. Here we include a heuristic description of the steps involved in predicting E to provide some context of the assessment methodology. The first step in model development is to classify reference sites into groups of sites with similar taxonomic composition, with statistical procedures called cluster analyses. Next, models are developed that use watershed descriptors (i.e., climatic setting, soil characteristics, stream size) to generate equations that ultimately allow us to predict the probability that a new site falls within each group of reference sites. These equations help account for environmental heterogeneity and ensure that when a new site is assessed, it is compared against ecologically similar reference sites. When a new site is assessed, predictions of group membership are then coupled to the distributions of taxa across groups of reference sites to estimate the probability of capturing (P_c) each taxon from the regional pool of all taxa found across all reference sites. E is then calculated as the sum of all taxa P_c's that had a greater than 50% chance of occurring at a site, given the site's specific environmental characteristics.

The accuracy and precision of RIVPACS models depend in part on the ability of the models to discriminate among groups of biologically similar reference sites, which are generated in the early stages of model development. We evaluated an extensive list of 82 Geographic Information System (GIS) based watershed descriptors for use as potential predictor variables in models that predict the probability of membership within biological groups for sites not used in model construction. GIS-based predictor variables, instead of field-derived descriptors, were evaluated for a couple of reasons. First, GIS-based descriptors are unlikely to be influenced by human disturbance and are therefore unlikely to bias estimates of expected conditions (Hawkins, 2004). Second, these predictors can be easily obtained for any site, which will ultimately allow the DWQ to take advantage of macroinvertebrate samples collected by others. We evaluated various subsets of potential predictors in an iterative analytical process that explored the extent to which different combinations of predictors were able to explain the biological variability among reference sites. In the final analysis, 15 variables were selected that together resulted in the most precise model (Table 1).

The RIVPACS model used for the 2007 assessments was both accurate and precise when evaluated by examining the range of O/E scores obtained from reference sites. If the model was perfectly accurate and precise, we would expect the O/E score for all reference sites to be 1. Instead, reference O/E values typically are spread in a roughly normal distribution, centered on 1 (Wright, 1995). Model precision can be expressed as the standard deviation (SD) of reference O/E values, with lower SDs indicating higher model precision. The RIVPACS model used for the *2008 Integrated Report* assessments had a SD of 0.13, which is more precise than most models used in other water quality programs. The average reference O/E score for Utah's model is 1.05, which means that the model is slightly biased to generate higher O/E values than expected (Figure 2). We also evaluated the accuracy of the model by examining the distribution of reference O/E scores in different environmental settings and found that reference O/E values were not biased by stream size, elevation, or ecoregion.

Table 2.15.1. Final predictor variables used in model construction.	
General Category	**Description**
Geographical	Maximum watershed elevation (meters) from National Elevation Dataset
Geographical	Mean watershed elevation (meters) from National Elevation Dataset.
Geographical	Average slope calculated from Geographic Information System (GIS) data
Geographical	Watershed area in square kilometers.
Geology	Predicted potential for soil erosion based on lithology from state geology maps and estimated physical weathering rates based on known rock hardness.
Geology	Variable indicates dominant geology (1=yes; 2=no)
Soils	Watershed mean high values of available water capacity of soils (fraction) from State Soil Geographic (STATSGO) Database.
Soils	Watershed mean high values of soil bulk density of soils types within the basin (grams per cubic centimeter) from State Soil Geographic (STATSGO) Database.
Weather	Average of the annual minimum of the predicted mean monthly number of days with measurable precipitation (days) derived from PRISM (Parameter-elevation Regressions on Independent Slopes Model) data for all pixels in a watershed.
Weather	Watershed average of the mean day of year (1-365) of the first freeze derived from the PRISM data.
Weather	Watershed average of the mean day of year (1-365) of the last freeze derived from the PRISM data.
Weather	Annual minimum of predicted mean monthly precipitation (mm) derived from the PRISM data for the sampling site
Weather	Annual mean of the predicted mean monthly precipitation (mm) derived from the PRISM data for the sampling site.
Weather	Stream network average of the annual mean of the predicted mean monthly air temperature (tenths of degree Celsius) derived from PRISM data.
Weather	Watershed average of the annual mean of the predicted mean monthly air temperature (tenths of degree Celsius) derived from PRISM data.

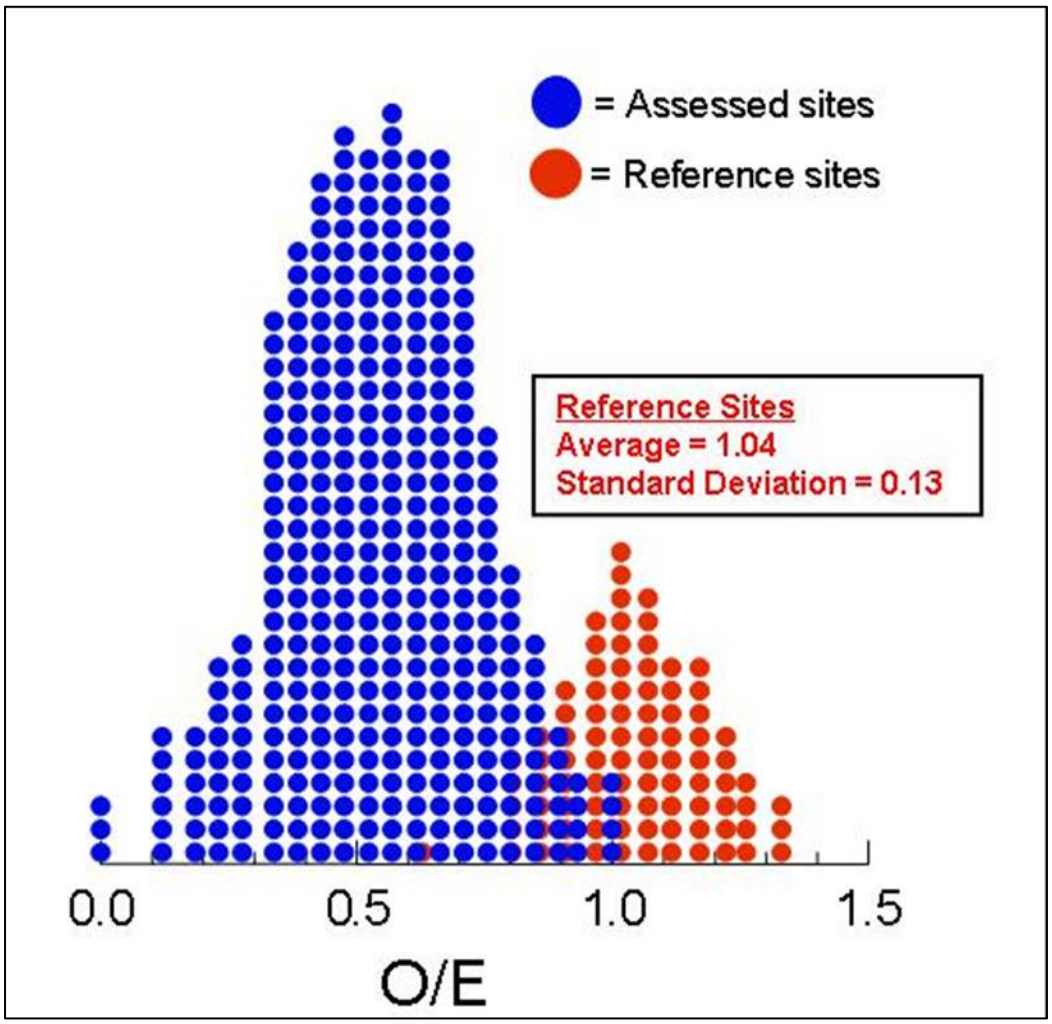


Figure 2.15.2. Distribution of reference and test O/E scores.

2.15.4. Assessing Biological Beneficial Use Support

Utah does not currently have numeric biological criteria. However, model outputs are used to guide assessments under the narrative standards of the Utah Clean Water Act (R317-2). To make the narrative assessments as rigorous as possible, we followed a systematic procedure that allowed us to use the RIVPACS model O/E values to determine aquatic life beneficial use support (Figure 3). Ultimately, the goal of this assessment process is to characterize each Assessment Unit as *Fully Supporting* or *Not Fully Supporting* aquatic life beneficial uses. In this section, we describe our assessment methods.

Utah currently assesses watersheds based on established Assessment Units (AUs). While many AUs contain a single biological collection site, some AUs contain multiple sites. In such instances, DWQ staff examines available data to determine if multiple sites within an AU occur in similar ecological settings. Data evaluated to make these comparisons include: stream hydrology, stream order, predominant riparian and upland vegetation, and/or major changes habitat characteristics measured at each site. If these comparisons suggest that sites within an AU are ecologically similar, O/E scores from all sites within an AU are averaged for assessment purposes provided that conclusions of biological condition are similar. If O/E scores differ appreciably among multiple sites within an AU, then DWQ will investigate possible explanations for such discrepancies. If DWQ finds multiple sites within an AU from different environmental settings AUs are subdivided into smaller watershed units whenever clear boundaries can be identified (e.g., Forest Service boundaries, confluence with tributaries).

To translate the O/E values into assessment categories it is necessary to devise impairment thresholds, or O/E scores that indicate whether or not a site is meeting biological beneficial uses (Table 2.15.2). For these assessments, DWQ determined that a mean O/E value less than 0.74 (26% loss of expected species) indicates non-support of beneficial uses if >3 samples are used to assess the site. The threshold of 0.74 represents a departure from 1.0 (no taxa loss) of 2 standard deviations of reference O/E scores. For all sites with multiple years of data, the average difference between maximum and minimum O/E values is 0.2. At least 3 yearly samples are preferred for assessments because O/E scores can vary from year-to-year and assessments based on average conditions. Assessments based on the average condition of ≥3 samples helps reduce the possibility of making an error of biological beneficial use support as a result of an unusual sampling event (i.e., following a flash flood, improperly preserved sample).

One ramification of requiring at least three samples is that remediation efforts can be postponed for years because biological samples are only collected once per year. To minimize delayed response times, DWQ identified a second threshold value of 0.54 (0.74 – 0.20 average year-to-year variability) for sites with <3 samples (Table 2.15.2). This second threshold expedites environmental response at severely degraded sites where additional sampling would be unlikely to alter an assessment of impairment. Sites with < 3 samples that have a mean O/E score ≥0.54 and <0.74 will be placed in impairment category 3A, which indicates that there is insufficient data to make an assessment. All sites listed as 3A will be given a high priority for future biological monitoring.

Table 2.15.2 Beneficial use support determination for O/E values obtained from different sample sizes.			
Sample Size	**O/E Threshold**	**Use Determination**	**Comments**
≥ 3 samples collected over 3 years	Mean O/E score ≥ 0.74	Fully Supporting	
≥ 3 samples collected over 3 years	Mean O/E score < 0.74	Not supporting	Threshold based on 2 SD of reference O/E scores
< 3 samples	Mean O/E score >0.54 – 0.74	Category 3A (insufficient data)	
< 3 samples	Mean O/E score <0.54	Not supporting	Original threshold with consideration for year-to-year variability of 0.20

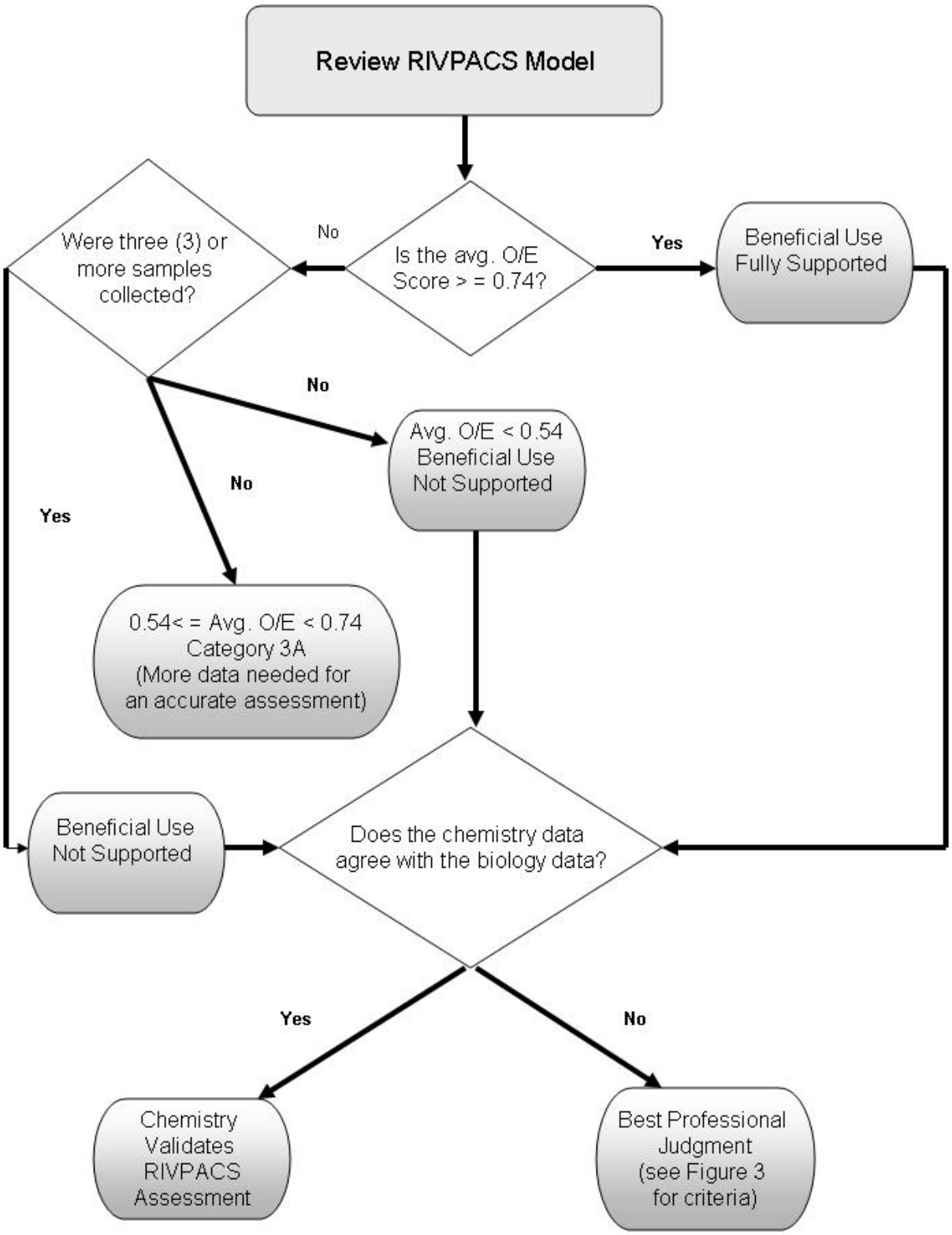


Figure 2.15.3. Flow diagram depicting decision tree for biological assessment.

2.15.4. Merging Biological and Chemical Assessments

For years, DWQ has assessed biological beneficial use attainment with water chemistry standards that are assumed to be protective of stream biota. Before making final decisions about biological beneficial use support, a comparison is made between impairment assessments obtained from stream biota with those obtained from stream chemistry. The primary goal behind these evaluations is to eliminate both false positive and false negative assessments, which both misdirect efforts to address water quality problems. There are 4 potentially confounding factors that warrant a more careful scrutiny of incongruous biological and chemical assessments. These 4 factors are summarized in a Best Professional Judgment (BPJ) framework (Figure 4) wherein disagreements between chemistry and biology assessments are objectively and systematically evaluated on a case-by-case basis.

2.15.4.1. Were the chemical and biological samples collected in a similar locations?

Biological and chemical sample sites are not always co-located, which may lead to different assessments if land-use or habitat is different among chemistry and biology sites. For instance, in one assessment unit a biological sample may have been collected in the upper watershed and represent the water quality in the headwaters, versus a downstream water quality station that is potentially located in a different ecological setting. If the chemical and biological sample locations are clearly distinct, the assessment unit is divided at a clear boundary (e.g., Forest Service boundary, tributary convergence, water withdrawal) where they existed. However, in some cases, sites may be assessed as 3A (more data required) because clear boundaries are not immediately apparent from available data.

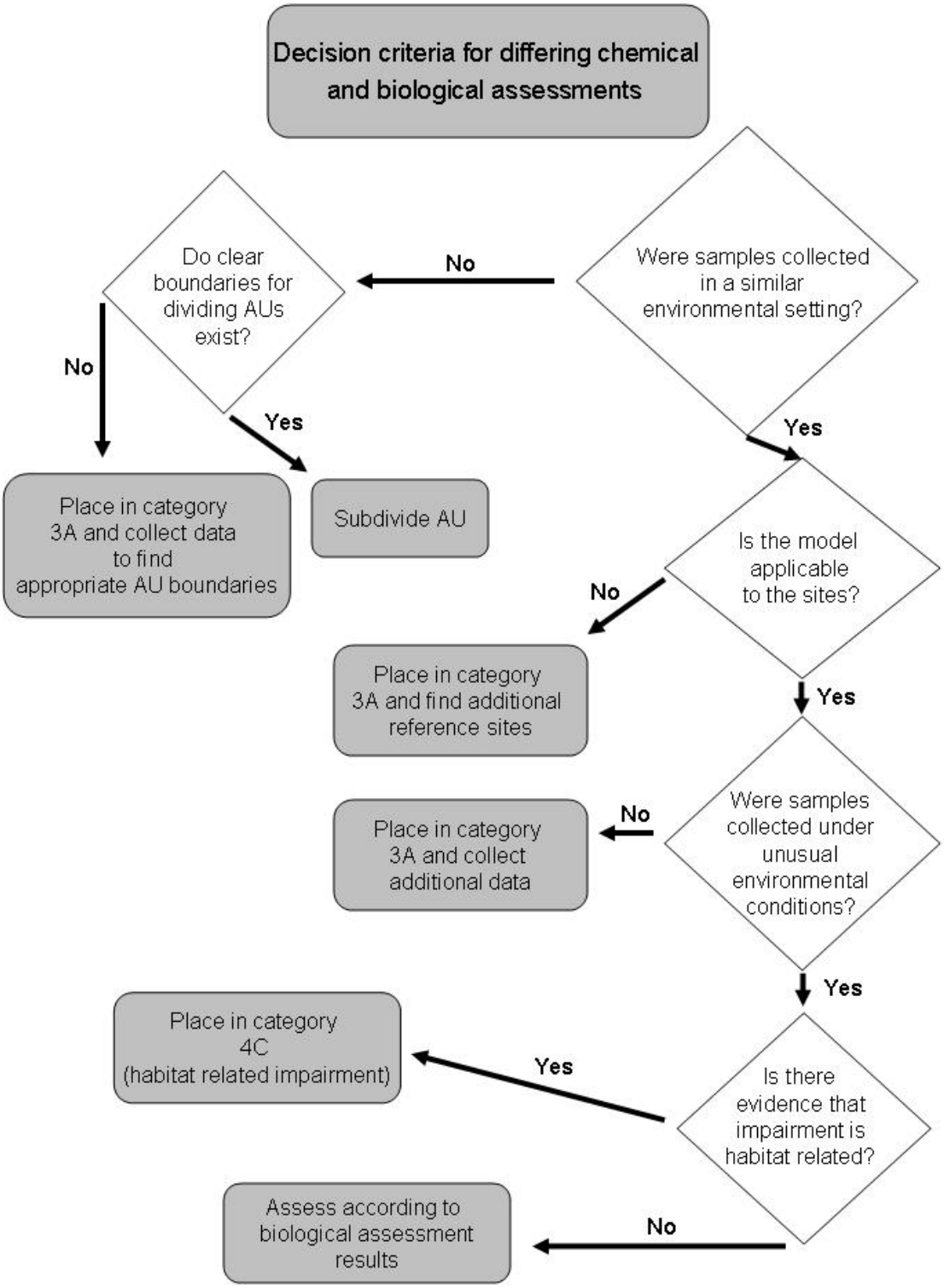
2.15.4.2. Is the model applicable to the sites?

One of the fundamental assumptions of RIVPACS models is that the suite of reference sites used in model construction encompasses the range of conditions observed in the sites that are to be assessed. All sites are evaluated to determine whether this assumption is met before a final assessment is made. For example, DWQ found a site located in a relatively undisturbed environmental setting with low O/E values. Investigations into this unexpected result revealed that the site was located in a large, sandy bottomed river, and that the current model cannot be appropriately applied to such sites because it based generated with few reference sites with similar characteristics. In instances where model results are suspect, the AU is placed into category 3A until additional reference sites can be sampled and incorporated into the model.

2.15.4.3 Were the chemical or biological samples collected during unusual environmental conditions?

Conclusions of impairment can potentially be biased when samples are collected during unusual environmental conditions. For instance, both biological composition and chemical criteria are known to be altered by drought and data collected under these conditions may be suspect. Similarly, the composition of stream assemblages is known to be altered by flash floods and samples collected following these events are suspect. In these situations, the AU is placed into category 3A until additional data can be collected to corroborate assessment results.

Figure 2.15.4. Best professional judgment criteria.



2.15.4.4 Is there strong evidence that impairment is habitat related?

If biological assessments indicate impairment and chemistry data do not there exists the possibility that the biota are exclusively responding to habitat degradation. If there is strong evidence that this is the case, then the AU is assigned to category 4C (habitat related impairment). Sites are not placed into the 4C category without strong evidence of habitat degradation and a lack of potential sources for chemical contaminants. TMDLs are not required for class 4C waters, and this assessment category allows resources to be focused solely on the development and implementation of non-point source restorations to improve the biological condition of these watersheds.

2.15.5. Results

To make assessments in this report, we obtained O/E values for 444 individual samples collected from 234 sites throughout the state for the 2008 assessments (Appendix XX). Overall, we conducted biological assessments on 164 AUs, representing 5,116 miles of stream and 36% of the total perennial stream miles (14,250) in Utah. Some sites were sampled every year; however, the majority of sites were sampled in response to previously identified water quality concerns or on a rotating basin schedule. In general, samples used in these analyses were collected over the past 5 years. Older data were sometimes used to corroborate more-recent findings if there was evidence that major changes in land-use had not occurred since samples were collected. In addition, we limited these analyses to samples collected in the autumn (September to early November) to minimize seasonal changes in taxonomic composition.

O/E scores from all sampling events ranged from near 0.105 to 1.315 as shown in Figure 1. Based solely on the biological assessment, of 164 AUs, 78 were fully supporting, 46 were non-supporting, and 40 were 3A. This is depicted graphically based on stream miles (Figure 5). When these data were combined with the chemical assessment, final analysis revealed that 96 AU's were fully supporting, 49 AU's were non-supporting, 13 AU's were placed into category 3A, 5 AU's were classified as 4C (a clear indication that the impairment was habitat-related), and 1 AU was identified as 4A, an impairment with a completed TMDL. A look at the spatial distribution of the biological assessments revealed that biologically degraded sites occurred throughout the state, but with some localized clumping of degraded sites (Figure 6). Finally, the results were summarized as a function of the total number of stream miles assessed (Figure 7).

Overall, we found 18 AU's where chemical and biological assessments led to different conclusions with regard to attainment of biological beneficial use support. In 11 instances the biological data indicated sites were not supporting of biological beneficial uses, whereas the chemistry data indicated them as fully supporting. These results were further refined with our BPJ criteria (Figure 3) as follows: 4 AU's were impaired based on habitat degradation (4C), 5 AU's were suspect because variation in O/E values indicated suspect samples or poor model performance (3A), and 2 AU's had chemistry data and biological data obtained from sites very different environmental settings. In this case, the AU was split and each one was assessed independently, which resulted in subwatersheds where one was fully supporting, whereas the other was not supporting biological beneficial uses. Similarly, there were 7 AU's where chemistry data indicated biological beneficial uses were not supported, whereas biological data suggested the AUs were fully supporting. We reconciled this discrepancy to make a final

assessment as follows: for 4 AU's the chemical data were suspect because they were collected during drought conditions (delist), and for 3 AUs it was clear that the chemical and biological sites were located in different environmental settings. In this case, the AU was split and each one was assessed independently.

2.15.5. Conclusions and Next Steps

The 2008 *Integrated Report* is the first time that biological monitoring has been incorporated into Utah's Water Quality Analyses for assessments of biological beneficial use support. While our biological assessment program remains in its infancy, we believe that this program represents a valuable new tool that allows us to better achieve our mandate to protect, maintain, and restore the quality of Utah's waters.

When interpreting the results of these assessments it is important to note that the sites were not randomly selected but in many cases deliberately selected to evaluate sites that we previously identified as being potentially degraded. For example, we targeted many sites with elevated phosphorous because we were previously unable to list AUs based on DWQs phosphorous indicator value. Because sites were not randomly selected these results are not indicative of the overall condition of Utah's waters. Over the next couple of years we intend to sample >50 randomly selected sites to allow more robust generalizations about the biological integrity of all of Utah's streams and rivers.

Development of our RIVPACS model was an iterative process and for this first reporting period, we used the best data available when these analyses were conducted. Over the past couple of years we have sampled additional reference sites to better encompass the diversity of sites throughout Utah. Currently, a new model is under development that will incorporate these additional data. This new model and its subsequent results will be incorporated into the 2010 *Integrated Report*.

As stated earlier, this assessment represents a work in progress and improvements to our biological assessment process have been identified. For instance, we plan to create similar biological assessment tools for diatoms. Diatoms have the potential to provide a more complete picture of biological conditions because these organisms are diverse and numerous throughout Utah. Moreover, diatoms are primary producers and may be more sensitive to some stressors (i.e., nutrients) than macroinvertebrates due to their role in stream ecosystems. We have already collected diatom samples at reference sites and now have sufficient data to begin development of tools that will allow us to use these assemblages to provide another measure of biological integrity. Just how resulting diatom assessment tools will be integrated with those obtained for diatoms will be determined as we evaluate these data.

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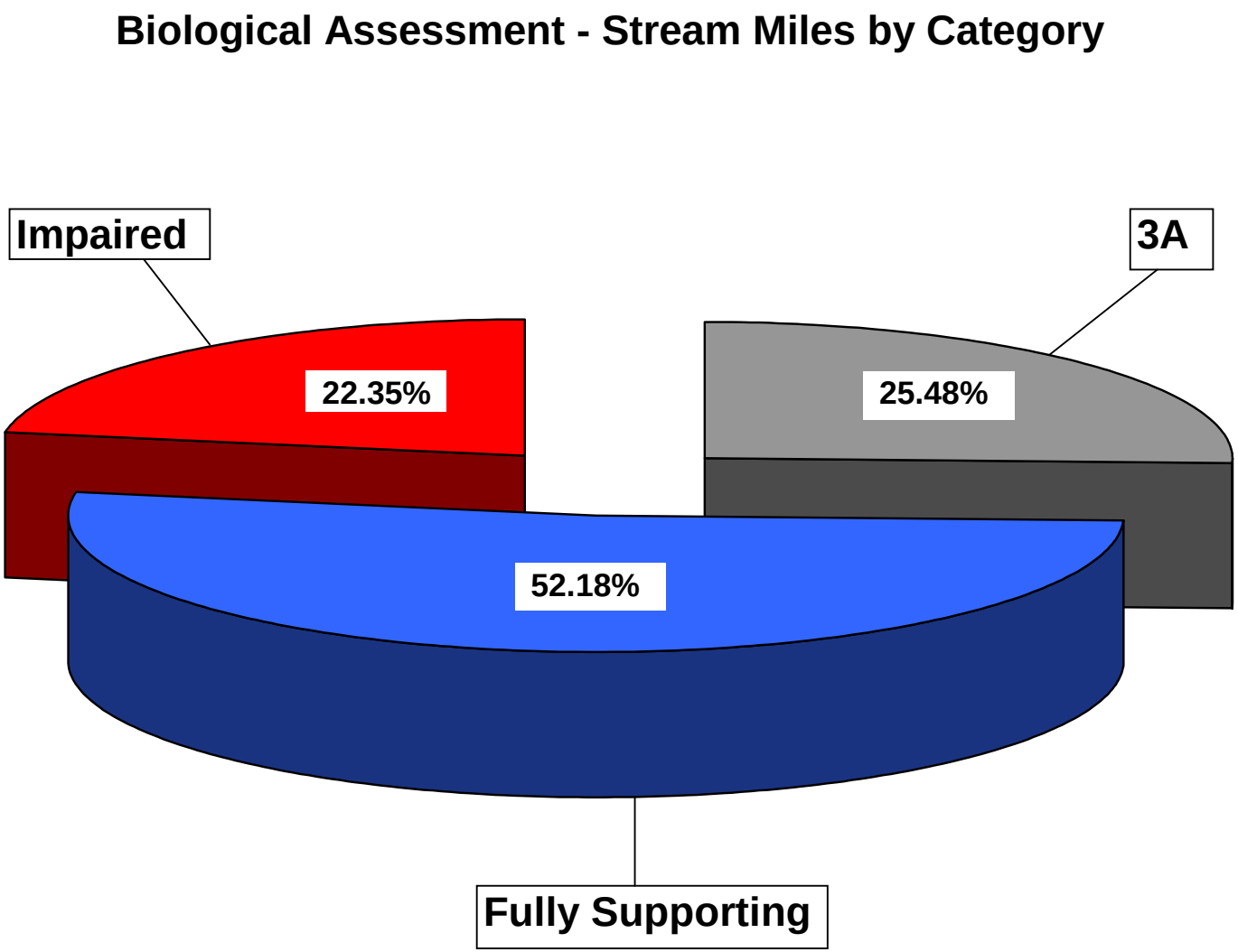

Figure 2.15.5. Biological assessment in percentage of stream miles.

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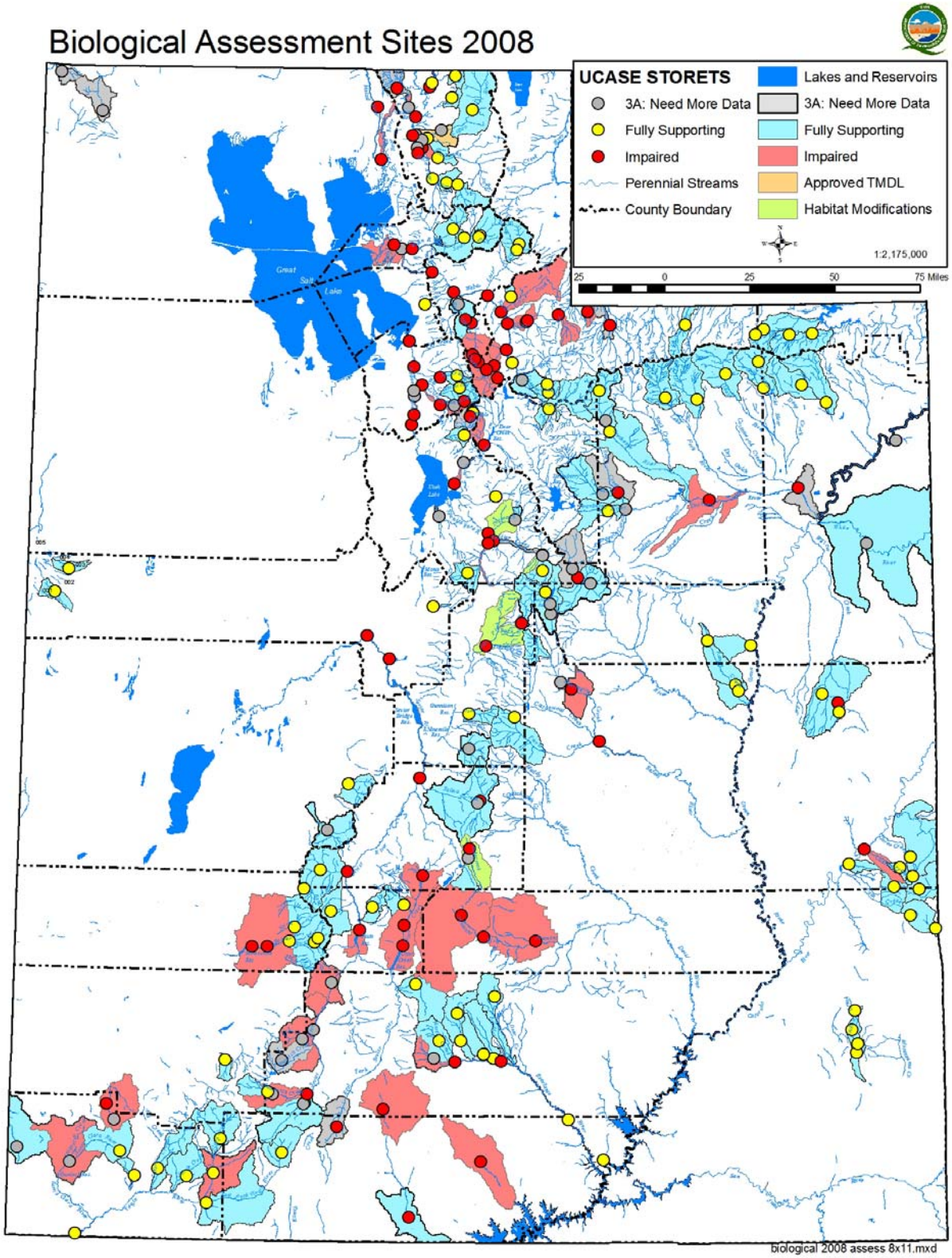

Figure 2.15.6. Final Class 3 aquatic life assessment for units with biological data.

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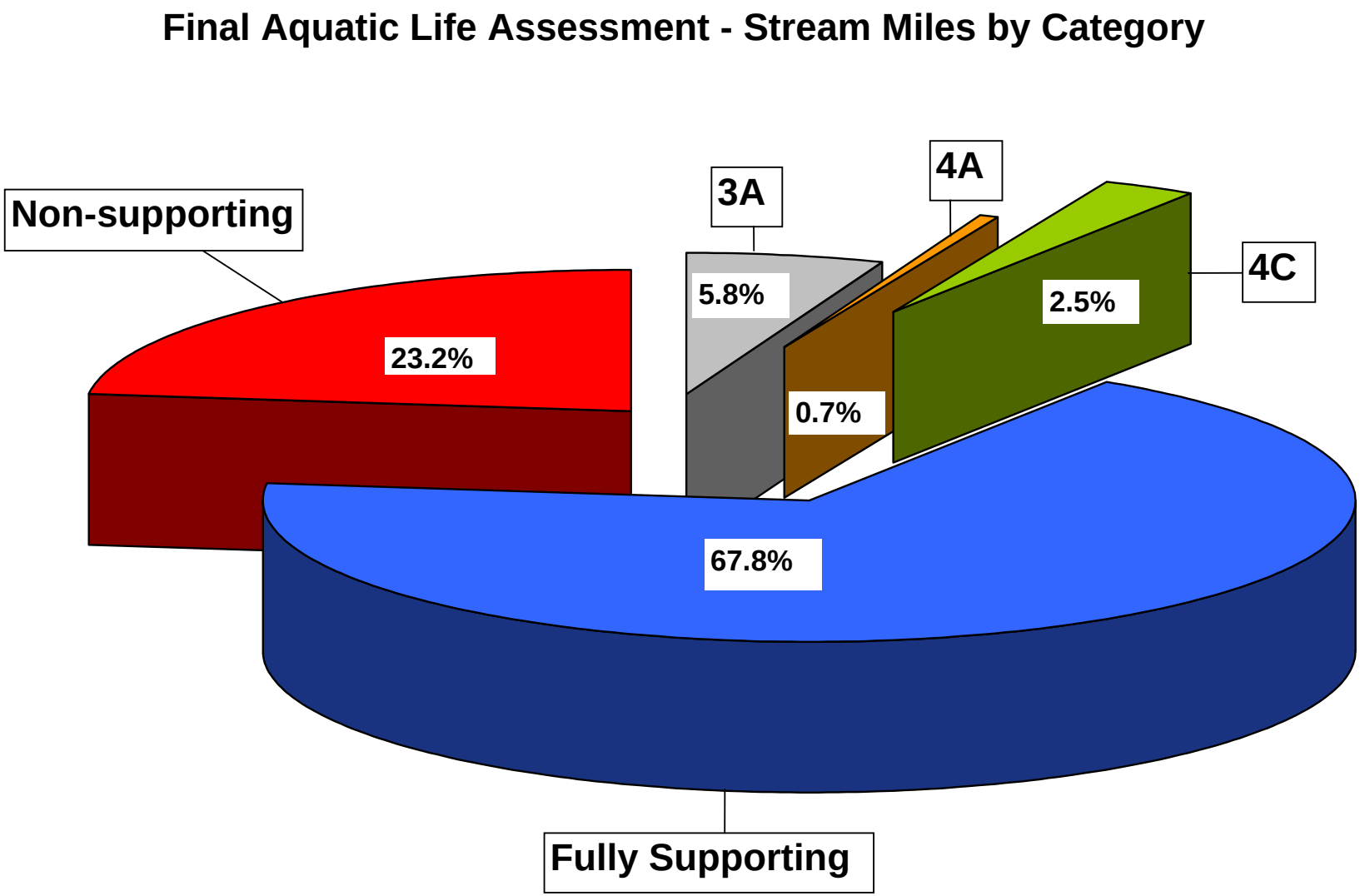

Figure 2.15.7. Final aquatic life assessment in percentage of stream miles.

2.15.6. References

Clarke, R.T.; M.T. Furse, J.F. Wright and D. Moss. 1996. Derivation of a biological quality index for river sites: comparison of the observed with the expected fauna. Journal of Applied Statistics 23: 311-332.

Davies, N.M, R.H. Norris and M.C. Thoms. 2000. Prediction and assessment of local stream habitat features using large-scale catchment characteristics. Freshwater Biology, 45:343-369.

Feldman, David. 2006. A Report to the DEQ Water Quality Planning Bureau on the Proper Interpretation of Two Recently Developed Bioassessment Models. Montana Department of Environmental Quality. 17 pgs.

Furse, M.T., D. Moss, J.F. Wright and P.D. Armitage. 1984. The influence of seasonal and taxonomic factors on the ordination and classification of running-water sites in Great Britain and on the prediction of their macro-invertebrate communities. Freshwater Biology, 14:257-280.

Hawkins, C.P. and D.M. Carlisle. 2001. Use of Predictive Models for Assessing the Biological Integrity of Wetlands and Other Aquatic Habitats. In *Bioassessment and Management of North American Freshwater Wetlands*, edited by Russell B. Rader, Darold P. Batzer, and Scott A. Wissinger. John Wiley & Sons, Inc.

Hawkins, C.P, R.H. Norris, J.N. Hogue, and J.W. Feminella. 2000. Development and evaluation of predictive models for measuring the biological integrity of streams. Ecological Applications 10: 1456-1477.

Hawkins, C.P. 2004. Predictive Model Assessments: A Primer. The Western Center for Monitoring and Assessment of Freshwater Ecosystems, Utah State University, 29 September 2004. Website (http://129.123.10.240/wmcportal/DesktopDefault.aspx).

Hargett, E.G., J.R. ZumBerge, and C.P. Hawkins. 2005. Development of a RIVPACS Model for Wadable Streams of Wyoming. Wyoming Department of Environmental Quality, Water Quality Division, 64 pgs. .

Hughes, R.M.; D.P. Larsen; and J.M. Omernik. 1986. Regional reference sites: a method for assessing stream potential. Environmental Management 5: 629-635.

Jessup, B., C.P. Hawkins, and J. Stribling. 2006. Biological Indicators of Stream Condition in Montana Using Benthic Macroinvertebrates. Tetra Tech. Technical Report prepared for the Montana Department of Environmental Quality, Helena, Montana. 76 pgs.

Karr, J.R. 1981. Assessment of biotic integrity using fish communities. Fisheries 6:21-27.

Karr, J.R. and D.R. Dudley. 1981. Ecological perspectives on water quality goals. Environmental Management 5(1): 55-68.

Marchant, R. and G. Hehir. 2002. The use of AUSRIVAS predictive models to assess the response of lotic macroinvertebrates to dams in south-east Australia. Freshwater Biology, 43:1022-1050.

Metzeling, L., D. Robinson, S. Perris and R. Marchant. 2002. Temporal persistence of benthic invertebrate communities in south-eastern Australian streams: taxonomic resolution and implications for the use of predictive models. Marine and Freshwater Research, 53:1223-1234.

Moss, D. J.F. Wright, M.T. Furse, and R.T. Clarke. 1999. A comparison of alternative techniques for prediction of the fauna of running-water sites in Great Britain Freshwater Biology. 41:167-181.

Paul, M. J., J. Gerritsen, CP. Hawkins, and E. Leppo. 2005. Development of Biological Assessment Tools for Colorado. Tetra Tech. Technical Report prepared for the Colorado Department of Public Health and Environment, Water Quality Control Division – Monitoring Unit, Denver, CO. 41 pgs.

Sudaryanti, S., Y. Trihadiningrum, B.T. Hart, P.E. Davies, C. Humphrey, R.H. Norris, J. Simpson and L. Thurtell. 2001. Assessment of the biological health of the Brantas River, East Java, Indonesia using the Australian River Assessment System (AUSRIVAS) methodology. Aquatic Ecology, 35(2):135-146.

Suplee, M; R. Sada de Suplee; D. Feldman; and T. Laidlaw. 2005. Identification and Assessment of Montana Reference Streams: A Follow-Up and Expansion of the 1992 Benchmark Biology Study. Montana Department of Environmental Quality, Planning Prevention and Assistance Division, Water Quality Planning Bureau, Water Quality Standards Section. 1520 E. 6th Avenue, Helena, MT 59620.

Wright, J.F. 1995. Development and use of a system for predicting the macroinvertebrate fauna in flowing waters. Australian Journal of Ecology 20: 181-197.

Wright, J.F., M.T. Furse, and P.D. Armitage. 1993. RIVPACS: a technique for evaluating the biological water quality of rivers in the UK. European Water Pollution Control 3: 15-25.