- Avoid impacts to natural resources (Jordanelle Reservoir and the Provo River).
- Avoid impacts to federal projects and facilities (Jordanelle Dam and associated features).
- Generate hydroelectric power as an incidental use to the delivery of water for CUP purposes, which include municipal and industrial water supply, irrigation supply, flood control, and fish and wildlife.
- Protect water quality in Jordanelle Reservoir and the Provo River.

1.2.2 Need for the Proposed Project

The proposed project is needed to develop hydroelectric power to meet increased power demands.

1.3 History and Background

The CUP's Bonneville Unit, located in northern Utah, was authorized as a participating project for construction, including hydroelectric power generation, by the CRSP Act of 1956. The 1979 Municipal and Industrial System (M&I) Final Environmental Impact Statement (EIS) first discussed the construction and operation of a hydroelectric facility below Jordanelle Dam (Reclamation, 1979). The 1987 Final Supplement to the M&I Final EIS deferred construction of the facility until non-federal participation could be achieved (Reclamation, 1987). The construction of Jordanelle Dam included provisions for hydroelectric power. The 2004 Final EIS for the Utah Lake Drainage Basin Water Delivery System (ULS) describes the completion of the Bonneville Unit deliveries (CUWCD, 2004) and although it does include Bonneville Unit power development in Diamond Fork Canyon, the ULS project does not change the provisions for non-federal development of hydroelectric power at Jordanelle Dam. This EA updates and uses information and data from the ULS EIS and 1987 M&I Final Supplement relative to the construction of a hydroelectric power plant and associated facilities. The operation of Jordanelle Dam and Reservoir with the proposed hydroelectric project in place would remain the same as described in the 2004 ULS EIS.

The CUPCA authorized the construction of other features of the Bonneville Unit. Section 208 of the CUPCA provides that CUP power facilities be developed and operated in accordance with the CRSP Act and states, "Use of Central Utah Project water diverted out of the Colorado River Basin for power purposes shall only be incidental to the delivery of water for other authorized project purposes. Diversion of such waters out of the Colorado River Basin exclusively for power purposes is prohibited." DOI, in consultation with the Western Area Power Administration, selected the joint proposal of CUWCD/HL&P to develop non-federal hydroelectric power at Jordanelle Dam through a lease of power privilege (Federal Register Vol. 64, No. 127, P. 36030-36032). The Federal Register notice stated that "any lease of power privilege at...Jordanelle Dam...must accommodate existing contractual commitments related to operation and maintenance of such existing facilities."

This lease of power privilege is an alternative to development of federal hydropower. A lease of power privilege grants a non-federal entity the right to utilize, consistent with CUP purpose, water power head and storage at and/or operationally in conjunction with the

CUP, for non-federal electric power generation and sale by the entity. The general authority for lease of power privilege under Bureau of Reclamation (Reclamation) legal statutes includes, among others, the Town Sites and Power Development Act of 1906 (43 U.S.C §522) and the Reclamation Project Act of 1939 (43 U.S.C. §485h(c)). A federal power project was not considered because by December 2002, when federal power was authorized for funding, DOI had already selected a potential lessee and entered into negotiations.

Negotiation for the lease of power privilege contract was announced in the Federal Register on October 25, 2000 (Vol. 64, No. 207, P. 63879-63880). The proposed execution of the lease contract would be subject to NEPA compliance. Power developed at Jordanelle Dam would be purchased by HL&P and sold to their customers.

1.4 Location of the Project

The proposed project is located on the downstream side of Jordanelle Dam below Jordanelle Reservoir. Jordanelle Dam and Jordanelle Reservoir are on the Provo River in Wasatch County Utah, approximately 4 miles north of Heber City, Utah (Figure 1). Figure 2 shows project features adjacent to Jordanelle Dam, including ownership. Figure 3 shows major project features including the proposed power plant and the transmission line to connect the power plant to the existing electric power distribution system of PacifiCorp (operating in Utah as Utah Power) or HL&P.

1.5 Authorizing Actions, Permits, and Licenses

As discussed in Section 1.3 above, the CRSP Act and the CUPCA authorized the proposed project. The lease of power privilege is authorized through a variety of legal statutes. Permits and approvals potentially required for the proposed project are shown in Table 1-1.

1.6 Interrelated Projects

1.6.1 Bonneville Unit, CUP

The ULS is the last of the six original systems of the Bonneville Unit of the Central Utah Project (CUP), authorized by the CRSP Act in 1956 and CUPCA in 1992, to develop central Utah's water resources for municipal and industrial supply, irrigation, flood control, hydroelectric power, fish and wildlife, and recreation. The Jordanelle Dam is a feature of the M&I System of the Bonneville Unit of the CUP. The Bonneville Unit includes facilities to develop and more fully utilize water tributary to the Duchesne River in the Uinta Basin of Utah, to facilitate a trans-basin diversion from the Colorado River Basin to the Bonneville Basin, and to develop and distribute project and local water supplies in the Colorado and Bonneville basins.

Jordanelle Dam Hydroelectric Project description:

Location

The Jordanelle Dam Hydroelectric Project (JDHP) will be located on the downstream side of Jordanelle Dam below Jordanelle Reservoir. Jordanelle Dam and Jordanelle Reservoir are located on the Provo River in Wasatch County, Utah.

Powerhouse

The proposed powerhouse will be a reinforced concrete structure located partially within the rock berm at the toe of the dam, west of the existing outlet works. The penstock will be constructed from the 72-inch-diameter connection in the outlet conduit and then routed to the proposed powerhouse where it will bifurcate into two 66-inch-diameter pipes feeding the turbines.

The floor of the powerhouse will be set at an elevation above the high tail-water elevation. This elevation will allow maintenance to be performed on the turbines without the need to de-water the tailrace. The turbines, generators, and all mechanical equipment will be located at this level. The turbines will discharge into a tailrace channel below the turbine floor.

The major equipment located on the turbine floor will include two turbine/generator units; turbine controllers; turbine inlet valves located on the penstock to each turbine; a hydraulic power unit for each unit and valve; and sump pumps.

The powerhouse arrangement will include a control room area. A control room is required to house the control panels, switchgear, motor control center, panel boards, batteries, and battery chargers. The control room will be isolated from the turbine floor and sound-proofed to provide a quiet space for the operator. It will be located above the turbine floor to protect the equipment from potential flooding, and it will be located near the plant substation to minimize conduit and cable runs.

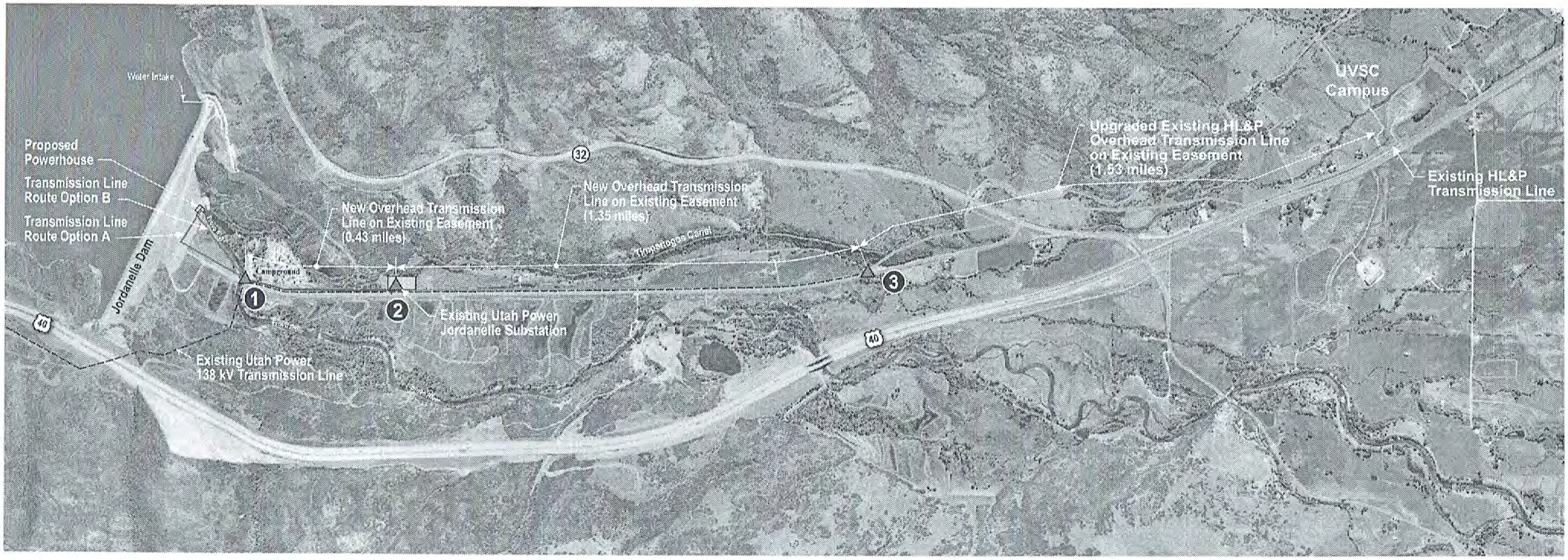
Turbines and Generators

The power plant will house two horizontal Francis turbines, each rated at approximately 300 cubic feet per second (cfs). The turbines will drive synchronous generators with output ratings of about 6 megawatts (MW) each and speeds of 600 revolutions per minute (rpm). Each generating unit would be equipped with a butterfly inlet valve, manual and automatic controls, and electrical switchgear. Electric power will be generated at 12.47 kV, then stepped up via a transformer, as necessary, to the transmission voltage at the power plant's nearby substation.

The capacity of the power plant is based upon the installation of two turbinegenerators, identical in size, and rated 6 MW at 300 cfs each.

Transmission Line and Utility Interconnection

The generated electric power will be transmitted to the site of interconnection with the utility's facilities via a new, and upgraded existing, overhead 12.47-kV, 3-phase, wood pole assemblies. A pole-mounted isolation switch will be installed. Metering will be performed by the existing HL&P system, and at the Jordanelle Hydroelectric powerplant.



LEGEND

- ▲ Potential Interconnection Sites
- (1) County Road Bridge (Alternative 2)
- (2) Utah Power Jordanelle Substation (Alternative 3)
- (3) Heber Light & Power System (Alternative 4 - Preferred Alternative)

Approximate Scale in Feet: 0 1000 2000 3000

Figure 3
PROJECT SITE MAP
JORDANELLE DAM HYDROELECTRIC PROJECT
ENVIRONMENTAL ASSESSMENT

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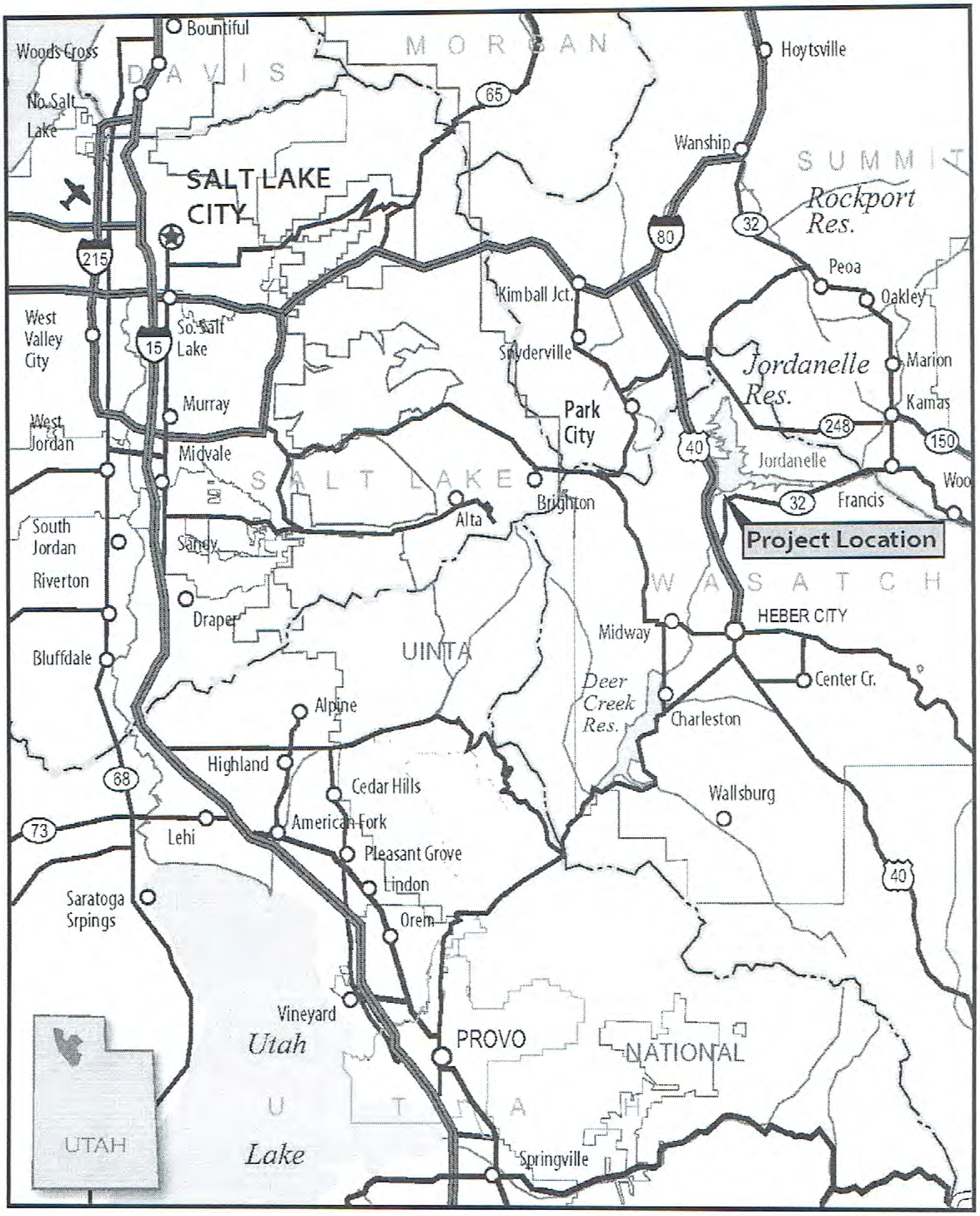

Approximate Scale In Miles

0 5 10

N

Figure 1
Project Location Map
JORDANELLE DAM HYDROELECTRIC PROJECT
ENVIRONMENTAL ASSESSMENT

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ATTACHMENT 3

Government Agency Contacts:

C✓

Department of Interior
Reed Murray, CUPCA Program Director
302 East 1860 South
Provo, UT 84606
801-379-1237

TALKED 2 TIMES.

Utah Reclamation, Mitigation, and Conservation Commission
Mark Holden
230 S. 500 E., Suite 230
Salt Lake City, UT 84102
801-524-3146 ext. 103

C✓

U.S. Bureau of Reclamation
Upper Colorado Region
Provo Area Office
Bruce C. Barrett
302 East 1860 South
Provo, UT 84606
801-379-1100

Non-Governmental Organization Contacts:

Salt Lake County Fish and Game Association
Dan Potts
801-596-1536

C✓

Provo River Water Users Association
Keith Denos, General Manager
265 West 1100 North
Pleasant Grove, UT 84062
801-796-8770

Utah Council, Trout Unlimited
Paul F. Dremann
2348 Lynwood Dr.
Salt Lake City, UT 84109
801-467-3862

CUP, for non-federal electric power generation and sale by the entity. The general authority for lease of power privilege under Bureau of Reclamation (Reclamation) legal statutes includes, among others, the Town Sites and Power Development Act of 1906 (43 U.S.C §522) and the Reclamation Project Act of 1939 (43 U.S.C. §485h(c)). A federal power project was not considered because by December 2002, when federal power was authorized for funding, DOI had already selected a potential lessee and entered into negotiations.

Negotiation for the lease of power privilege contract was announced in the Federal Register on October 25, 2000 (Vol. 64, No. 207, P. 63879-63880). The proposed execution of the lease contract would be subject to NEPA compliance. Power developed at Jordanelle Dam would be purchased by HL&P and sold to their customers.

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The proposed project is located on the downstream side of Jordanelle Dam below Jordanelle Reservoir. Jordanelle Dam and Jordanelle Reservoir are on the Provo River in Wasatch County Utah, approximately 4 miles north of Heber City, Utah (Figure 1). Figure 2 shows project features adjacent to Jordanelle Dam, including ownership. Figure 3 shows major project features including the proposed power plant and the transmission line to connect the power plant to the existing electric power distribution system of PacifiCorp (operating in Utah as Utah Power) or HL&P.

1.5 Authorizing Actions, Permits, and Licenses

As discussed in Section 1.3 above, the CRSP Act and the CUPCA authorized the proposed project. The lease of power privilege is authorized through a variety of legal statutes. Permits and approvals potentially required for the proposed project are shown in Table 1-1.

1.6 Interrelated Projects

1.6.1 Bonneville Unit, CUP

The ULS is the last of the six original systems of the Bonneville Unit of the Central Utah Project (CUP), authorized by the CRSP Act in 1956 and CUPCA in 1992, to develop central Utah's water resources for municipal and industrial supply, irrigation, flood control, hydroelectric power, fish and wildlife, and recreation. The Jordanelle Dam is a feature of the M&I System of the Bonneville Unit of the CUP. The Bonneville Unit includes facilities to develop and more fully utilize water tributary to the Duchesne River in the Uinta Basin of Utah, to facilitate a trans-basin diversion from the Colorado River Basin to the Bonneville Basin, and to develop and distribute project and local water supplies in the Colorado and Bonneville basins.

transmission line differ by action alternative, as do the sites for interconnection with the electric utility grid.

2.3 Alternative 1—No Action Alternative

Under the No Action Alternative, none of the features proposed in the action alternatives would be constructed. Existing dam releases would continue under current conditions without energy generation and the purposes of the proposed project would remain unmet. Finally, any anticipated environmental impacts of the action alternatives would not occur.

2.4 Project Features Common to All Action Alternatives

2.4.1 Powerhouse

The design of the powerhouse facility is the same under all action alternatives (Alternatives 2, 3, and 4). The powerhouse and penstock would be located a sufficient distance away from the toe of the dam so that the stability of the dam is not affected by the excavation for the powerhouse or the penstock.

The proposed powerhouse would be a reinforced concrete structure located partially within the rock berm at the toe of the dam, west of the existing outlet works. The penstock would be constructed from the 72-inch-diameter connection in the outlet conduit and then routed to the proposed powerhouse where it would bifurcate into two 66-inch-diameter pipes feeding the turbines. Penstock diameter would be 72 or 84 inches, depending upon final hydraulic analysis and equipment bids.

The floor of the powerhouse would be set at an elevation above the high tail-water elevation. This elevation would allow maintenance to be performed on the turbines without the need to de-water the tailrace. The turbines, generators, and all mechanical equipment would be located at this level. The turbines would discharge into a tailrace channel below the turbine floor. The final elevation of the turbines and tailrace channel would be determined when the turbines are selected.

The plan dimensions of the turbine floor are determined by the equipment size and the space required to maintain, disassemble, remove, or replace the equipment, and for other maintenance activities. The major equipment located on the turbine floor would include two turbine/generator units; turbine controllers; turbine inlet valves located on the penstock to each turbine; a hydraulic power unit for each unit and valve; and sump pumps.

The proposed powerhouse arrangement would include a control room area. A control room is required to house the control panels, switchgear, motor control center, panel boards, batteries, and battery chargers. The control room would be isolated from the turbine floor and sound-proofed to provide a quiet space for the operator. It would be located above the turbine floor to protect the equipment from potential flooding, and it would be located near the plant substation to minimize conduit and cable runs.

Powerhouse and area lighting will be provided for security, safety, and maintenance purposes. Offsite lighting will be minimized through use of cut-off luminaires. The District will take into account directional lighting, wherever possible.

2.4.2 Turbines and Generators

The power plant would house two horizontal Francis turbines, each rated at approximately 300 cubic feet per second (cfs). The turbines would drive synchronous generators with output ratings of about 6 megawatts (MW) each and speeds of 600 revolutions per minute (rpm). Each generating unit would be equipped with a butterfly inlet valve, manual and automatic controls, and electrical switchgear. Electric power would be generated at 4.16 or 12.47 kV, then stepped up via a transformer, as necessary, to the transmission voltage at the power plant's adjacent substation.

The proposed capacity of the power plant is based upon the installation of two turbine-generators, identical in size, and rated 6 MW at 300 cfs each. The ratings of these units were selected on the basis of analysis of the site flow and head conditions. Employing the ULS hydrology as the basis, the following considerations governed unit selection and rating:

- Optimal unit selection is based upon consideration of available head and flow, as both determine unit characteristics, and both vary independently. Overall power plant cost is likewise a factor in determining the most economical installation.
- Unit(s) were sized such that 125 cfs (normal site minimum flow) was within the minimum flow range of a single turbine. The number and relative sizing of turbine units was then selected based upon the maximum total flow that can be utilized economically. Multiple equipment manufacturers were consulted in order to predict the best turbine design for the site conditions. The planned capacity is an accurate estimate, with the final value determined by actual equipment supplier bids.
- The largest single unit that can operate with reasonable efficiency and stability at 125 cfs is one whose maximum flow rating is about 300 cfs and whose generator output is about 6 MW.
- Both single- and double-unit plant configurations were analyzed, along with equally and unequally sized units. Considerations of ease of maintenance, spare parts inventory, and operational redundancy favored equally-sized units. Twin 6-MW units were determined to be the most economical development for the anticipated site flow and head conditions. Larger installed capacities would capture higher flows, but the infrequency of such flows resulted in a less economical development.

2.4.3 Transmission Line and Utility Interconnection

The generated electric power would be transmitted to the site of interconnection with the utility's facilities via an overhead 3-phase power line. The voltage, configuration, and route of the line would vary by interconnection site, which comprise the three action alternatives. The interconnection site establishes the demarcation between project facilities and the utility's facilities.

The alternative interconnection sites are:

- At a location on county-managed lands south of the project near the county road bridge. This would provide interconnection at 138 kV with Utah Power facilities.

- At a location within the Utah Power Jordanelle Substation. This would provide interconnection at 12.47 kV with Utah Power facilities.
- At a location along the county road, near the southern terminus of the new UP 138-kV transmission line. Existing HL&P transmission line facilities extend north to this location. This would provide interconnection at 12. 47 kV with existing and upgraded HL&P facilities.

In each case, overhead pole assemblies would be of raptor-safe design, utilizing enhanced spacing between energized parts, in accordance with recognized standards.

Each of the transmission line alternatives can extend across the federally managed lands, from the power plant to a location near the county road bridge, by following one of two route options:

- Route Option A—West across the base of the dam, along the access road to an existing power line alignment following the main access road to the county bridge.
- Route Option B—Direct from the power plant area to the county bridge area along the existing levee.

2.5 Alternative No. 2—Transmission Line for 138-kV Interconnection with Utah Power

The elements of this alternative described below would be in addition to the elements common to all alternatives as described above in Sections 2.4.1 through 2.4.3.

Interconnection utility and site. Utah Power, at 138 kV. Metering and pole-mounted isolation switches would be installed at a location adjacent to the existing county road bridge (Figure 3, Site 1).

Line construction and description. New overhead 138-kV, 3-phase, wood or steel pole assemblies with davit insulator arms. Approximate height of the pole would be 60 feet. See Figure 4 for typical line structure profile.

Route. From power plant substation to interconnection site by way of federal property route Options A or B. Option A has been selected as the preferred route.

2.6 Alternative 3—Transmission Line for 12.47-kV Interconnection with Utah Power

The elements of this alternative described below would be in addition to the elements common to all alternatives as described above in Sections 2.4.1 through 2.4.3.

Interconnection utility and site. Utah Power, at 12.47 kV. Metering and metal-enclosed switchgear would be installed within the UP Jordanelle Substation (Figure 3, Site 2).

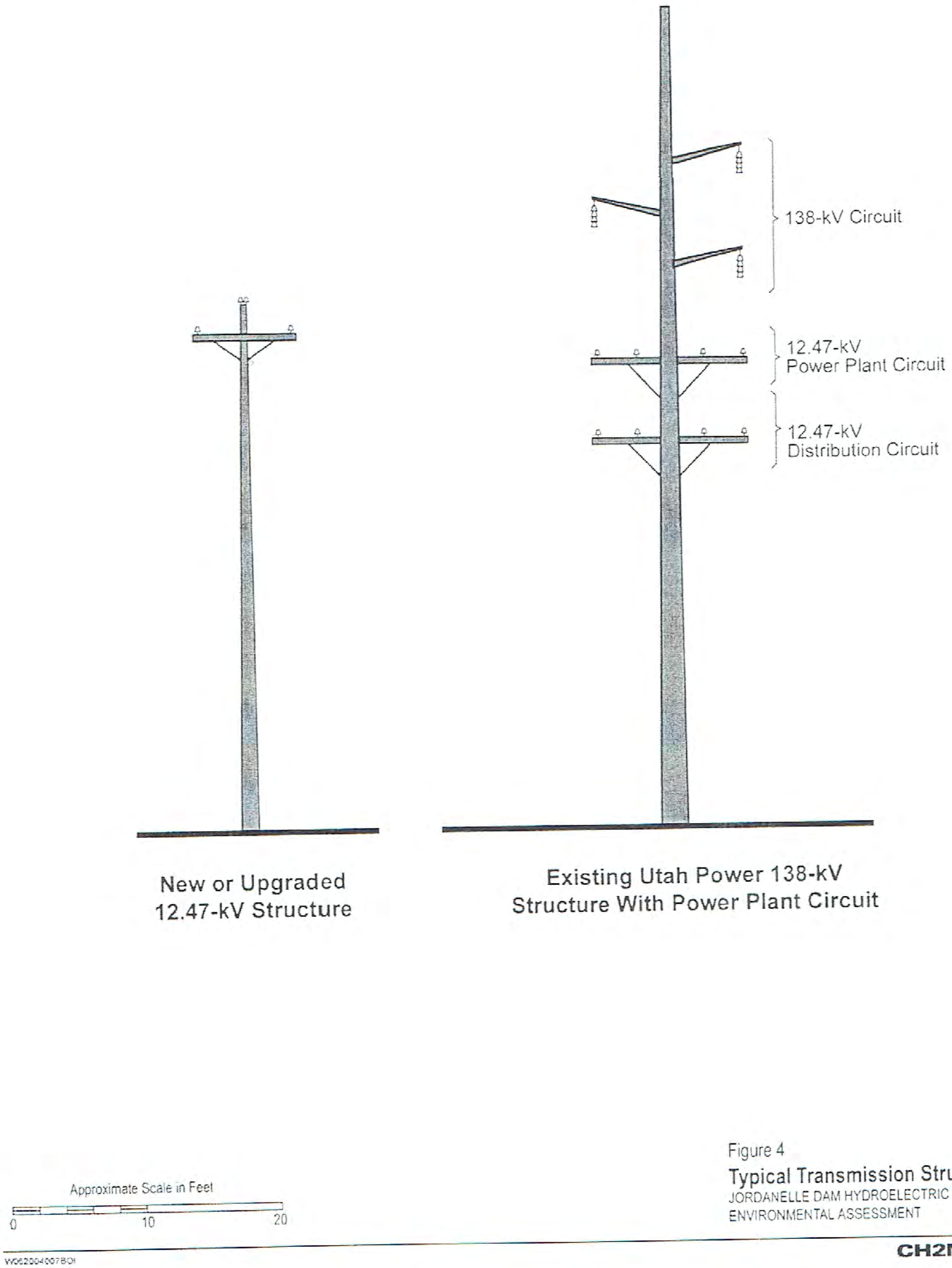

Figure 4
Typical Transmission Structures
JORDANELLE DAM HYDROELECTRIC PROJECT
ENVIRONMENTAL ASSESSMENT

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Line construction and description. New overhead 12.47-kV, 3-phase, wood pole assemblies with single cross-arms. Approximate height of the pole would be 45 feet. Where the route coincides with that of Utah Power 138-kV line, the new line may be supported on existing 138-kV poles structures. See Figure 4 for typical line structure profile.

Route. From power plant substation to county bridge area by way of federal property route Options A or B. Option A has been selected as the preferred route. Then, the route is south along the county road about 0.43 mile to UP's Jordanelle substation within existing power line easements.

2.7 Proposed Action (Alternative 4)—Transmission Line for 12.47-kV Interconnection with Heber Light & Power

The elements of the Proposed Action described below would be in addition to the elements common to all alternatives as described above in Sections 2.4.1 through 2.4.3.

Interconnection utility and site. Heber Light & Power, at 12.47 kV. A pole-mounted isolation switch would be installed at a location along the county road near the terminus of the new UP 138-kV transmission line, and at the northern end of an existing HL&P line (Figure 3, Site 3). Existing HL&P system metering, as well as that installed at the power plant, would be employed.

Line construction and description. New, and upgraded existing, overhead 12.47-kV, 3-phase, wood pole assemblies with single cross-arms. Approximate height of the pole would be 45 feet. Where the route coincides with that of Utah Power 138-kV line, new line may be supported on existing 138-kV pole structures. See Figure 4 for typical line structure profile.

Route. New line from power plant substation to county bridge area by way of federal property route Options A or B. Option A has been selected as the preferred route. Then, the route is south along the county road about 0.43 mile past UP's Jordanelle substation, then an additional 1.35 miles south to the interconnection site. Finally, power would be routed over 1.53 miles of line facilities to be upgraded by HL&P to an existing upgraded HL&P transmission line. All line construction would occur within existing power line easements. The line upgrades would consist of replacing any damaged or obsolete hardware with comparable hardware and installation of new conductors. All upgraded line facilities would be visually and structurally similar to existing facilities.

2.8 Construction Procedures

Specification of construction procedures has not been completed at this stage of the project. However, a conventional construction process of about 18 months duration is anticipated. The power plant work area would be immediately below the existing dam. A general contractor would complete the work, employing the services of excavation, concrete, building, mechanical, and electrical subcontractors. Standard operating procedures (SOPs) would be used to ensure compliance with all construction standards, and Best Management Practices (BMPs) would be employed (see Section 2.10). Construction inspection would be conducted by CUWCD and DOI to ensure quality construction, ensure environmental compliance, and to protect the federal investment. Construction would be employed so as not to impede or modify operational releases from the reservoir. Figure 2 shows the area where the staging areas/construction office would be located.

2.8.1 Construction Schedule

The proposed construction schedule for the project is presented on the following page. The schedule is preliminary and would vary based on many factors, including the schedule of this NEPA analysis.

2.9 Facility Operation

Existing facilities that would be used to pass the release water from Jordanelle Reservoir through Jordanelle Dam to the turbines include the selective level outlet works (SLOW), low-level outlet works (LLOW), tunnels and pipelines, and a gate chamber within the dam. The SLOW and LLOW are designed and used to mix water from different reservoir depths to control and meet water quality standards for phosphorus, temperature, and dissolved oxygen levels in water discharged to the Provo River downstream of Jordanelle Dam. Operations that mix and blend Jordanelle Reservoir water to meet requirements of the Water Quality Management plan (the Plan) for Deer Creek and Jordanelle Reservoirs would be unchanged under the proposed project (Psomas, 1999).

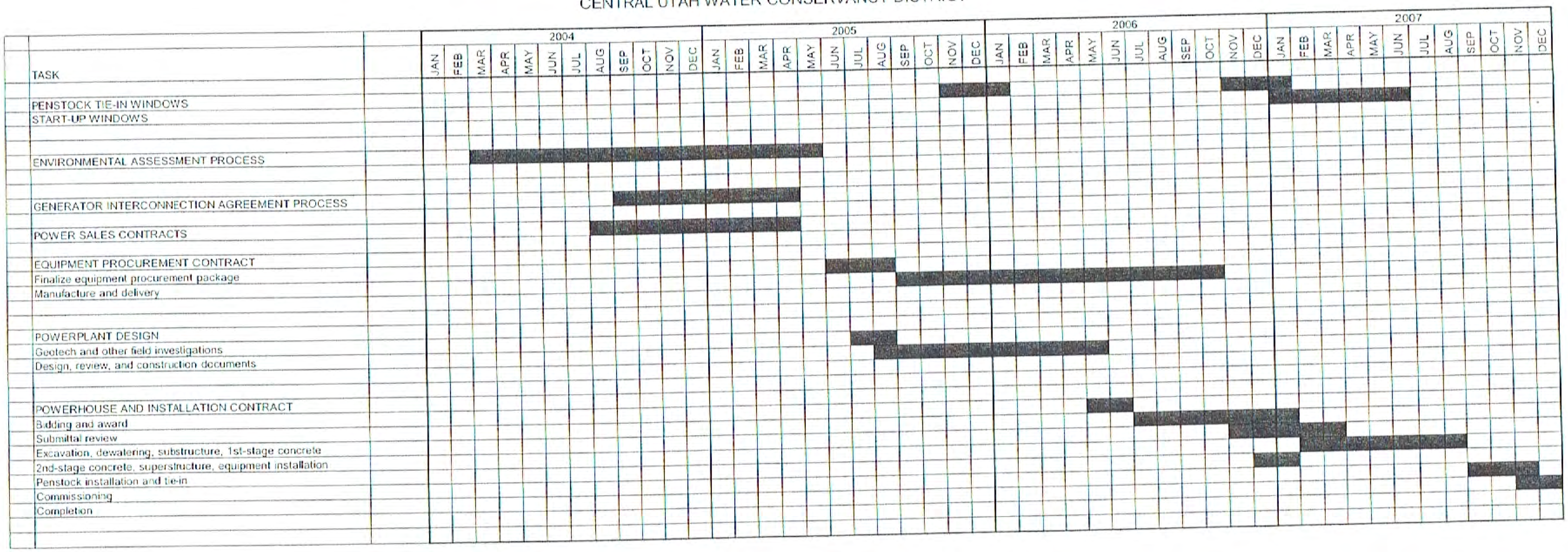
The SLOW intake tower has six 5-foot-wide by 8-foot-high gated openings at different depths for passing flow. Gate elevations vary from 6,125 feet (shallowest) to 6030 feet (deepest) (see Table 2-1). The gates in the SLOW tower are operated to limit the water velocity through each opening to 10 feet per second (fps). The SLOW tower leads to a shaft and 7-foot-diameter tunnel that connects to a gate chamber approximately 500 feet downstream.

TABLE 2-1
Elevations of Principal Project Features

Principal Feature	Elevation (feet above mean sea level)
Dam crest	6,185
Spillway crest	6,182
Maximum reservoir	6,182 (flood)
Maximum joint use reservoir	6,166.4 (normal full pool)
Selective level intake (SLOW)	See Gates 1 to 6 below
Gate No. 1	6,125
Gate No. 2	6,106
Gate No. 3	6,087
Gate No. 4	6,068
Gate No. 5	6,052
Gate No. 6	6,030
Low level intake (LLOW)	5,902
Outlet works centerline	5,886.5
Tail water elevation	5,876 to 5,879

PROJECT SCHEDULE

JORDANELLE DAM HYDROELECTRIC PROJECT
CENTRAL UTAH WATER CONSERVANCY DISTRICT



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The LLOW intake structure has a 9.5-foot by 9.5-foot bulkhead isolation gate. The gate elevation is 5902 feet, which is 128 feet deeper than the deepest SLOW gate opening (see Table 2-1). The LLOW intake structure leads to a 9.5-foot-diameter tunnel that connects to the gate chamber approximately 830 feet downstream of the intake structure. The LLOW intake is used whenever the discharge is greater than 1,200 cfs, or when the reservoir is below 6040 feet elevation.

Jordanelle Reservoir releases are made through the 7-foot-diameter SLOW tunnel or the 9.5-foot-diameter LLOW tunnel described above. The two tunnels come together at the gate chamber in the left abutment of the dam. When reservoir releases are greater than 300 cfs, the flow passes from the gate chamber to the outlet works through a single 9.5-foot-diameter, 1,000-foot long tunnel. This 9.5-foot-diameter tunnel bifurcates into two 78-inch-diameter pipes in the outlet works at the toe of the dam. Currently, this flow is discharged into the Provo River through fixed-cone valves at the downstream end of the 78-inch-diameter pipes. Lower flows are released through a separate 36-inch-diameter pipeline and jet-flow valve housed in the same outlet work structure as the larger valves.

Reservoir releases through the outlet works valves are discharged into the outflow channel. The outflow channel is an engineered channel constructed as part of the original Jordanelle Dam and extends about 600 feet downstream to the existing Timpanogos Canal diversion and dam. The channel's pool elevation is established by the operation of this diversion dam and its gated outlet.

Under the proposed project, the powerhouse penstock would connect to an existing 72-inch-diameter steel stub-out located upstream of the two outlet works pipes. A 72-inch-diameter penstock about 250 feet long would be constructed from the connection to the stub-out to the proposed powerhouse. The proposed project would utilize flows released for CUP purposes, including irrigation, M&I, and instream flow uses for fish and wildlife, together with non-project water being released to downstream users, in accordance with the Deer Creek-Jordanelle Operating Agreement and state water rights.

The proposed 12-MW project would operate throughout a range of reservoir elevations and release flows, as estimated within the ULS. Existing reservoir storage and release patterns would not be modified by the project. The proposed project would be able to utilize all of the flow released from the reservoir up to 600 cfs during periods when the reservoir is at elevation 6037 feet or higher. The estimated range of reservoir elevations and flows over which plant operation is effective would determine the exact design characteristics of the turbines. Whenever reservoir elevation and/or release flow fall outside the plant's operating range and subject to the downstream water quality criteria, releases would be made via the existing outlet works valves to increase dissolved oxygen by aerating the water.

The operating characteristics of the actual turbines have not yet been confirmed. However, it is anticipated that with turbines operating singly or together, the plant would effectively utilize flows between about 125 and 600 cfs. In addition, the plant would only be operated at reservoir elevations that fall within the turbine limits and wherein Water Quality Management Plan requirements are met. These conditions are expected to occur approximately 80 percent of the time, based on the flow duration and elevation duration curves developed from the PROSIM model.

The dissolved oxygen content of releases made through the turbines is expected to be lower than releases made through the outlet works valves because the aeration produced by the valves would not occur. It is anticipated that there may be times when the dissolved oxygen content of the releases made through the turbines may be below acceptable levels, particularly when the reservoir is below elevation 6070 feet. During these periods, dissolved oxygen in the river immediately downstream from the project would be maintained at acceptable levels by passing all or some of the reservoir discharge through the outlet works valves. It is anticipated that the project would be operated to minimize the head loss in the outlet work system to the greatest extent possible within the water quality constraints (the Plan). Reservoir releases under the proposed project would be the same as at present, varying from a minimum flow requirement of 125 cfs from October through March up to as much as 2,400 cfs from April to September. Tail water elevations would continue to be controlled by the Timpanogos Canal diversion dam on the Provo River several hundred feet downstream of Jordanelle Dam.

The proposed facilities will not introduce conditions of nitrogen supersaturation in water releases. No spillway structures, the most common source of this condition, are proposed. The existing reservoir intakes are not prone to air entrainment, and the turbines will discharge into a shallow tailrace where mixing and turbulence further prevent supersaturation conditions.

The Project Control System will provide protective functions as well as manual and automatic startup/shutdown of the generating units. In addition, it will provide remote control and monitoring of the operation of Jordanelle Dam facilities. The generating units and the existing outlet works control valves will be automatically controlled together to release required flows from the dam. Required releases will automatically be maintained during power plant startup and shutdown conditions. The control system will adjust flow division between outlet works and power plant in response to changing water quality conditions.

The CUWCD would work with the DOI to develop a security plan that will be consistent with and integrated into the present security program for Jordanelle Dam and Reservoir. Security measures would be included in the construction of the facilities.

2.10 Best Management Practices

A number of standard requirements (BMPs) that are intended to reduce short- and long-term impacts would be implemented during construction and operation of all Jordanelle Hydroelectric Project features. Certain procedures relate only to construction activities in the vicinity of the dam, roadways, waterways, or other sensitive habitats.

Adherence to standard and project-specific BMPs for the following activities would reduce short-term impacts during the construction of hydroelectric facilities at the dam, and the transmission line:

- Landscape preservation and impact avoidance
- Erosion and sediment control
- Biological and cultural resource site clearances
- Site restoration and revegetation
- Air quality protection
- Prevention of water pollution

TABLE 1-1
Permits and Approvals Required by the CUWCD for Development, Construction, Operation, and Maintenance of the Proposed Project

Permits and Approvals	Issuing Entity
Approve Proposed Project for Construction	CUWCD Board of Directors
Approve Project Construction	U.S. Department of the Interior
Lease of Power Privilege Contract	U.S. Department of the Interior
Section 404 Clean Water Act General Permit 40	U.S. Army Corps of Engineers
Section 404 Permit Oversight Authority	U.S. Environmental Protection Agency
Fish and Wildlife Coordination Act	U.S. Fish and Wildlife Service
Endangered Species Act Section 7 Consultation	U.S. Fish and Wildlife Service
Approve a Contamination Evaluation/Assessment/Prevention Plan, if Necessary	U.S. Fish and Wildlife Service
Section 401 Water Quality Certificates and Section 402 NPDES Permits	Utah Division of Water Quality
Stream Channel Alteration Permit	Utah Division of Water Rights, State Engineer's Office
Utah Construction Activity Permit	Utah Department of Environmental Quality
Compliance with Utah Occupational Safety and Health Administration (OSHA) Regulations during Project Construction, Operation, and Maintenance	State of Utah OSHA
Section 106 National Historic Preservation Act and State Antiquities Consultation	Utah Division of State History, Utah State Archaeologist, and Utah State Historic Preservation Officer
Concurrence on Fish and Wildlife Coordination Act	Utah Division of Wildlife Resources
Migratory Bird Treaty Act of 1918	U.S. Fish and Wildlife Service
Heber Light and Power Agreement for Project Construction, Operation, and Maintenance	CUWCD and U.S. Department of the Interior
Wasatch County Building Permits and, if Necessary, Permits to Construct in County Road Right-of-Way	Wasatch County
Agreements for Easements, Rights-of-Way, Access, and Entry Permits, as Needed	CUWCD with U.S. Department of the Interior for federal property; CUWCD and HL&P with Wasatch County for easements off federal property; Landowners whose property is directly affected by project construction, operation, and/or maintenance

TABLE 1-1
Permits and Approvals Required by the CUWCD for Development, Construction, Operation, and Maintenance of the Proposed Project

Permits and Approvals	Issuing Entity
Approve Proposed Project for Construction	CUWCD Board of Directors
Approve Project Construction	U.S. Department of the Interior
Lease of Power Privilege Contract	U.S. Department of the Interior
Section 404 Clean Water Act General Permit 40	U.S. Army Corps of Engineers
Section 404 Permit Oversight Authority	U.S. Environmental Protection Agency
Fish and Wildlife Coordination Act	U.S. Fish and Wildlife Service
Endangered Species Act Section 7 Consultation	U.S. Fish and Wildlife Service
Approve a Contamination Evaluation/Assessment/Prevention Plan, if Necessary	U.S. Fish and Wildlife Service
Section 401 Water Quality Certificates and Section 402 NPDES Permits	Utah Division of Water Quality
Stream Channel Alteration Permit	Utah Division of Water Rights, State Engineer's Office
Utah Construction Activity Permit	Utah Department of Environmental Quality
Compliance with Utah Occupational Safety and Health Administration (OSHA) Regulations during Project Construction, Operation, and Maintenance	State of Utah OSHA
Section 106 National Historic Preservation Act and State Antiquities Consultation	Utah Division of State History, Utah State Archaeologist, and Utah State Historic Preservation Officer
Concurrence on Fish and Wildlife Coordination Act	Utah Division of Wildlife Resources
Migratory Bird Treaty Act of 1918	U.S. Fish and Wildlife Service
Heber Light and Power Agreement for Project Construction, Operation, and Maintenance	CUWCD and U.S. Department of the Interior
Wasatch County Building Permits and, if Necessary, Permits to Construct in County Road Right-of-Way	Wasatch County
Agreements for Easements, Rights-of-Way, Access, and Entry Permits, as Needed	CUWCD with U.S. Department of the Interior for federal property; CUWCD and HL&P with Wasatch County for easements off federal property; Landowners whose property is directly affected by project construction, operation, and/or maintenance

Canal diversion dam on the Provo River several hundred feet downstream of the dam outlet works.

The estimated average monthly Provo River flows from releases from Jordanelle Reservoir for the proposed ULS alternative (in cfs and acre feet) are in Appendix F (CUWCD, ULS-FEIS Final Surface Water Hydrology Technical Report, Volume 2, Appendix B). These estimated flows are common for all Alternatives and the No Action Alternative. On an annual basis, flows under the proposed alternative remain the same as the No Action Alternative's conditions and the monthly flows would also remain the same.

TABLE 3-1
Expected Provo River Flows Immediately Downstream of Jordanelle Dam

Month	Average (cfs)	Maximum (cfs)	Minimum (cfs)
January	138	150	125
February	141	278	125
March	186	1204	125
April	206	768	127
May	648	1333	234
June	909	1643	318
July	634	1427	326
August	482	915	288
September	330	508	224
October	157	172	133
November	144	164	126
December	141	162	126
Average	344	516	210

Source: Table P-1a, Page 2, Section 2. – Surface Water Hydrology Technical Report, Volume 2, Appendix B.

Current Operation to Maintain Surface Water Quality

A Water Quality Management Plan (the Plan) was developed for the Provo River Basin in 1984 because of concerns regarding development potential around the proposed Jordanelle Reservoir, and because of eutrophication problems identified in 1976 in a Water Quality Management Plan prepared by the Mountainlands Association of Governments and the State of Utah. As a result, the Governor of Utah, Bureau of Reclamation, and Mountainlands Association of Governments prepared a plan to protect and improve the water quality of Deer Creek Reservoir and the proposed Jordanelle Reservoir.

The Jordanelle Technical Advisory Committee (JTAC) and a Political Policy and Oversight Committee were established to develop and implement the Plan. The Plan was formally approved and implemented in 1984. The primary operational objective of the Plan is to eliminate blue-green algae and reduce total productivity in Deer Creek Reservoir. The secondary objective is to provide optimum temperatures for trout over as much of the Provo River between Jordanelle and Deer Creek Reservoirs as possible. These objectives are achieved by controlling the quality of water released to the Provo River from Jordanelle Reservoir.

To meet the operational objectives of the Plan, water for Jordanelle Reservoir enters the outlet tunnel of the dam through either the SLOW or the LLOW, depending on the reservoir elevation and water quality characteristics. The SLOW and LLOW are designed to mix and blend water from different reservoir depths to control and meet water quality standards for phosphorus, temperature, and dissolved oxygen levels in water discharged to the Provo River downstream of the dam. Currently, the valves in the outlet works oxygenate releases to the Provo River. The goal for water temperature in the Provo River downstream of Jordanelle Dam has been maintained between 50 and 55 degrees F by making flow releases through the gates in the SLOW when the reservoir is above elevation 6070 feet. When the reservoir is below elevation 6070 feet, releases made from the SLOW may have to be supplemented by releases from the LLOW to maintain the temperature requirements in the Provo River.

The Jordanelle outlet works have not been operated with the reservoir as low as elevation 6070 feet since the reservoir has been filled and historical monitoring has not found the LLOW level dissolved oxygen levels to be extremely low. However, it is anticipated that dissolved oxygen levels at the LLOW intake elevation of 5902 feet could be close to zero milligrams per liter (mg/L) under certain conditions. Under those conditions, supplemental flow from the SLOW as well as re-aeration of the water by the outlet works valves would be required to increase the dissolved oxygen content of the water.

Various operational efforts that have been, or would be, implemented under current conditions to achieve Plan objectives for water temperature and phosphorus control, and to meet dissolved oxygen standards for the protection of cold water aquatic life, are outlined below.

Water Temperature and Phosphorus. Normal summer operation of the Jordanelle SLOW can accomplish the objectives for phosphorus and water temperature when the reservoir exceeds elevation 6100 feet. The reservoir is anticipated to be above elevation 6100 feet 85 percent of the time, based on the PROSIM model of reservoir operation, which was developed by the CUWCD and Reclamation based on water years 1950 to 1989. Operation of any combination of full or partially open SLOW gates that provides river temperatures between 50 and 54 degrees F at a reservoir elevation above 6100 feet would achieve both objectives.

Water temperature objectives for Jordanelle Dam discharges in September and October can be met by releasing water from depths exceeding 100 feet. Therefore, both the primary and secondary Plan objectives for phosphorus and water temperature can be achieved by the same SLOW operating criteria under the present mesotrophic condition and phosphorus status in Jordanelle Reservoir. After irrigation deliveries to Heber Valley stop in September, the uppermost submerged gate on the SLOW would be closed to avoid exportation of any blue-green algae present in Jordanelle Reservoir. From December to April, any combination of SLOW and LLOW gates should be acceptable to meet temperature and phosphorus water quality objectives.

When the reservoir is below 6100 feet from mid-July through September, it may be necessary to blend water from the LLOW to keep discharge temperatures below approximately 56 degrees F. This may result in higher concentrations of phosphorus being released. Under these conditions, the Water Quality Management Plan calls for the use of monitoring and adaptive management to decide how soon and how long it would be beneficial to blend at least a portion of the flow from the LLOW.

Dissolved Oxygen. The State of Utah dissolved oxygen standard for cold water fishery (early and all other life stages, 30-day average) is 6.5 mg/L and the Environmental Protection Agency (EPA) has identified 5 mg/L dissolved oxygen as the minimum chronic standard for the protection of freshwater, cold water aquatic life. Under present operations, the release of water from the outlet works valves is re-aerated and dissolved oxygen exceeds water quality standards (8 to 9 mg/L monthly mean) as measured at a continuous monitoring station downstream of the dam outlet and Timpanogos Canal diversion. Some additional aeration between the dam releases and current monitoring station can occur from water dropping over the Timpanogos Diversion Dam and flows in the stream.

3.8.4 Impact Analysis

Alternative 1—No Action

There would be no change from existing conditions under this alternative.

Alternative 2

Surface Water Quantity. The volume of water stored in Jordanelle Reservoir, as well as the timing and volume of reservoir releases to the Provo River throughout the year would be the same under Alternative 2 as under existing conditions (the No Action Alternative). Reservoir water releases would be the same with or without the proposed project in place (see Chapter 2 for a description of proposed project operation). The minimum instream flow requirement of 125 cfs for the Provo River between Jordanelle Dam and Deer Creek Reservoir would remain in effect and would continue to be met under Alternative 2. Expected average, minimum, and maximum flows in the Provo River downstream of Jordanelle Dam would also be the same as under existing conditions or the No Action Alternative.

For these reasons, operation and maintenance of the proposed project under Alternative 2 is not expected to have any effect on surface water resources or quantity compared to existing conditions or the No Action Alternative. No large quantity of water would be needed or used from the Provo River during project construction that would adversely impact river flows.

Surface Water Quality. Two elements of surface water quality are considered: dissolved oxygen levels in water discharged to the river, and passage of phosphorus and algal blooms during low reservoir levels.

The proposed power plant would be operated during periods when the following two conditions are met: when reservoir elevation is high enough to permit effective turbine operation, and when such reservoir releases can meet the requirements of the Water Quality Management Plan.

ATTACHMENT 7

B. Water Quality

Our facility is currently under construction; however, we have enclosed the following Watershed Management Unit Stream Assessments to demonstrate that the Provo River below Jordanelle Dam is in compliance with the Clean Water Act:

For Question B.1.a. and/or B.1.b.

- 2002 Utah Lake – Jordan River Watershed Management Unit Stream Assessment. This report shows the Provo River below Jordanelle Dam as "Fully Supporting" water quality standards (pg. 12 & 14).

- 2004 305(b) Water Quality Assessment. Assessed Classes Supporting (pg. 6)

- 2006 305(b) Water Quality Assessment. Jordan River/Utah Lake Management Unit. Assessed Classes Supporting.

For Question B.2.

We have enclosed Utah's 2006 Integrated Report Volume II: Utah's 303 (d) List. The only portion of river that is listed below Jordanelle Reservoir is Snake Creek, which is not fed by Jordanelle. We have also included the Classification of Waters of the State, specific to the Utah Lake-Jordan River Basin.

UTAH LAKE - JORDAN RIVER WATERSHED MANAGEMENT UNIT STREAM ASSESSMENT

UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF WATER QUALITY

UTAH LAKE-JORDAN RIVER WATERSHED MANAGEMENT UNIT STREAM ASSESSMENT

Prepared by
Thomas W. Toole
August 2002

Division of Water Quality
Department of Environmental Quality

ACKNOWLEDGMENTS

This report was prepared through the efforts of many people who provided extensive information and assistance. Thanks go to Florence Reynolds, Salt Lake City, Steve Jensen, Salt Lake County, Dr. Lawrence Grey, Utah Valley State College, Rob Baskin, United States Geological Survey, Bob Gecy and Chad Hermandorfer, Uinta National Forest, for providing the State with data and information to be used in assessing water quality in the Utah Lake - Jordan River Watershed Management Unit.

The efforts of Richard Denton and the staff of the monitoring section insured data would be available in a timely manner for completing this report.

Mark C. Stanger, Water Quality Section, produced the graphics and provided or obtained the necessary geographical information to produce the maps and generate data contained in the report.

Special thanks go to Dave Wham, TDML Section, for his assistance in compiling data, providing information on activities in the watershed, and for his efforts in analyzing the metals data and working on the fish consumption advisory on the North Fork of the American Fork River.

EXECUTIVE SUMMARY

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. Samples collected during various periods and various frequencies at eighty monitoring sites from July 1, 1995 to June 30, 2000 within the Utah Lake-Jordan River Watershed Management Unit were used to assess water quality and to determine whether or not rivers and streams were supporting their designated beneficial uses. Samples were collected at different frequencies depending upon the site and whether or not the site was part of the Division of Water Quality's (DWQ) cooperative monitoring program. Salt Lake City, the Central Utah Water Conservancy District, and the Jordanelle Technical Advisory Committee were the cooperating agencies.

Samples collected from July 1, 1999 to June 30, 2000 as part of the DWQ intensive monitoring program were collected twice a month during spring run-off and once a month during the rest of the year. No samples were collected in December. The DWQ long-term monitoring sites were collected at the same frequency during the intensive monitoring period, but were only collected eight times prior to this survey. Samples collected by the cooperating agencies were generally collected on a monthly basis each year.

In addition to the data obtained from the above monitoring, data collected at four of the United States Geological Survey sites, as part of their National Water Quality Assessment Program (NAWQA) in the Jordan River watershed, were used to assess water quality. Bacteriological data collected by Salt Lake City and Salt Lake County in streams along the Wasatch Front were also used to assess water quality. The United State's Forest Service provided data on metals in fish tissue from 5 sample locations on the North Fork of the American Fork River. Benthic macroinvertebrate data and sediment data were obtained from Dr. Lawrence Grey, Utah Valley State College, to assess water quality in the Soldier and Thistle Creek watersheds.

Streams were assessed against State water quality standards and pollution indicators to determine if their designated beneficial uses were being met. The streams in the Utah Lake - Jordan River Watershed Management Unit are classified as one of the following or a combination of the following beneficial use classifications: protected as a source of drinking water (1C), secondary contact recreation (2B), cold water game fish (3A), warm water game fish (3B), non-game fish and other aquatic life (3C), other aquatic wildlife (3D), and agricultural use including irrigation and stock watering (4).

There are an estimated 1,314 perennial stream miles within the Utah Lake - JordanRiver Watershed Management Unit, One-thousand twenty-five (1,025) miles (78.0%) were assessed for support of their designated beneficial uses. Of these, 848.5 (82.7%) miles were determined as fully supporting all their beneficial uses, 108.3 (10.6%) miles were assessed as partially supporting, and 68.4 (6.7%) miles were assessed as not supporting at least one designated beneficial use. The Class 2B, contact recreation, beneficial use assessment was done primarily using physical/chemical data and were not considered fully assessed unless bacteriological data were also collected.

One-thousand twenty-five (1,025) stream miles were assessed for aquatic life use support. This was

81.2% of the estimated stream miles that were classified for this beneficial use. Of the streams assessed for aquatic life, 854 miles (83.3%) were assessed as fully supporting, 102.7 miles (10.0%) partially supporting this beneficial use and 68.4 miles (6.7%) were listed as being non supporting

Of the 923 stream miles assessed for agricultural use, 899 miles (97.4%) were assessed as fully supporting, 24.2 miles (2.6%) were assessed as partially supporting and no stream miles were assessed as not supporting the agricultural beneficial use.

Individual Use Support Summary for the Utah Lake - JordanRiver Watershed Management Unit (Stream Miles).

Goals [a]	Use	Size Assessed	Size Fully Supporting	Size Fully Supporting but Threatened	Size Partially Supporting	Size Not Supporting	Size Not Attainable
Protect & Enhance Ecosystems	Aquatic Life	1,025.2	854.1 (83.3%)	0.0 (0.0%)	108.3. (10.0%)	68.4 (6.7%)	0.0 (0.0%)
Protect & Enhance Public Health	Fish Consumption	5.6	0.0 (0.0%)	0.0 (0.0%)	0.0 (0.0%)	5.6 (100%)	0.0 (0.0%)
	Swimming [b]	101.3	81.7 (80.7%)	0.0 (0.0%)	29.8 27.3%	0.0 (0.0%)	0.0 (0.0%)
	Secondary Contact	101.3	81.7 (80.7%)	0.0 (0.0%)	29.8 27.3%	0.0 (0.0%)	0.0 (0.0%)
	Drinking Water	402.6	402.6 (100%)	0.0 (0.0%)	0.0 (0.0%)	0.0 (0.0%)	0.0 (0.0%)
Social and Economic	Agricultural	923.2	899.0 (897.4%)	0.0 (0.0%)	24.0 (2.6%)	0.0 (0.0%)	0.0 (0.0%)
	Total	1,025.4	848.5 (82.7%)	0.0 (0.0%)	108.3 (10.6%)	68.4 (6.75)	0.0 (0.0%)

a - These goals are part of the national water quality goals adopted by the EPA Office of Water and the ITFM in their Environmental Goals and Indicators effort.

b - Class 2B (secondary contact) streams were evaluated as swimmable for proposes of the CWA goals, therefore the swimming and secondary contact classification categories are the same.

No water quality impairments were found when waters classified as 1C (protected as a source of drinking water) were assessed. Of the streams for which there were fecal coliform data available, only one was impaired for contact recreation (Class 2B) because of high concentrations of fecal coliforms.

Major Causes of Impairment

The major causes of impairment were metals, habitat alterations, flow alterations and pH. The major sources of impairment were resource extraction, habitat modification, hydromodification, and agricultural activities. Urban storm-water runoff is considered a significant source of organic loading that creates a large oxygen demand in the lower parts of the Jordan River that causes the oxygen level in the stream not to meet State standards.

Waters Not Meeting Standards

The Jordan River from Farmington Bay upstream to North Temple was assessed as impaired because of low dissolved oxygen.

Emigration Creek and its tributaries were found not supporting its secondary contact recreation designation because of high concentrations of fecal coliforms. Potential sources for the fecal coliforms are natural sources and septic tanks. Further work needs to be done in this water shed to determine the sources of the fecal coliforms. Little Cottonwood Creek and its tributaries, upstream from the water treatment plant to its headwaters, were impaired because of potential effects of zinc on aquatic life in the stream. The North Fork of the American Fork River and its tributaries above Tibble Fork Reservoir were impaired because of high levels of arsenic found in fish tissue samples. The Utah Department of Health, Utah Department of Environmental Quality, and the Utah County Health Department have issued a fish consumption advisory for these streams. Historical mining activities, mine drainage and tailings, are the sources of metals in Little Cottonwood Creek and the North Fork of the American Fork River.

Violations of the State's temperature standards for aquatic life occurred in the Jordan River from Bluffdale to the Narrows, and Currant Creek, downstream from Mona Reservoir causing them to be listed as impaired.

Evaluation of water chemistry, sediment, and benthic macroinvertebrate data indicated that Soldier Creek, from its confluence with Thistle Creek, upstream to the point where Starvation Creek enters Soldier Creek, was impaired because of excessive sedimentation and phosphorus. Diamond Fork River and its tributaries from its confluence with the Spanish Fork River were impaired because of flow alterations and habitat degradation. This is caused by the excess amounts of water that are diverted into the stream from Strawberry Reservoir. Sixth Water Creek, a tributary to Diamond Fork River was affected by this also. When Diamond Fork pipeline project is completed, water will be piped downstream to the Spanish Fork River, When this occurs, it is expected that these streams can be rehabilitated and support their aquatic life beneficial use designation.

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Utah Lake-Jordan River Watershed Management Unit Assessment

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 1 and is located in the north central part of the state (Figure 1).

Table 1. Hydrological Unit Codes and Names	
Hydrological Unit Code	Hydrological Unit Name
16020201	Utah Lake
16020202	Spanish Fork
16020203	Provo
16020204	Jordan

Materials and Methods

Field and Laboratory–Eighty stations (Figure 2, Table 2) in the Utah Lake-Jordan River Watershed Management Unit were monitored from July 1, 1995 through June 30, 2000 by the Utah Division of Water Quality and its cooperating agencies. In addition, Salt Lake City monitored stations within the Jordan River watershed for total

Figure 1. Utah Lake - Jordan River Watershed location.

and fecal coliforms. Salt Lake County monitored sites on Emigration Creek for total and fecal coliforms and the U.S. Forest Service collected fish tissue samples on the North Fork of the American Fork River. Data were also collected by the United States Geological Survey under the Great Salt Lake Basins portion of the National Water Quality Assessment Program (NAWQA).

Physical-Chemical Samples-The Division of Water Quality (DWQ) monitored physical and chemical parameters at 48 sites (Table 2) during the July 1, 1999 - June 30, 2000 intensive monitoring survey. These sites were monitored twice monthly during the spring run-off period and once a month during the rest of the period except for December 1999.

Data from six long term sites were also used to assess water quality. They were sampled at the same frequency as intensive sites during the intensive survey but were only sampled eight times a year during the other years. In addition, the DWQ had cooperative agreements with Salt Lake City, the Central Utah Water Conservancy District, and the Jordanelle Technical and Advisory Committee. These cooperative agreements included the collection and processing of samples at the State Health Laboratory. Twenty-six cooperative sties were monitored. They were generally sampled monthly each year.

The following procedures were used by DWQ. Oxygen, pH, water temperature, and conductivity were measured *in situ*. Instantaneous flows were measured using a flow meters during each survey, unless the station was located at or near a U.S. Geological Survey (U.S.G.S.) gaging station. Water quality samples were collected according to standard field procedures defined and adopted by the Division of Water Quality in 1993 (DWQ, 1993). Chemical analysis in the laboratory included ammonia, total phosphorus, dissolved nitrate-nitrite, dissolved total phosphorus, total suspended solids, total dissolved solids, dissolved calcium, dissolved magnesium, dissolved potassium, dissolved sodium chloride concentration, sulfate, alkalinity and hardness. Turbidity was also determined in the laboratory. Concentrations for the following dissolved metals were determined: arsenic, barium, cadmium, chromium, copper, iron, lead, selenium, silver, zinc, and mercury. Field preservation and laboratory analysis of laboratory samples were performed according to standard procedures used by the Division of Health's State Laboratory and are EPA approved. Cooperating agencies followed guidelines in the DWQ's field procedures.

Physical and chemical data obtained from the U.S. Geological Survey were used to assess water quality in Red Butte Creek, Little Cottonwood Creek and a portion of the Jordan River near Salt Lake City. These data were collected for the Great Salt Lake Basins NAWQA Program. Data were collected from October 1998 through June 2001 on a variable basis. Sampling effort ranged from several times each month to monthly.

Benthic Macroinvertebrate Samples-Benthic macroinvertebrate data collected at 11 sites (Figure 2, Table 2) in the Spanish Fork River area and were used to assess several streams. These samples were collected and identified by Dr. Lawrence Gray, Utah Valley State College. Four surber samples (1 square foot each) were taken randomly in a transect across a riffle/run reach. Data provided to the DWQ included identifications, biomass, and graphical presentations of data.

Sediment Samples-Substrate samples were also collected by Dr. Lawrence Gray at the 11 macroinvertebrate sites. Substrates at each site were collected with a corer to a depth of 10 cm. Several cores were taken at each site and combined into one sample. Only materials pebble or smaller in size (<64 mm) were retained. After drying, the sample was sieved through a set of standard sieves into pebble, gravel, sand, and silt+clay fractions. The percent of the weight of the combined sand-silt-clay fraction to total sample weight was calculated for each sample.

Table 2. Benthic Macrointvertebrate Sample Sites.

Station Identification	Station Description
b1	Little Clear Creek

b2	Thistle Ck at Nebo Creek
b3	Thistle Ck at rehab site
b4	Clear Creek
b5	Starvation Creek
b6	Tie Fork Creek
b7	Lake Fork Creek
b8	Solider Ck at Mill Fork Creek
b9	Lower Soldier Creek
b10	Summit Creek
b11	Hobble Creek

Bacteriological Samples-Total and fecal coliform samples were collected from 24 sites located in Little Cottonwood, Big Cottonwood, Mill Creek, Parleys Creek, Lambs Canyon and Emigration Canyon Creeks by the Salt Lake City Public Utilities Department (Figure 2, Table 3). Samples were usually collected weekly from April or May through October, and then monthly during the other months. Data collected in 1998, 1999, and 2000 were used to assess beneficial use for drinking water (Class 1C) and contact recreation (Class 2B). These data were provided to the DWQ by Florence Reynolds of the Salt Lake City Department of Public Utilities.

Salt Lake County collected bacteriological samples in Emigration Canyon at five locations (Figure 2) from May 23 to November 7, 2001. Samples were collected at each location in the morning, at noon, and in the afternoon on a weekly basis. Steve Jensen of the Salt Lake County Public Works Department provided the data for analysis.

Table 3. Salt Lake City Bacteria Sampling Sites.

Station ID	Canyon	Site Name
MC1	Mill Creek	UB
MC2	Mill Creek	TOLL GATE
MC3	Mill Creek	FSB
CC1	City Creek	ABOVE GATE
CC2	City Creek	BELOW GATE
LB1	Lambs Canyon	LAMBS
PC1	Parley's Canyon	LAMBS WIER
EC1	Emigration Creek	ABOVE ROTARY
LC1	Little Cottonwood	USF BNDRY
LC3	Little Cottonwood	RED PINE
LC6	Little Cottonwood	BL SNOWB
LC8	Little Cottonwood	PERUVIAN
LC9	Little Cottonwood	SUNNYSIDE
BC1	Big Cottonwood	FS BOUNDARY
BC2	Big Cottonwood	STORM MTN
BC4	Big Cottonwood	L BLANCH
BC5	Big Cottonwood	MILL B
BC8	Big Cottonwood	JORDAN PINES
BC10	Big Cottonwood	SILVER FORK
BC12	Big Cottonwood	SOLITUDE
BC13	Big Cottonwood	BRIGHTON LP
BC14	Big Cottonwood	1ST BRDGE
BC15	Big Cottonwood	2ND BRDGE
BC16	Big Cottonwood	LST HOUSE

Fish Tissue- The Uinta National Forest collected fish tissue samples from 5 sites in the North Fork of American Fork Creek in 1999; North Fork below Tibble Fork, North Fork above Tibble Fork, North Fork above confluence with Major Evans Gulch, North Fork between Pacific Mine and Dutchman Flat, and North Fork above Pacific Mine (Figure 2). Four fish were collected at each site. Brown and Cutthroat trout were collected because they are a naturally reproducing species in the creek and would have the highest potential for long term exposure to contaminants. Muscle tissue samples were collected and analyzed for 21 metals by the Utah State University Toxicology Lab.

Stream Miles-Stream mile estimates for beneficial use support and miles of streams classified were calculated using 1:100,000 digital line graph (DLG) traces stored on the State's Automated Geographic Reference Center's computer and ARC/INFO. Calculations for perennial stream miles using the State's file indicated that there are 1,314 perennial stream miles in the Utah Lake-Jordan River Basin.

Data Analysis-All water quality sample data and field data collected by the DWQ and cooperating agencies were entered into the Division of Water Quality's data base and compared against the State's water quality standards for each of a river or stream's designated beneficial uses (DWQ, 2000). Data from the U.S.G.S. were analyzed using EXCEL spreadsheets and compared against State standards. Bacteriological data were provided to the State in EXCEL spreadsheets and analyses were done using this software.

Specific methods for assessing beneficial use support for the different beneficial use designations assigned to rivers and streams are listed in Chapter VI, Tables VI-1 through VI-4.

Table 4. Monitoring Sites and Cooperating Agencies

STORET No.	Site Description	Agency	STORET No.	Site Description	Agency
499569	DIAMOND FORK AB MONKS HOLLOW	cuwcd	499654	MILL RACE CREEK AT I-15 CROSSING (2 MI S PROVO COURTHOUSE)	int
499571	DIAMOND FORK CREEK ABOVE SIXTH WATER CREEK	cuwcd	499686	NORTH FORK PROVO R AB SUNDANCE RESORT	int
499573	SIXTH WATER CREEK AB / DIAMOND FORK CREEK	cuwcd	499707	LAKE CK AB CNFL / TIMBER CREEK	int
499576	DIAMOND FORK AB / HAWTHORNE CAMPGROUND	cuwcd	499767	MCHENRY CREEK	int
499232	JORDAN R 1100 W 2100 S	int	499846	UPPER S FORK PROVO R AB CNFL / PROVO R	int
499254	MILL CK AB CENTRAL VALLEY WWTP AT 300W	int	591045	SNAKE CK ABOVE GOLF COURSE	int
499297	BIG COTTONWOODK CK AB JORDAN RIVER AT 500 W	int	591283	DEER CK ABOVE TIBBLE FORK RESERVOIR	int
499358	LITTLE COTTONWOOD CK AB JORDAN R AT 600 WEST	int	591352	DANIELS CK AB DEER CK RESERVOIR	int
499409	JORDAN RIVER BL 6400 S AT I 215 XING	int	591355	DANIELS CK AB FIRST DIVERSION	int
499417	JORDAN R AT 7800 S XING AB S VALLEY WWTP	int	591363	PROVO R AB CNFL / SNAKE CK AT MCKELLARS BRIDGE	int
499418	BINGHAM CK AB CNFL / JORDAN RIVER AT 1300 WEST XING	int	591976	SPRING CK AB CNFL / BEER CREEK @8400 S	int
499444	BUTTERFIELD CK AT MOUTH OF CANYON	int	591984	BEER CK AB CNFL/ SPRING CREEK @4800 W	int
499472	JORDAN RIVER AT NARROW - PUMP STATION	int	499678	PROVO RIVER AT MURDOCK DIVERSION	jtac
499498	AMERICAN FORK RIVER AT MOUTH OF CANYON	int	499681	PROVO RIVER AT OLMSTEAD DIVERSION	jtac
499512	LINDON DRAIN AT CO RD XING AB UT LAKE	int	499683	LOWER SOUTH FORK PROVO RIVER	jtac
499532	CURRANT CREEK BL MONA RES AT MOUTH OF CANYON	int	499685	N FK PROVO R AB CNFL / PROVO R AT WILDWOOD	jtac
499535	SALT CREEK AT CANYON MOUTH BL QUARRY	int	499687	LITTLE DEER CK AB CNFL / PROVO RIVER	jtac
499536	SALT CK @ USFS BNDY	int	499730	PROVO R AT MIDWAY CUTOFF RD XING N OF HEBER	jtac
499538	SALT CK AB CNFL / RED CREEK	int	499733	PROVO R AT JORDANELLE ON US40 XING	jtac
499539	HOP CREEK AB CNFL / SALT CREEK	int	499813	PROVO RIVER US89 ALT XING	jtac
499551	PETEETNEET CK AB MAPLE DELL CMPGD	int	591016	SNAKE CK AB CNFL / PROVO R @BOR GAGE	jtac
499554	SUMMIT CK (SANTAQUIN CANON AB OLD NFS BNDY	int	591321	PROVO R BL DEER CREEK RES	jtac
499558	SPANISH FORK R AB UTAH L (LAKESHORE)	int	591346	MAIN CK AB DEER CK RES AT US189 XING	jtac
499560	SPANISH FORK R AT MOARK DIVERSION	int	499088	JORDAN R AT STATE CANAL ROAD XING	lt
499564	DIAMOND FK CK AB SPANIS FK R AT US6 89 XING	int	499182	JORDAN R AT CUDAHY LANE AB S DAVIS S WWTP	lt
499580	THISTLE CK AB THISTLE LAKE	int	499460	JORDAN R AT BLUFFDALE ROAD XING	lt
499581	BENNIE CREEK .9 MILE AB / FOREST BNDRY	int	499479	JORDAN RIVER AT UTAH LAKE OUTLET	lt
499582	NEBO CREEK AT / FOREST BNDRY	int	499579	SPANISH FK R AB CNFL / DIAMOND FK CK	lt
499586	THISTLE CK AT NFS BOUNDARY	int	499840	PROVO R AB WOODLAND AT USGS GAGE NO.10154200	lt
499587	LAKE FORK AT NFS BOUNDARY	int	499195	CITY CK AB FILTRATION PLANT	slc
499588	SOLDIER CREEK AB CNFL / LAKE CREEK	int	499210	RB2 RED BUTTE CK AB RES	slc

499590	SHEEP CREEK AB CNFL / SOLDIER CREEK-FLOW ONLY	int	499214	EMIGRATION CANYON CK AT ROTARY GLEN	slc
499591	DAIRY FORK AB CNFL / SOLDIER CREEK-FLOW ONLY	int	499216	EMIGRATION CANYON CK AT SWITCHBACK	slc
499592	TIE FORK AT MOUTH	int	499217	MT DEL CK @ U65 XING BL LIL DEL	slc
499593	CLEAR CK AB CNFL SOLDIER CK	int	499219	LITTLE DEL CK@ U65 XING AB LIL DEL	slc
499594	STARVATION CK AB CNFL SOLDIER CK	int	499220	PARLEYS CANYON CK @ U65 XING AB DEL	slc
499595	SOLDIER CK AB STARVATION CK	int	499221	LAMBS CANYON CREEK BL I-80 AT WEIR	slc
499610	HOBBLE CK AT I-15 BDG 3MI S OF PROVO	int	499264	MILL CK AT USF BOUNDARY	slc
499613	LEFT FK HOBBLE CK AB RIGH FORK	int	499310	BC1 BIG COTTONWOOD CK AT USFS BOUNDARY	slc
499614	RIGHT FK HOBBLE CK @ CHERRY CMPGD	int	499366	LITTLE COTTONWOOD CK AT FORSEST BNDRY	slc
int	Division of Water Quality Intensive Monitoring Site		cuwcd	Central Utah Water Conservancy Cooperative Monitoring Site	
lt	Division of Water Quality Long term Monitoring Site		jtac	Jordannelle Technical Advisory Committee Cooperative Monitoring Ssite	
slc	Salt Lake City Cooperative Monitoring Site				

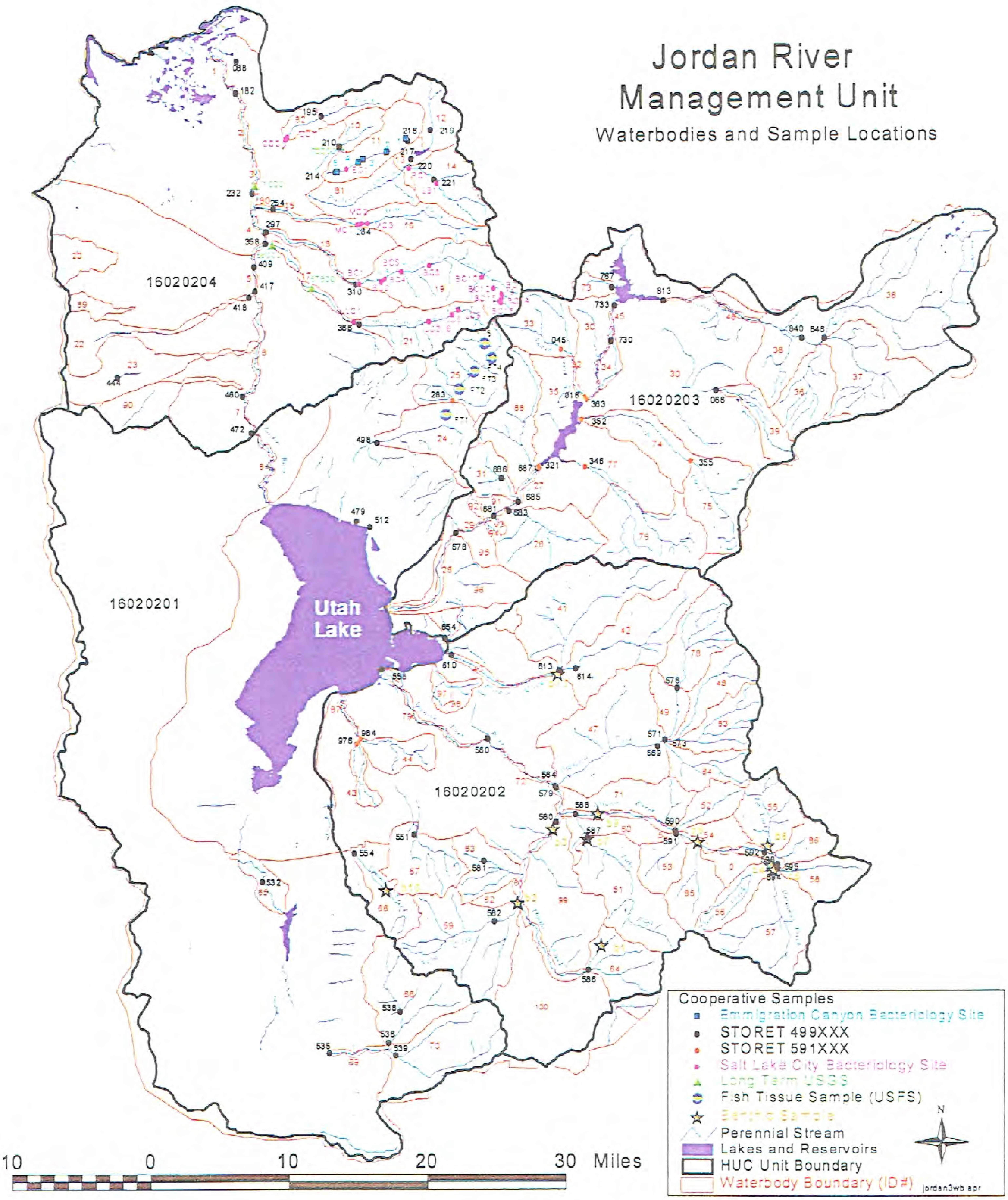

Figure 2. Waterbodies and sampling sites for Utah Lake - Jordan River Watershed water quality assessment.

Results

Beneficial Use Assessment-There are an estimated 1,314 perennial stream miles within the Utah Lake-Jordan River Watershed Management Unit. Some 1,025 miles (78.0%) were assessed for support of their designated beneficial uses. All stream miles designated as Class 2A (contact recreation) waters were assessed using physical/chemical data. Bacteriological data were used to assess 97 miles of streams. Only those segments where bacteriological data were collected are considered fully assessed for Class 2A waters.

Of the1,025 miles assessed, 848 (82.7%) miles were assessed as fully supporting their beneficial uses, 108 (10.6%) miles were assessed as partially supporting, and 68 (6.7%) miles were assessed as not supporting at least one designated beneficial use (Figure 3).

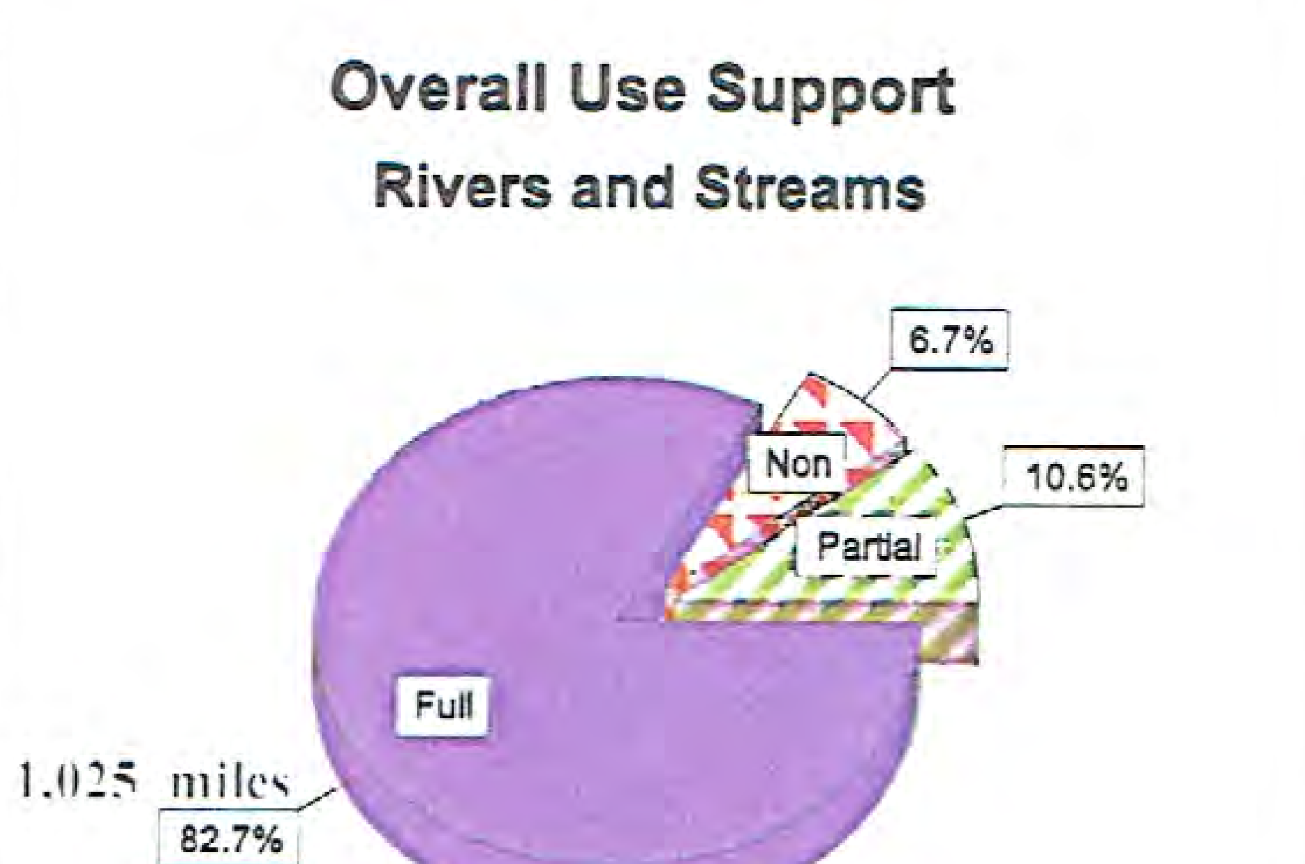

Figure 3. Overall use support for rivers and streams-Jordan River.

Individual beneficial use support is listed in Table 5.

One-thousand twenty-five (1,025) stream miles were assessed for aquatic life use support. This was 81.2% of the estimated stream miles that were classified for this beneficial use.

Of the streams assessed for aquatic life, 854 miles (83.3%) were assessed as fully supporting, 103 miles (10.0%) partially supporting this beneficial use and 68 miles (6.7%) were listed as being non supporting.

Of the 923 stream miles assessed for agricultural use, 899 miles (97.4%) were assessed as fully supporting, 24.2 miles (2.6%) were assessed as partially supporting and no stream miles were assessed as 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.

Beneficial use designations for streams are shown in Figure 4 and the overall beneficial use support is shown in Figure 5.

The causes and sources of impairment are listed in Table 6 and Table 7 respectively. The major causes of impairment were metals, habitat alterations, flow alterations and pH. The percent of miles impacted were 5.0, 4.3, 3.2, and 2.4 percent respectively (Figure 6). The relative contribution of each cause to water quality impairment is shown in Figure 7.

The major sources of impairment were resource extraction, habitat modification, hydromodification, and agricultural activities as shown in Figure 8. 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 9.

A description of the impaired segments and the causes and sources of impairments are listed in Table 8. Figure 6 identifies segments that have elevated levels of total phosphorus.

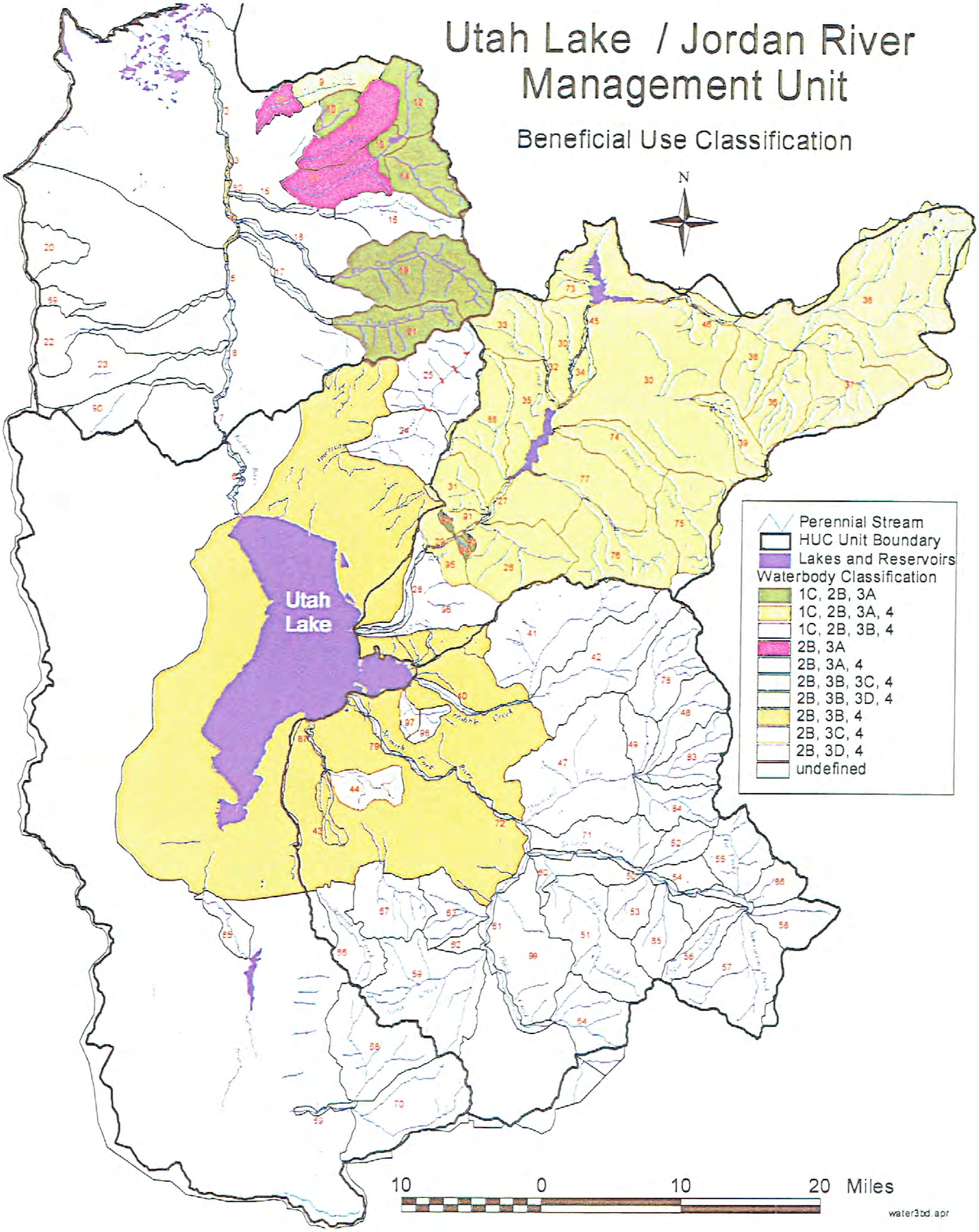

Figure 4. Beneficial use classification designations in the Utah Lake-Jordan River Watershed Management Unit.

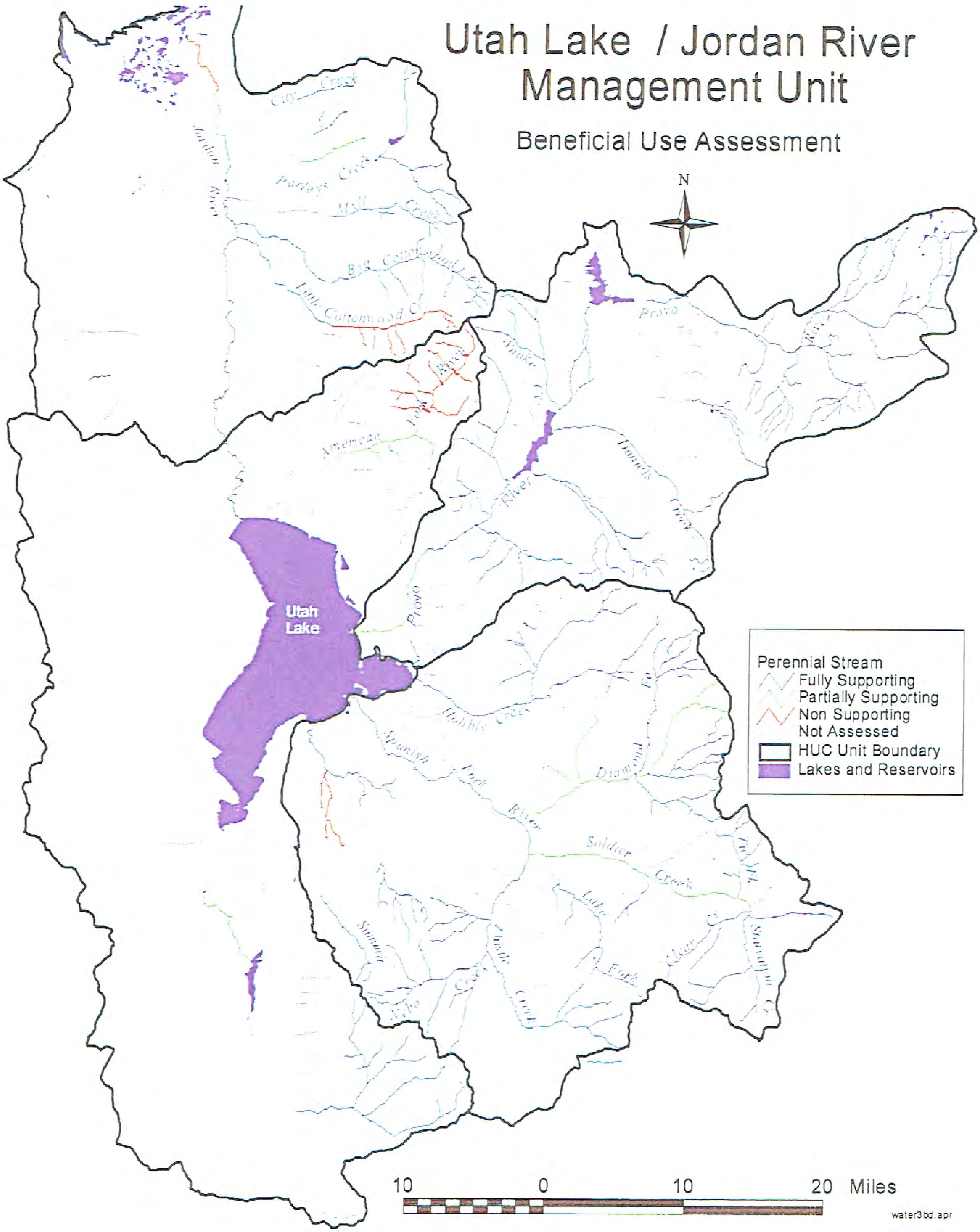

Figure 5. Overall beneficial use support in the Utah Lake-Jordan River Watershed Management Unit.

Jordan River - Three segments of the Jordan were assessed as not supporting at their aquatic life beneficial use support designation. Low dissolved oxygen concentration in two stream segments from Farmington Bay upstream to North Temple violated the dissolved oxygen standards for the aquatic life beneficial use and the Jordan River from Bluffdale to the Narrows exceeded the temperature standard for a Class 3A water (cold water game fish).

Urban storm-water runoff is considered a significant source of organic loading that creates a large oxygen demand in the lower parts of the Jordan River that causes the oxygen level in the stream not to meet State standards. A proposed Nonpoint Source Project, if approved, will evaluate the BOD demand from Farmington Bay upstream to Utah Lake to determine what inputs are occurring that could be causing the low dissolved oxygen concentrations in the lower portion of the river.

Emigration Creek - Emigration Creek was assessed as partially supporting its contact recreation beneficial use designation (Class 2B) after evaluating the bacteriological data provided by Salt Lake County.

Parleys Canyon Creek - Parleys Canyon Creek from 1300 East to Mountain Dell Reservoir has been assessed as not supporting its Class 3A designation because of hydromodification caused by the interstate highway. This segment is a candidate for being assigned a new beneficial use classification because of the road and the inability to correct this situation.

Mill Creek - The upper portion of Mill Creek was assessed as supporting its Class 3A beneficial use and a request to remove it was made in the 2002 303(d) list submission.

Little Cottonwood Creek - Little Cottonwood and its tributaries were assessed as being impaired by zinc in a portion of Little Cottonwood Creek upstream from the Metropolitan Waste Water Treatment Plant to headwaters. A TMDL, addressing the zinc problem, was submitted to EPA on April 1, 2002. If it is approved, this stream segment will be removed from the 303(d) list.

Big Cottonwood Creek - All segments of Big Cottonwood Creek and its tributaries were assessed as meeting their beneficial uses.

American Fork River - Based upon the fish tissue data collected by the U.S.F.S., a fish consumption advisory for arsenic was issued by the State Department of Environmental Quality, the Department of Health and the Utah County Health Department for the North Fork American Fork River upstream from Tibble Fork Reservoir (Appendix VI-2, Figure VI-1). This health advisory resulted in that portion of the river being listed as impaired. The lower portion of the American Fork River exceeded the State Standard of 9.0 for pH.

Provo River - All segments of the Provo River, with the exception of the river from Utah Lake to the Murdock Diversion, were assessed as meeting their beneficial uses. The lower segment was in violation of the pH standard. The source of this violation is unknown, but is thought to be related to algal growth in this section of the river.

Diamond Fork River - Diamond Fork River and its tributary Sixth Water Creek were determined to be impaired by flow alterations and habitat alterations. The source of these impairments is caused by hydromodification when the water is discharged from the tunnel from Strawberry Reservoir. The project to divert this water down the canyon via a pipeline to the Spanish Fork River should help alleviate these problems.

Soldier Creek - The only other segment in the Spanish Fork drainage that was assessed as impaired was Soldier Creek from its confluence with Thistle Creek to its confluence with Starvation Creek. The impairment was caused by sediment and total phosphorus. Water chemistry data, sediment data, and benthic macroinvertebrate data collected by Dr. Lawrence Gray, was used to make this assessment. Benthic macroinvertebrate data were compared with sites on Hobble Creek, Summit Creek, and Thistle Creek to help make this determination. Graphical plots of number of taxa versus sediment particle size were also used. In addition, field surveys were made by DWQ, Natural Resource Conservation Service, and the Utah Division of Wildlife Resources to evaluate the percent of cut banks and sediment deposition. This segment was then listed under the narrative standard based upon weight of evidence.

Currant Creek - Current Creek, downstream from Mona Reservoir to the mouth of Goshen Canyon was listed as impaired because of temperature violations. The reason for these violations is not known.

All other stream segments assessed in the Utah Lake-Jordan River Watershed Management Unit were meeting the criteria for their beneficial use designations. Table VI-9 list those segments that were meeting their beneficial use standards, but because of elevated levels of phosphorus, these segments will need to be evaluated further. Through this evaluation, those needing additional work such as diurnal dissolved oxygen data, benthic macroinvertebrate data, and periphyton data will be identified.

Table 5. Individual Use Support Summary for the Utah Lake - Jordan River Watershed Management Unit (Stream Miles).

Goals [a]	Use	Size Assessed	Size Fully Supporting	Size Fully Supporting but Threatened	Size Partially Supporting	Size Not Supporting	Size Not Attainable
Protect & Enhance Ecosystems	Aquatic Life	1,025.2	854.1 (83.3%)	0.0 (0.0%)	108.3. (10.0%)	68.4 (6.7%)	0.0 (0.0%)
Protect & Enhance Public Health	Fish Consumption	5.6	0.0 (0.0%)	0.0 (0.0%)	0.0 (0.0%)	5.6 (100%)	0.0 (0.0%)
	Swimming [b]	111.5	81.7 (73.3%)	0.0 (0.0%)	29.8 (26.7%)	0.0 (0.0%)	0.0 (0.0%)
	Secondary Contact	111.5	81.7 (73.3%)	0.0 (0.0%)	29.8 (26.7%)	0.0 (0.0%)	0.0 (0.0%)

	Drinking Water	402.6	402.6 (100%)	0.0 (0.0%)	0.0 (0.0%)	0.0 (0.0%)	0.0 (0.0%)
Social and Economic	Agricultural	923.2	899.0 (97.4%)	0.0 (0.0%)	24.0 (2.6%)	0.0 (0.0%)	0.0 (0.0%)
	Total	1,025.4	848.5 (82.7%)	0.0 (0.0%)	108.3 (10.6%)	68.4 (6.7%)	0.0 (0.0%)

a - These goals are part of the national water quality goals adopted by the EPA Office of Water and the ITFM in their Environmental Goals and Indicators effort.

b - Class 2B (secondary contact) streams were evaluated as swimmable for proposes of the CWA goals, therefore the swimming and secondary contact classification categories are the same.

Table 6. Stream Miles Impaired by Various Causes within the Utah Lake - Jordan River Water Quality Management Unit.

Cause Category	Contribution to Impairments	
	Major	Moderate/Minor
Cause unknown	0.0	0.0
Unknown toxicity	0.0	0.0
Pesticides	-	-
Priority organics	-	-
Nonpriority organics	-	-
Metals	50.9	0.0
Ammonia	0.0	0.0
Chlorine	0.0	0.0
Other inorganics	0.0	0.0
Nutrients	0.0	18.5
pH	0.0	24.2
Siltation/Sediments	0.0	18.5
Organic Enrichment/low DO	6.1	4.5
Salinity/TDS/Chlorides	0.0	0.0
Thermal modifications	11.4	11.7
Flow alterations	0.0	32.4
Other habitat alterations	0.0	43.7
Pathogen Indicators	0.0	5.6
Radiation	-	-
Oil and grease	0.0	0.0
Taste and odor	-	-
Noxious aquatic plants	-	-
Total toxics	0.0	0.0
Turbidity	0.0	0.0
Exotic species	-	-
Other (specify)	0.0	0.0

* = Category not applicable.
- = Category applicable, no data available.
0 = Category applicable, but size of waters in the category is zero.

Table 7. Stream Miles Impaired by Various Source Categories in the Utah Lake-Jordan River Watershed Management Unit

Source Category	Contribution to Impairments	
	Major	Moderate/Minor
Industrial Point Sources	0.0	10.6
Municipal Point Sources	0.0	10.6
Combined Sewer Overflow	-	-

Table 7. Stream Miles Impaired by Various Source Categories in the Utah Lake-Jordan River Watershed Management Unit		
Source Category	Contribution to Impairments	
	Major	Moderate/Minor
Agriculture	0.0	38.5
Silviculture	0.0	0.0
Construction	0.0	0.0
Urban Runoff/Storm Sewers	0.0	5.6
Resource Extraction	50.9	0.0
Land Disposal	0.0	0.0
Hydromodification	0.0	38.5
Habitat Modification	0.0	43.7
Marinas	-	-
Atmospheric Deposition	-	-
Contaminated Sediments	-	-
Unknown Source	11.4	35.9
Natural Sources	5.6	5.6
Reservoir Releases	0.0	0.0
Recreation	0.0	0.0

* = Category not applicable.
- = Category applicable, no data available.
0 = Category applicable, but size of waters in the category is zero.
Note: Major category is now used only for waters found not supporting.

Table 8. Impaired Stream Segments in the Utah Lake - Jordan River Watershed

Polygon No	Waterbody ID	Name	Description	Stream Miles	Beneficial Use Class	Beneficial Use Support	Cause	Impact of Cause	Source	Impact of Source
24	UT16020201-001	American Fork River-1	American Fork River and tributaries from Diversion at mouth of Canyon to Tibble Fork Res	14.0	2B	PS	pH	Moderate	Unknown	Moderate
24	UT16020201-001	American Fork River-1	American Fork River and tributaries from Diversion at mouth of Canyon to Tibble Fork Res	14.0	3A	PS	pH	Moderate	Unknown	Moderate
24	UT16020201-001	American Fork River-1	American Fork River and tributaries from Diversion at mouth of Canyon to Tibble Fork Res	14.0	4	PS	pH	Moderate	Unknown	Moderate
25	UT16020201-002	American Fork River-2	American Fork River and other tributaries above Tibble Fork Dam	30.8	3A	NS	Arsenic	Moderate	Resource Extraction	Major
65	UT16020201-003	Currant Creek	Current Creek from mouth of Gohsen Canyon to Mona Reservoir	7.6	3A	PS	Temperature	Moderate	Unknown	Moderate
47	UT16020202-006	Diamond Fork-1	Diamond Fork Creek from confluence w/ Spanish Fork River to Sixth Water confluence-tribs	20.0	3A	PS	Riparian Habitat Alteration	Moderate	Hydromodification	Moderate
47	UT16020202-006	Diamond Fork-1	Diamond Fork Creek from confluence w/ Spanish Fork River to Sixth Water confluence-tribs	20.0	3A	PS	Riparian Habitat Alteration	Moderate	Habitat Modification	Low
47	UT16020202-006	Diamond Fork-1	Diamond Fork Creek from confluence w/ Spanish Fork River to Sixth Water confluence-tribs	20.0	3A	PS	Riparian Habitat Alteration	Moderate	Agriculture	Low
47	UT16020202-006	Diamond Fork-1	Diamond Fork Creek from confluence w/ Spanish Fork River to Sixth Water confluence-tribs	20.0	3A	PS	Flow Alteration	Moderate	Hydromodification	Moderate
47	UT16020202-006	Diamond Fork-1	Diamond Fork Creek from confluence w/ Spanish Fork River to Sixth Water confluence-tribs	20.0	3A	PS	Stream Habitat Alteration	Moderate	Hydromodification	Moderate
48	UT16020202-009	Sixth Water Creek	Sixth Water Creek and tributaries from confluence w/ Diamond Fork Creek to headwaters	13.4	3A	PS	Habitat Alteration	Moderate	Habitat Modification	Moderate
48	UT16020202-009	Sixth Water Creek	Sixth Water Creek and tributaries from confluence w/ Diamond Fork Creek to headwaters	13.4	3A	PS	Habitat Alteration	Moderate	Hydromodification	Moderate
48	UT16020202-009	Sixth Water Creek	Sixth Water Creek and tributaries from confluence w/ Diamond Fork Creek to headwaters	13.4	3A	PS	Flow Alteration	Moderate	Hydromodification	Moderate
50	UT16020202-012	Soldier Creek-1	Soldier Creek from confluence with Thistle Creek to confluence of Starvation Creek	18.5	3A	PS	Sediment	Moderate	Agriculture	Moderate
50	UT16020202-012	Soldier Creek-1	Soldier Creek from confluence with Thistle Creek to confluence of Starvation Creek	18.5	3A	PS	Sediment	Moderate	Hydromodification	Moderate

Table 8. Impaired Stream Segments in the Utah Lake - Jordan River Watershed

Polygon No	Waterbody ID	Name	Description	Stream Miles	Beneficial Use Class	Beneficial Use Support	Cause	Impact of Cause	Source	Impact of Source
50	UT16020202-012	Soldier Creek-1	Soldier Creek from confluence with Thistle Creek to confluence of Starvation Creek	18.5	3A	PS	Total Phosphorus	Moderate	Agriculture	Moderate
50	UT16020202-012	Soldier Creek-1	Soldier Creek from confluence with Thistle Creek to confluence of Starvation Creek	18.5	3A	PS	Total Phosphorus	Moderate	Hydromodification	Moderate
43	UT16020202-026	Spring Creek	Spring Creek and tributaries from confluence w/ Beer Creek to headwaters	11.4	3A	NS	Temperature	Major	Unknown	Major
28	UT16020203-001	Provo River-1	Provo River from Utah Lake to Murdock Diversion	10.2	2B	PS	pH	Moderate	Unknown	Moderate
28	UT16020203-001	Provo River-1	Provo River from Utah Lake to Murdock Diversion	10.2	3A	PS	pH	Moderate	Unknown	Moderate
28	UT16020203-001	Provo River-1	Provo River from Utah Lake to Murdock Diversion	10.2	4	PS	pH	Moderate	Unknown	Moderate
1	UT16020204-001	Jordan River-1	Jordan River from Farmington Bay upstsream 6.3 miles	6.1	3C	NS	Dissolved Oxygen	Major	Municipal Discharge	Moderate
1	UT16020204-001	Jordan River-1	Jordan River from Farmington Bay upstsream 6.3 miles	6.1	3C	NS	Dissolved Oxygen	Major	Urban Runoff	Moderate
1	UT16020204-001	Jordan River-1	Jordan River from Farmington Bay upstsream 6.3 miles	6.1	3C	NS	Dissolved Oxygen	Major	Industrial Discharge	Moderate
2	UT16020204-002	Jordan River-2	Jordan River from 6.3 miles upstream to North Temple	4.5	3B	PS	Dissolved Oxygen	Moderate	Municipal Discharge	Moderate
2	UT16020204-002	Jordan River-2	Jordan River from 6.3 miles upstream to North Temple	4.5	3B	PS	Dissolved Oxygen	Moderate	Urban Runoff	Moderate
2	UT16020204-002	Jordan River-2	Jordan River from 6.3 miles upstream to North Temple	4.5	3B	PS	Dissolved Oxygen	Moderate	Industrial Discharge	Moderate
7	UT16020204-007	Jordan River-7	Jordan River from Bluffdale to Narrows	4.1	3A	PS	Temperature	Moderate	Unknown	Moderate
11	UT16020204-012	Emigration Creek	Emigration Creek and tributaries from Foothill BLVD to headwaters	5.6	2B	PS	Fecal Coliforms	Major	Septic Systems	Moderate
11	UT16020204-012	Emigration Creek	Emigration Creek and tributaries from Foothill BLVD to headwaters	5.6	2B	PS	Fecal Coliforms	Major	Wildlife	Moderate
21	UT16020204-022	Little Cottonwood Creek-2	Little Cottonwood Creek and tributaries form Metropolitan WTP to headwaters	20.1	3A	NS	Zinc	Major	Resource Extraction	Major
81	UT16020204-025	Parley Canyon Creek-1	Parley's Canyon Creek and tributaries from 1300 East to Mountain Dell Reservoir	11.4	3C	PS	Habitat Alteration	Moderate	Habitat Modification	Habitat Modification

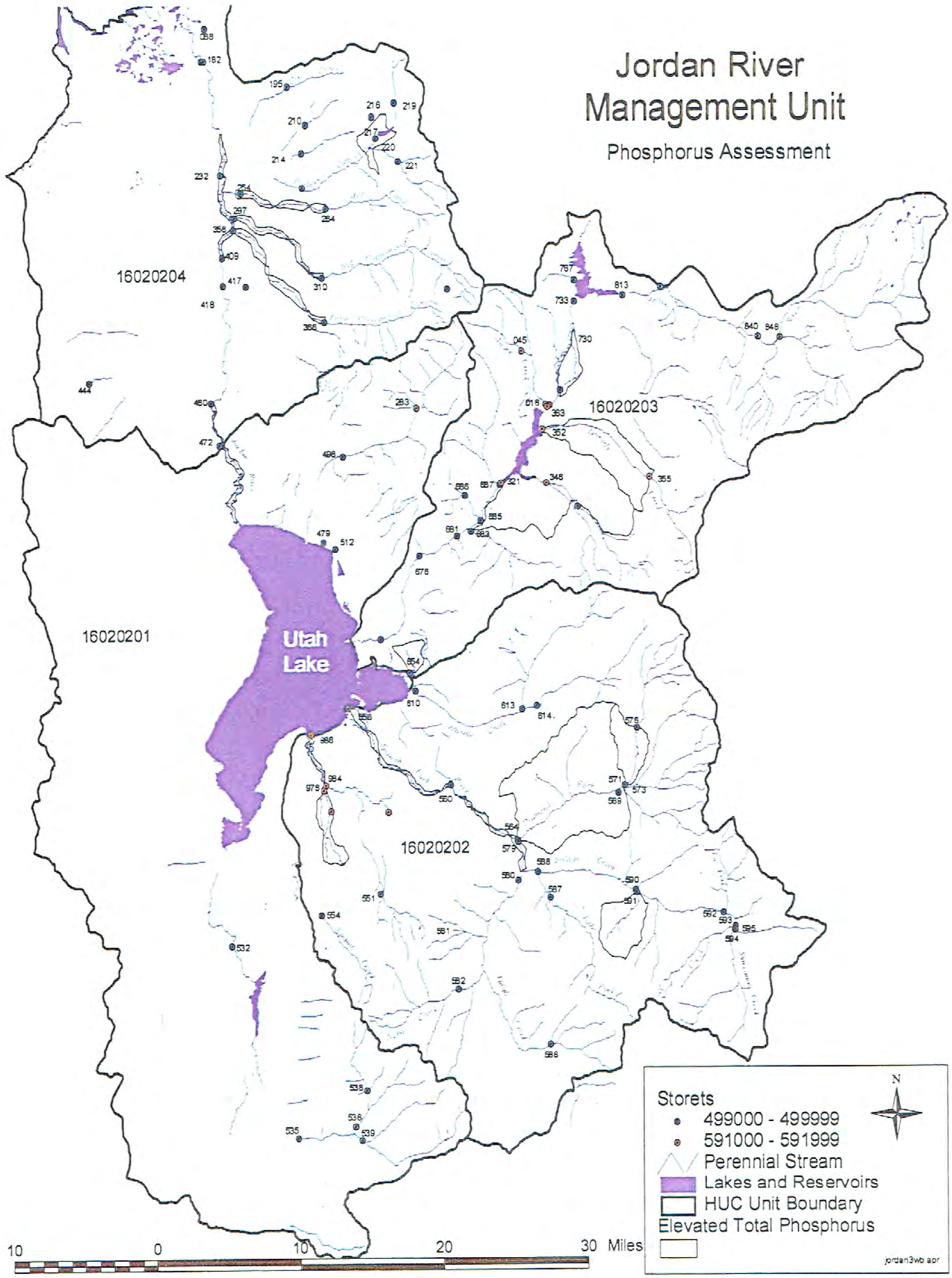

Figure 6. Waterbodies with elevated total phosphorus-Utah Lake Jordan River.

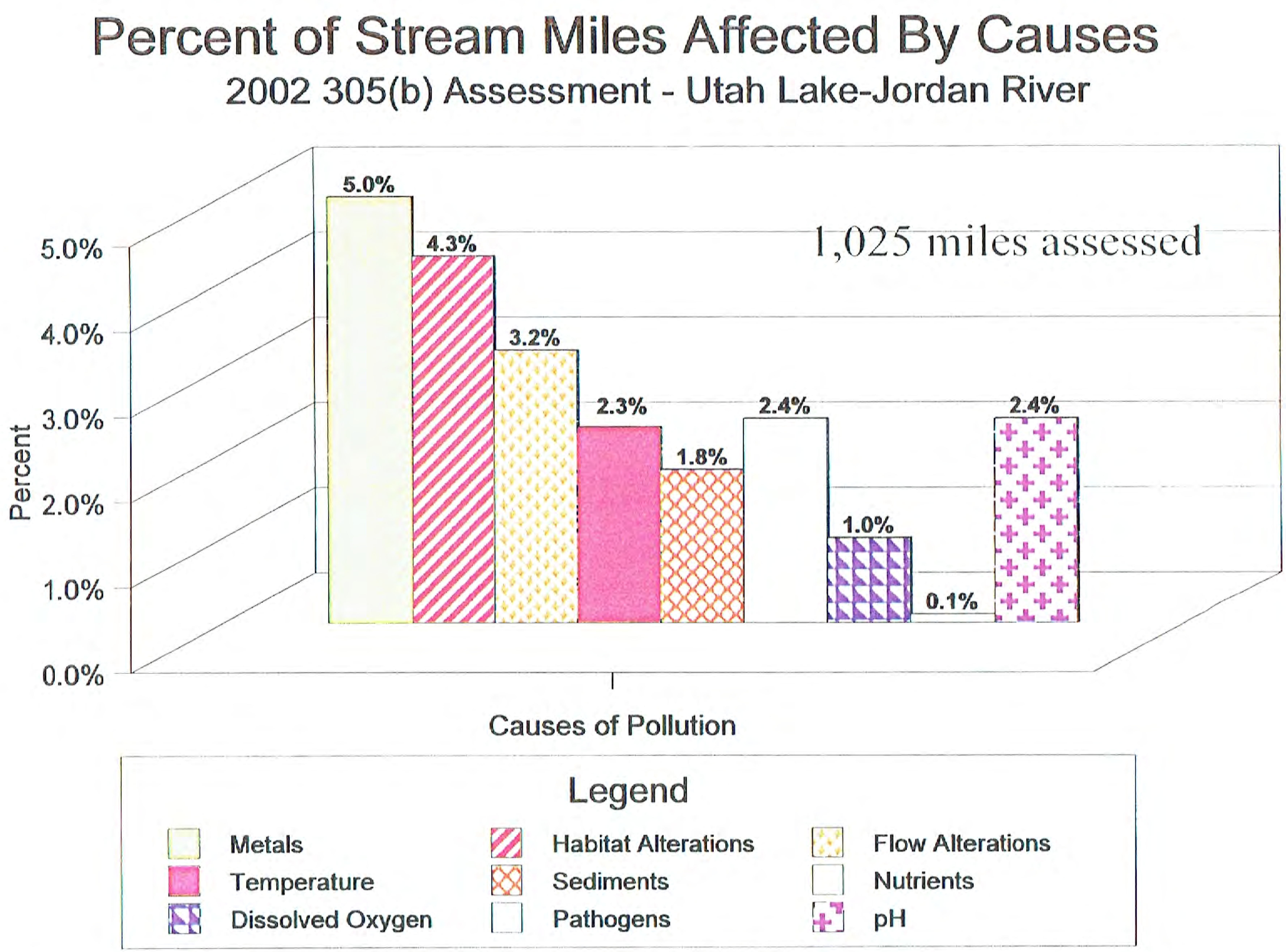

Figure 7. Percent of assessed miles impacted by causes - Utah Lake-Jordan River Watershed Management Unit.

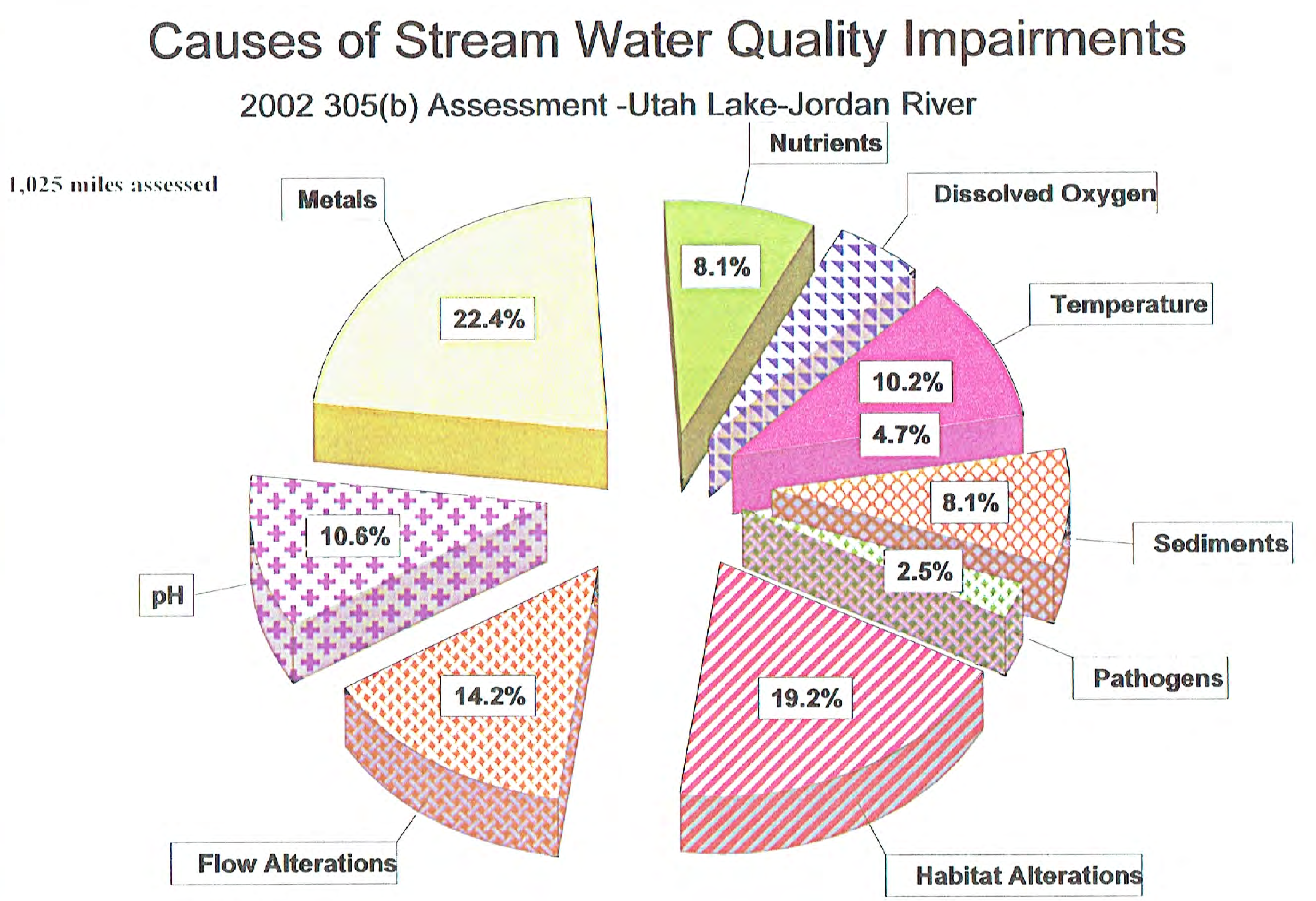

Figure 8. Relative percent contribution by cause to impairment of stream water quality -Utah Lake-Jordan River watershed.

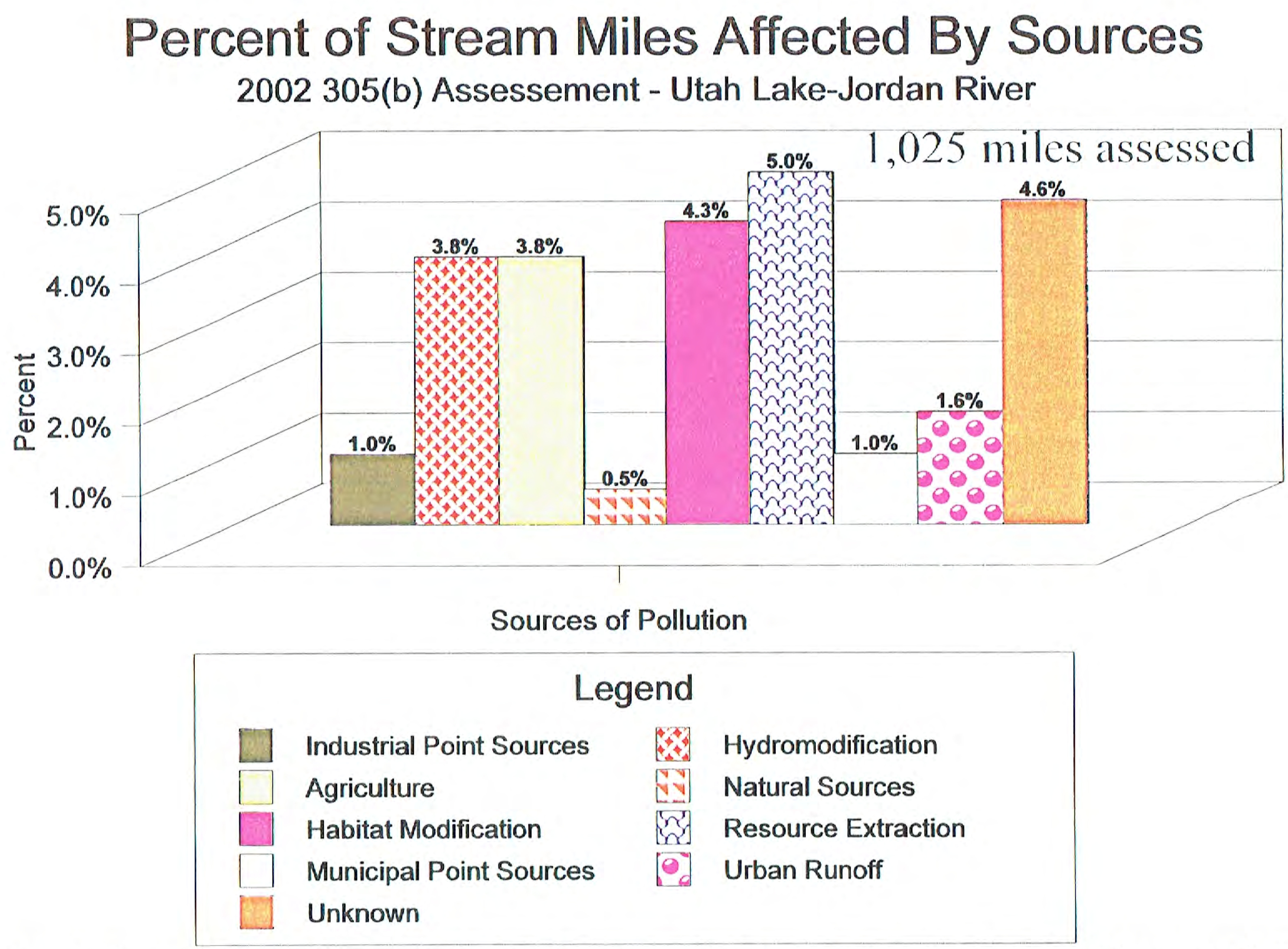

Figure 9. Percent of assessed stream miles impacted by sources - Utah Lake - Jordan River Watershed Management Unit.

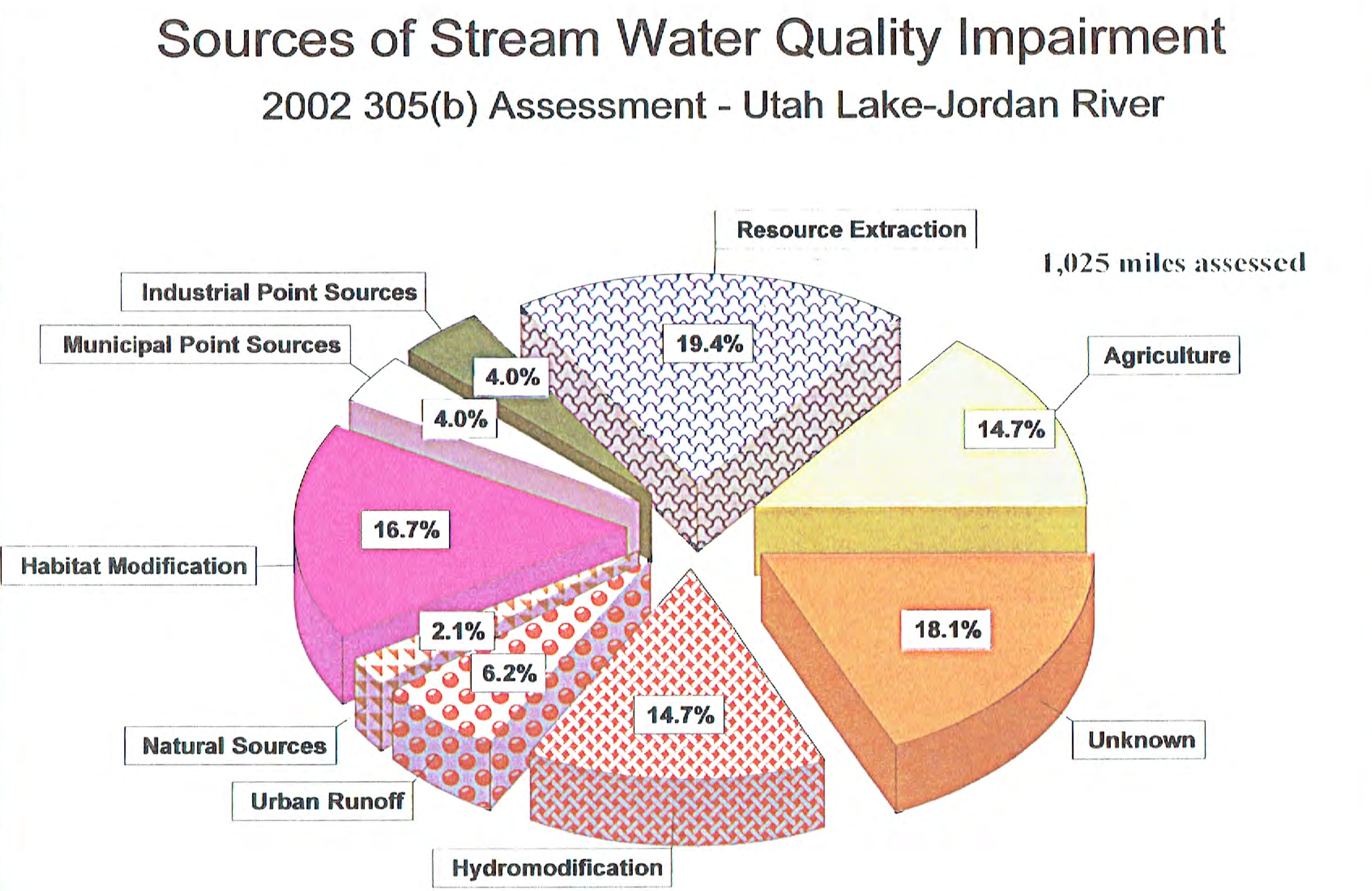

Figure 10. Relative percent contribution of sources to the impairment of stream water quality-Utah Lake-Jordan River watershed.

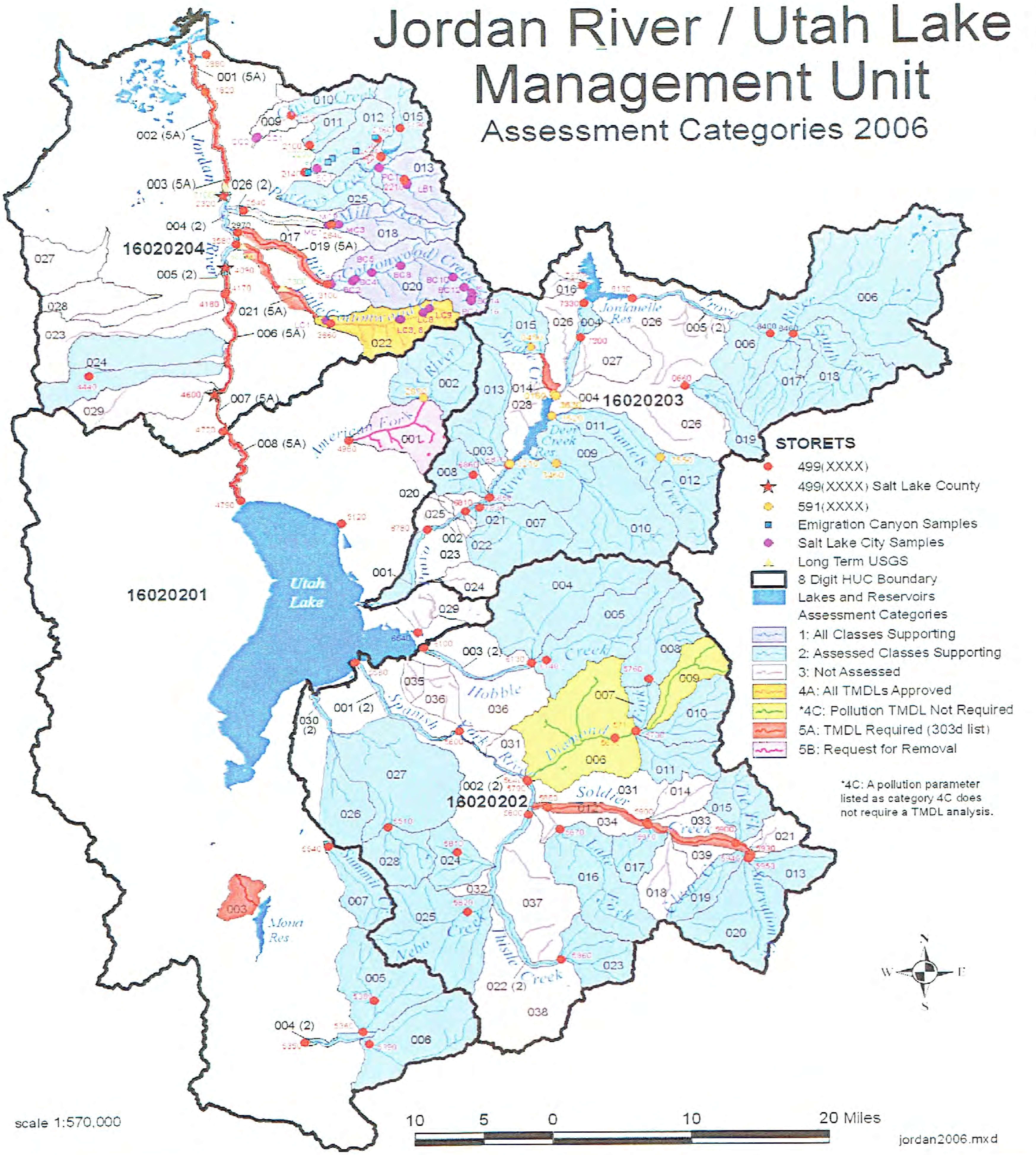

Figure I-5-2. Jordan River beneficial use assessment by categories.

Table I-6-5. Summary of Individual Lake Beneficial Use Support

LAKE DESCRIPTION	ACRES	OVERALL SUPPORT					OVERALL SUPPORT (Acreage)			On 303d List	Conventional Parameters DO, Temp, pH	Assessment Category	Total P > 0.025 mg/L Indicator	TSI >50	Winter DO/ Fish Kills	Cyanophyta present
		1998	2000	2002	2004	2006	FS	PS	NS							
laming Gorge Reservoir	42,020	FS	FS	FS	FS	FS	42020				FS	2				Y
orsyth Reservoir	158	PS	PS	PS	PS	PS		158		X	PS- DO**	5A		Y		N
rantsville Reservoir	88	FS	FS	FS	FS	FS	88				FS	2				Y
unlock Reservoir	266	PS	PS	PS	PS	PS		266		X	PS- DO	5A	Y			Y
unnison Bend Reservoir	706	FS	FS	FS	FS	FS	706				FS	2		Y		N
unnison Reservoir	1,287	PS	FS	FS	FS	FS	1287				FS	2	Y			N
loop Lake	162	FS	FS	FS	FS	FS	162				FS	2				Y
loover Lake	17	FS	FS	FS	FS	FS	17				FS	2				Y
luntington Lake North	225	PS	FS	FS	FS	FS	225				FS	2				N
luntington Reservoir	115	PS	FS	FS	FS	FS	115				FS	2				N
lyrum Reservoir	438	NS	PS	PS	PS	NS		438		X	NS-T	4				N
oes Valley Reservoir	1,183	FS	FS	FS	FS	FS	1183				FS	2				N
ohnson Valley Reservoir	285	PS	PS	PS	PS	PS		285		X	PS- DO	5A	Y	Y	DO	Y
ordanelle Reservoir	3,068	FS	FS	FS	FS	FS	3068				FS	2				N
ens Lake	86	NS	PS	PS	PS	FS		86		TMDL Completed	FS	4				N
ents Lake	26	NS	PS	PS	PS	PS		26		TMDL Completed	PS-DO	4	Y	Y		N
olob Reservoir	335	PS	FS	PS	PS	FS		335			FS	2	Y			
oosharem Reservoir	310	PS	PS	PS	PS	NS		310		X	NS-pH, PS-T	5A	Y	Y		Y
abaron Reservoir	24	NS	NS	NS	NS	PS			24	TMDL Completed	PS-pH*	4			DO	Y
ake Mary	23	PS	FS	FS	FS	FS	23				FS	2				N
ake Powell	162,760	FS	FS	FS	FS	FS	162760				FS	2				ND
ittle Creek Reservoir	65	PS	FS	FS	FS	FS	65				FS	2				Y
ittle Dell Reservoir	249	PS	FS	FS	FS	FS	249				FS	2				Y
loyds Reservoir	104	PS	FS	FS	PS	PS		104			FS	2				Y
ong Park Reservoir	60	FS	FS	FS	FS	FS	60				FS	2				Y
ost Creek Reservoir	52	FS	FS	FS	FS	FS	52				FS	2				N
ower Bowns Reservoir	90	PS	FS	FS	PS	PS		90		X	PS-pH	5A	Y			Y
ower Box Reservoir	50	NS	PS	PS	PS	NS		50		X	NS- DO, pH**	5A	Y	Y		Y
ower Gooseberry Reservoir	57	PS	PS	PS	PS	PS		57		X	PS-pH,DO	5A	Y		DO	Y
yman Lake	27	NS	PS	PS	PS	PS		27		X	PS- DO, pH	5A			DO	Y
lanning Meadow Reservoir	59	NS	PS	PS	PS	PS		59		X	PS- DO	5A	Y	Y	DO/FK	N
lantua Reservoir	554	NS	PS	PS	PS	NS		554		X	NS -pH, PS-T	5B	Y			Y

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Table C-2. Some Stream Segments Designated Uses Are Supported: Insufficient Data To Assess Other Designated Uses.

Watershed Management Unit	Watershed Management Unit	Watershed Management Unit	Watershed Management Unit	Beneficial Use Classes Assessed	Beneficial Use Classes Not Assessed	Stream Miles
Bear River	UT16010101-002	Six Mile Creek	Six Mile Creek from reservoir to headwaters	3A, 4	2B	15.27
Jordan / Utah Lake River	UT16020202-013	Soldier Creek-2	Soldier Creek and tributaries from confluence of Starvation Creek to headwaters	3A, 4	2B	6.45
Jordan / Utah Lake River	UT16020202-015	Tie Fork	Tie Fork and tributaries from confluence w/ Soldier Creek to headwaters	3A, 4	2B	15.44
Jordan / Utah Lake River	UT16020202-016	Lake Fork	Lake Fork and tributaries from USFS Boundary to headwaters	3A, 4	2B	22.33
Jordan / Utah Lake River	UT16020202-017	Dairy Fork	Dairy Fork and tributaries from confluence w/ Soldier Creek to headwaters	3A, 4	2B	5.69
Jordan / Utah Lake River	UT16020202-019	Clear Creek	Clear Creek and tributaries from confluence w/ Soldier Creek to headwaters	3A, 4	2B	12.63
Jordan / Utah Lake River	UT16020202-020	Starvation Creek	Starvation Creek and tributaries from confluence w/ Soldier Creek to headwaters	3A, 4	2B	19.50
Jordan / Utah Lake River	UT16020202-022	Thistle Creek-1	Thistle Creek from confluence with Soldier Creek to confluence with Little Clear Creek	3A, 4	2B	18.28
Jordan / Utah Lake River	UT16020202-023	Thistle Creek-2	Thistle Creek and tributaries from confluence with Little Clear Creek to headwaters	3A, 4	2B	16.82
Jordan / Utah Lake River	UT16020202-024	Bennie Creek	Bennie Creek and tributaries from confluence w/ Thistle Creek to headwaters	3A, 4	2B	13.36
Jordan / Utah Lake River	UT16020202-025	Nebo Creek	Nebo Creek and tributaries from confluence with Thistle Creek to headwaters	3A, 4	2B	36.67
Jordan / Utah Lake River	UT16020202-027	Beer Creek	Beer Creek and tributararies from confluence w/ Spring Creek to headwaters	3C, 4	2B	18.76
Jordan / Utah Lake River	UT16020202-028	Peteetneet Creek	Peteetneet Creek and tributaries from i Maple Dell Campground to headwaters	3A, 4	2B	17.35
Jordan / Utah Lake River	UT16020202-030	Benjamin Slough	Benjamin Sloough from confluence w/Utah Lake to Beer Creek confluence	3B, 4	2B	5.36
Jordan / Utah Lake River	UT16020203-001	Provo River-1	Provo River from Utah Lake to Murdock Diversion	3A, 4	2B	10.26
Jordan / Utah Lake River	UT16020203-002	Provo River-2	Provo River from Murdock Diversion to Olmstead Diversion	1C, 3A, 4	2B	3.66
Jordan / Utah Lake River	UT16020203-003	Provo River-3	Provo River from Olmstead Diversion to Deer Creek Res.	1C, 3A, 4	2B	5.91
Jordan / Utah Lake River	UT16020203-004	Provo River-4	Provo River from Deer Creek Reservoir to Jordanelle Reservoir	1C, 3A, 4	2B	9.54
Jordan / Utah Lake River	UT16020203-005	Provo River-5	Provo River from Jordanelle Reservoir to Woodland	1C, 3A, 4	2B	7.89
Jordan / Utah Lake River	UT16020203-006	Provo River-6	Provo River and tributaries from Woodland to headwaters	1C, 3A, 4	2B	83.39
Jordan / Utah Lake River	UT16020203-007	South Fork Provo River	Lower South Fork Provo River and tributaries from confluence w/ Provo River to headwaters	1C, 3A, 4	2B	20.60
Jordan / Utah Lake River	UT16020203-008	North Fork Provo River	North Fork Provo River and tributaries from confluence w/ Provo River to headwaters	1C, 3A, 4	2B	9.02

Bact. criterion

Utah's 2006 Integrated Report
Volume II: Utah's 303(d) List

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I. INTRODUCTION

Pursuant to Section 303(d) of the Clean Water Act as amended, each State is required to identify those assessment units (AUs) for which existing pollution controls are not stringent enough to implement state water quality standards. Thus, those waters or assessment units (i.e., lakes, reservoirs, rivers, and streams) that are not currently achieving or are not expected to achieve those standards are identified as water quality limited. An assessment unit is considered water quality limited when it is known that its water quality does not meet applicable water quality standards or is not expected to meet applicable water quality standards. Assessment units can be water quality limited due to point sources of pollutants, non point sources of pollutants or both. Examples of pollutants that can cause beneficial use impairment include chemicals for which there are numeric standards (e.g., ammonia, chlorine, organic compounds and trace elements), and pathogens.

Once an AU is identified as water quality limited, the State is to determine the source(s)of the water quality problem and to allocate the responsibility for controlling the pollution. This analysis which the State does to determine the reduction in pollutant loading necessary for that AU to meet water quality standards and support its beneficial uses is called a Total Maximum Daily Load analysis or "TMDL". The result of this process determines (1) the amount of a specific pollutant that an assessment unit can receive with out exceeding a water quality standard or impair a beneficial use, (2) the apportionment of the load to point and nonpoint sources, and (3) a margin of safety. While the term TMDL implies that loading capacity is determined on a daily time scale, TMDLs can range from meeting an instantaneous concentration (e.g., an acute standard) to computing an acceptable annual phosphorus load for a lake or reservoir.

When the State prepares its 303(d) list, it is required to prioritize its assessment units for TMDL development and to identify those AUs that will be targeted for TMDL development within the next two years.

For the 2006 Integrated Report, Utah is using the five-part integrated list for reporting the status of the State's waters (EPA, 2006). One major change from the 2004 Integrated Report report includes the reporting of all completed TMDLs in Category 4A, TMDLs completed and approved by EPA. Other TMDLs in the same AU not completed will be listed on the 2006 303(d) list. Therefore, an AU can be assessed as a Category 4A and 5A water. Waters found to be impaired by "pollutants" are required to have TMDLs developed. Water quality impairments caused by pollution, i.e. habitat alteration, flow alteration, will be listed in Category 4A, impaired, but a TMDL is not required for this type of impairment. The State will continue to add and delete AUs from the 303(d) list by moving them to the correct category according to the procedures outlined in this document. An overview of the five categories and a decision flow diagram are provided later in this report.

The 303(d) list is a dynamic list in which AUs can be added (i.e. new permits are issued, new assessments are made) or removed (i.e. water quality standards are now being met). Information supporting Utah's TMDL list is provided in the subsequent sections of this document. At a minimum, a state's supporting information should include: (1) a description of the methodology used to develop the list; (2) a description of the data and information used to develop the list; (3) the rationale for any decision to not use any information or the rationale for removing AUs previously listed as water quality limited; and (4) a summary of comments received on the list during the state's public comment period. Following an opportunity for public review and comment the State must submit its list to the EPA Regional Administrator by April 1, 2006.The EPA Regional Administrator then has 30 days to approve, conditionally approve, or disapprove a state's listing. If the EPA Regional Administrator disapproves a state's submittal. EPA then has 30 days to develop a list for the state.

II. ASSESSMENT UNIT DELINEATION AND IDENTIFICATION

To assess waters of the State, the Division of Water Quality (DWQ) has delineated lakes, reservoirs, streams, and rivers into discrete units called assessment units (AUs). Lakes and reservoirs have been delineated as individual AUs and the size is reported in acres. Rivers and streams have been delineated by specific river, river or stream reach, or several stream reaches in sub-watersheds. When using sub-watersheds to delineate stream AUs, the new U.S.G.S. 5th (10 digit) and 6th (12 digit) level watershed units for Utah were used to delineate the AUs. These watershed units allow for the aggregation of stream reaches into individual AUs that are hydrologically defined. The watershed units were developed by a group of individuals representing state and federal agencies, and have been certified by the Natural Resource Conservation Service. In delineating river and stream AUs, DWQ followed the guidelines listed below with the first two guideline statements being fixed rules.

1. Each AU is within an eight-digit USGS hydrologic unit (HUC).

2. Each river and stream AU is comprised of stream reaches having the same water quality standards classifications (2B, 1C, 3A,and 4 or 2B, 3B, and 4).

3. Large rivers such as the Green River, Colorado River and portions of other large rivers (Bear River, Weber River, etc), were delineated into "linear" or "ribbon" AUs. Where a major tributary entered these rivers or hydrological features such as dams exist, the river is further delineated into two or more AUs.

4. Tributary rivers and streams were delineated primarily using the 5th and 6th level hydrologic units to define the AUs.

5. Additional AUs were defined by combining or splitting 5th or 6th level watersheds using tributary streams, stream size, and ecological changes such as geology, vegetation, or land use.

6. Small tributary streams to larger streams that could not be incorporated into a watershed unit were combined into separate unique AUs.

These AUs units have been geo-referenced (indexed) to the National Hydrologic Database using a reach-indexing tool that provides the capability of using GIS techniques to display information and data for each AU. Beneficial use classifications and assessments for individual AUs can be mapped or displayed to provide visual representation of assessment results. Individual stream AUs were assigned a unique identification code for indexing which includes the 8-digit hydrological unit (HUC) number with the prefix UT and a 3-digit code to identify each unique AU in a HUC. Lake and reservoir AUs were identified by adding the prefix UT-L- to the 8-digit HUC number and adding a 3-digit code.

Figure 1 illustrates the results of using the above guidelines to delineate and identify AUs. The Weber River was delineated as a linear AU from its confluence with Chalk Creek upstream to the Wanship Dam (UT16020101-017). One AU, UT16020101-011, in the Chalk Creek watershed was delineated by combining two 5th level watershed units located in the South Fork Chalk Creek sub-basin. The first AU, (UT16020101-010), in the Chalk Creek watershed was delineated using the confluence of the South Fork as the upstream point. This necessitated splitting the 5th level watershed unit into two segments. An example of small tributary streams that could not be combined into a hydrological based AU is illustrated by theAU,UT16020101-019. These are very small tributaries and the Weber River is not reflective of their stream order or the habitat that they flow through. Rockport Reservoir (UT-L-16020101-002) and Echo Reservoir (UT16020101-001) are examples of lake and reservoir Aus.

III. Category Definitions for Listing Assessment Units.

For this reporting cycle, assessment units (AUs) will be placed in one of five attainment categories with sub-categories as needed (USEPA, 2006). The methodology for determining whether or not an AU is meeting water quality standards or fully supporting its designated beneficial uses is discussed in Section II. For those AUs for which there are no reliable data, either monitored or evaluated, for a specific designated beneficial use, a designation of **Not Assessed** for that specific beneficial use shall be assigned. For those AUs for which there are no reliable data, either monitored or evaluated, for all criteria for all applicable designated uses, a designation of **Not Assessed** will be assigned to all the designated beneficial uses for that AU.

The determination of use support using methods described in section II and other specified protocols will be combined to determine the overall water quality attainment category for each AU. The unique assessment categories are described as follows:

Category 1. All designated uses are attained. AUs are listed in this category if there are data and information that meet all requirements of the assessment and listing methodology and support a determination of full support for all of an AU's designated beneficial uses.

Category 2. Some of the designated uses are attained, but here is insufficient data to determine beneficial use support for the remaining designated uses. AUs are listed in this category if there are data and information that meet requirements of the assessment and listing methodology to support a determination that some, but not all, uses are attained. Attainment status of the remaining uses is unknown because there is insufficient or no data to assess beneficial use support.

Category 3. Insufficient or no data and information to determine if any designated use is attained. AUs are listed in this category where data or information is not sufficient or does not exist to determine whether any beneficial use is attained following the requirements of the assessment and listing methodology.

Category 4. Impaired for one or more designated uses, but does not require development of a TMDL.

A. TMDL has been completed for any pollutant. AUs are listed in this sub-category when any TMDL(s) has been developed and approved by EPA, that when implemented, are expected to result in full support of the water quality standards or support the designated beneficial uses. Where more than one pollutant is associated with the impairment of an AU, the AU and the parameter(s) that has an approved TMDL will be placed in this category. For those pollutants that still need a TMDL, they will be placed in Category 5.

B. Other pollution control requirements are reasonably expected to result in attainment of the water quality standard in the near future. Consistent with the regulation under 40 CFR, 130.7(b)(I), (ii), and (iii), AUs are listed in this subcategory where other pollution control requirements (e.g., best management practices)required by local, state, or federal authority are stringent enough to meet any water quality standard or support any beneficial use applicable to such waters.

C. The impairment is not caused by a pollutant. Assessment units are listed in this subcategory if the impairment is not caused by a pollutant (e.g., habitat alteration).

Category 5. The water quality standard is not attained and is caused by a pollutant. The AU is found not supporting one or more of its designated beneficial uses as determined by current water quality standards and assessment methodologies. This category constitutes the Section 303(d) list of waters. Category 5 is further delineated into the following sub-categories.

A. A TMDL is underway or scheduled [303(d) list]. AUs are listed in this category if the AU is impaired for one or more designated uses by a pollutant.

B. A request is made to remove one or more pollutants from the 303(d) list. AUs are listed in this category for the following reasons: If the most recent water quality assessment indicates that water quality standards are being met, the AU is listed in this sub-category. If errors in previous assessments or a new delineation of an assessment unit is the cause for meeting water quality standards, the AU is included in this sub-category. If a change in the water quality standards was made and it results in the AU meeting the standard, the AU is listed in this category. UPDES permit renewals for which a letter of approval has not been received were placed in this category. A more detailed list of reasons for removal is provided later in the report.

C. A Utah Pollutant Discharge Elimination System permit renewal TMDL is scheduled to determine discharge limitations that will meet water quality standards or protect designated beneficial uses. Parameters listed with UPDES Permit Renewal TMDLs are effluent limited and the receiving water is not impaired and does not violate water quality standards. Water quality standards may be violated and water quantity impaired if the permitted effluent limits are not met. Assessment units are listed in this category if there is a discharge permit renewal scheduled between April 1, 2006 and March 31, 2008 inclusive.

D. A Lake or Reservoir has been assessed as not meeting standards for one monitoring cycle. The assessment has identified impairment during one of the even or odd year monitoring cycles. If the AU is assessed as impaired during the next assessment period, it will be listed in Category 5A, TMDL required.

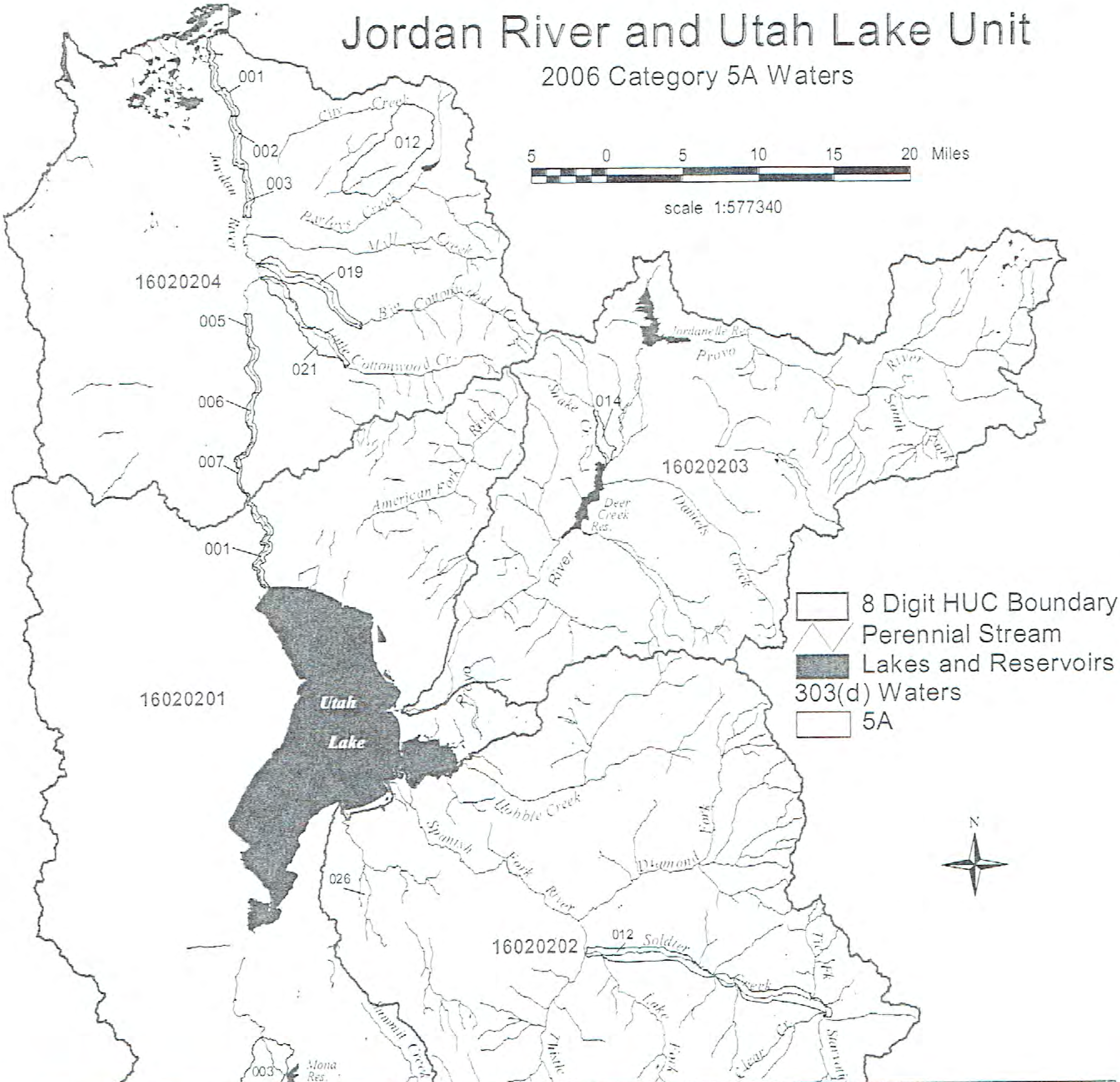
The five categories of reporting were developed by EPA to provide a clearer summary of a state's water quality status and to assist in developing management actions to protect and restore waters of the state to meet water quality standards and support beneficial uses. The decision criteria for determining where an AU is assigned is illustrated in Figure 2. Figure 3 illustrations further decision criteria applied to Category 5 sub-categories.

II. METHODOLOGY FOR DEVELOPING THE 303(d) LIST

The purpose of this section is to describe the methods and decision-making process used to identify and list water quality limited assessment units needing TMDLs, as well as the criteria used to de-list assessment units previously identified in any of the State's previous TMDL lists.

A. Division of Water Quality Programs Involved In Identifying Impaired Waters.

1. Utah Pollutant Discharge Elimination System Program (UPDES)- Any receiving AU (lake, reservoir, river, stream) on which a facility is located that requires a Utah Pollutant Discharge Elimination System discharge permit renewal between April 1, 2006 and March 31, 2008 for pollutants that are not controlled through technology-based requirements or end-of-pipe requirements was listed. The assessment units identified and associated with the UPDES permit dischargers are water quality limited, which means a TMDL is needed to determine proper water quality-based limits to assure water quality standards are maintained or attained. Listing of permittees and pollutants doesn't imply that the receiving water is currently



Assessment Unit	Name	Assessment Unit Description
UT16020201-001	Jordan River-8	Jordan River from Narrows to Utah Lake
UT16020201-003	Currant Creek	Current Creek from mouth of Goshen Canyon to Mona Reservoir
UT16020202-012	Soldier Creek-1	Soldier Creek from confluence with Thistle Creek to confluence of Starvation Creek
UT16020203-014	Snake Creek-1	Snake Creek from confluence w/ Provo River to WMSP Golf Course
UT16020204-001	Jordan River-1	Jordan River from Farmington Bay upstream contiguous with the Davis County line.
UT16020204-002	Jordan River-2	Jordan River from Davis County line upstream to North Temple Street.
UT16020204-003	Jordan River-3	Jordan River from North Temple to 2100 S
UT16020204-005	Jordan River-5	Jordan River from 6400 S to 7800 S
UT16020204-006	Jordan River-6	Jordan River from 7800 S to Bluffdale
UT16020204-007	Jordan River-7	Jordan River from Bluffdale to Narrows
UT16020204-012	Emigration Creek	Emigration Creek and tributaries from Foothill BLVD to headwaters
UT16020204-019	Big Cottonwood Creek-1	Big Cottonwood Creek and tributaries from Jordan River to Big Cottonwood WTP
UT16020204-021	Little Cottonwood Creek-1	Little Cottonwood Creek and tributaries from confluence Jordan River to Metropolitan WTP

Figure 8.Jordan River / Utah Lake Category 5 Assessment units

R317-2-13. Classification of Waters of the State (see R317-2-6).

13.5 Utah Lake-Jordan River Basin

b. Provo River Drainage

Provo River and tributaries, from Utah Lake to Murdock diversion		2B	3A	4
Provo River and tributaries, from Murdock Diversion to headwaters, except as listed below	1C	2B	3A	4
Upper Falls drainage above Provo City diversion	1C	2B	3A	
Bridal Veil Falls drainage above Provo City diversion	1C	2B	3A	
Lost Creek and tributaries above Provo City diversion	1C	2B	3A	

R317-2-6. Use Designations.

The Board as required by Section 19-5-110, shall group the waters of the state into classes so as to protect against controllable pollution the beneficial uses designated within each class as set forth below. Surface waters of the state are hereby classified as shown in R317-2-13.

6.1 Class 1 -- Protected for use as a raw water source for domestic water systems.

a. Class 1A -- Reserved.

b. Class 1B -- Reserved.

c. Class 1C -- Protected for domestic purposes with prior treatment by treatment processes as required by the Utah Division of Drinking Water

6.2 Class 2 -- Protected for recreational use and aesthetics.

a. Class 2A -- Protected for primary contact recreation such as swimming.

b. Class 2B -- Protected for secondary contact recreation such as boating, wading, or similar uses.

6.3 Class 3 -- Protected for use by aquatic wildlife.

a. Class 3A -- Protected for cold water species of game fish and other cold water aquatic life, including the necessary aquatic organisms in their food chain.

b. Class 3B -- Protected for warm water species of game fish and other warm water aquatic life, including the necessary aquatic organisms in their food chain.

c. Class 3C -- Protected for nongame fish and other aquatic life, including the necessary aquatic organisms in their food chain.

d. Class 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.

e. Class 3E -- Severely habitat-limited waters. Narrative standards will be applied to protect these waters for aquatic wildlife.

6.4 Class 4 -- Protected for agricultural uses including irrigation of crops and stock watering.

6.5 Class 5 -- The Great Salt Lake. Protected for primary and secondary contact recreation, waterfowl, shore birds and other water-oriented wildlife including their necessary aquatic organisms in their food chain, and mineral extraction.

R317-2-14. Numeric Criteria.

TABLE 2.14.1
NUMERIC CRITERIA FOR DOMESTIC,
RECREATION, AND AGRICULTURAL USES

Parameter	Domestic Source 1C	Recreation and Aesthetics 2A	Recreation and Aesthetics 2B	Agri-culture 4
BACTERIOLOGICAL (30-DAY GEOMETRIC MEAN) (NO.)/100 ML) (7)				
E. coli	206	126	206	
MAXIMUM (NO.)/100 ML) (7)				
E. coli	940	576	940	
PHYSICAL				
pH (RANGE)	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0
Turbidity Increase (NTU)		10	10	
METALS (DISSOLVED, MAXIMUM MG/L) (2)				
Arsenic	0.01			0.1
Barium	1.0			
Beryllium	<0.004			
Cadmium	0.01			0.01
Chromium	0.05			0.10
Copper				0.2
Lead	0.015			0.1
Mercury	0.002			
Selenium	0.05			0.05
Silver	0.05			
INORGANICS (MAXIMUM MG/L)				
Bromate	0.01			
Boron				0.75
Chlorite	<1.0			
Fluoride (3)	1.4-2.4			
Nitrates as N	10			
Total Dissolved Solids (4)	Irrigation			1200
	Stock Watering			2000
RADIOLOGICAL (MAXIMUM pCi/L)				
Gross Alpha	15			15

Gross Beta	4 mrem/yr
Radium 226, 228 (Combined)	5
Strontium 90	8
Tritium	20000
Uranium	30

ORGANICS
(MAXIMUM UG/L)

Chlorophenoxy Herbicides	
2,4-D	70
2,4,5-TP	10
Methoxychlor	40

POLLUTION
INDICATORS (5)

BOD (MG/L) 5 5 5 Nitrate as N
(MG/L) 4 4
Total Phosphorus as P
(MG/L)(6) 0.05 0.05

FOOTNOTES:

(1) Reserved

(2) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by atomic absorption or inductively coupled plasma (ICP) spectrophotometry.

(3) Maximum concentration varies according to the daily maximum mean air temperature.

TEMP (C)	MG/L
12.0	2.4
12.1-14.6	2.2
14.7-17.6	2.0
17.7-21.4	1.8
21.5-26.2	1.6
26.3-32.5	1.4

(4) Total dissolved solids (TDS) limits may be adjusted if such adjustment does not impair the designated beneficial use of the receiving water. The total dissolved solids (TDS) standards shall be at background where it can be shown that natural or un-alterable conditions prevent its attainment. In such cases rulemaking will be undertaken to modify the standard accordingly.

Site Specific Standards for Total Dissolved Solids (TDS)

Castle Creek from confluence with the Colorado River to Seventh Day Adventist Diversion: 1,800 mg/l;

Cottonwood Creek from the confluence with Huntington Creek to I-57: 3,500 mg/l;

Ferron Creek from the confluence with San Rafael River to Highway 10: 3,500 mg/l;

Gordon Creek from the confluence with Price River to headwaters: 3,800 mg/l;

Huntington Creek and tributaries from the confluence with Cottonwood Creek to U-10: 4,800 mg/l;

Ivie Creek and its tributaries from the confluence with Muddy Creek to U-10: 2,600 mg/l;

Lost Creek from the confluence with Sevier River to U.S. Forest Service Boundary: 4,600 mg/l;

Muddy Creek and tributaries from the confluence with Quitchupah Creek to U-10: 2,600 mg/l;

Muddy Creek from confluence with Fremont River to confluence with Quitchupah Creek: 5,800 mg/l;

North Creek from the confluence with Virgin River to headwaters: 2,035 mg/l;

Onion Creek from the confluence with Colorado River to road crossing above Stinking Springs: 3000 mg/l;

Brine Creek-Petersen Creek, from the confluence with the Sevier River to U-119 Crossing: 9,700 mg/l;

Pinnacle Creek from the confluence with Price River to headwaters: 3,800 mg/l;

Price River and tributaries from the confluence with Coal Creek to Carbon Canal Diversion: 1,700 mg/l;

Price River and tributaries from the confluence with Green River to confluence with Soldier Creek: 3,000 mg/l;

Quitchupah Creek from the confluence with Ivie Creek to U-10: 2,600 mg/l;
Rock Canyon Creek from the confluence with Cottonwood Creek to headwaters: 3,500 mg/l;

San Pitch River from below Gunnison Reservoir to the Sevier River: 2,400 mg/l;

San Rafael River from the confluence with the Green River to Buckhorn Crossing: 4,100 mg/l;

San Rafael River from the Buckhorn Crossing to the confluence with

Huntington Creek and Cottonwood Creek: 3,500 mg/l;

Sevier River between Gunnison Bend Reservoir and DMAD Reservoir: 1,725 mg/l;

Sevier River from Gunnison Bend Reservoir to Clear Lake: 3,370 mg/l;

Virgin River from the Utah/Arizona border to Pah Tempe Springs: 2,360 mg/l

(5) Investigations should be conducted to develop more information where these pollution indicator levels are exceeded.

(6) Total Phosphorus as P (mg/l) indicator for lakes and reservoirs shall be 0.025.

(7) Where the criteria are exceeded and there is a reasonable basis for concluding that the indicator bacteria are primarily from natural sources (wildlife), e.g., in National Wildlife Refuges and State Waterfowl Management Areas, the criteria may be considered attained. Exceedences of bacteriological numeric criteria from nonhuman nonpoint sources will generally be addressed through appropriate Federal, State, and local nonpoint source programs.

TABLE 2.14.2
NUMERIC CRITERIA FOR AQUATIC WILDLIFE

Parameter	Aquatic Wildlife			
	3A	3B	3C	3D
PHYSICAL				
Total Dissolved Gases	(1)	(1)		
Minimum Dissolved Oxygen (MG/L) (2)				
30 Day Average	6.5	5.5	5.0	5.0
7 Day Average	9.5/5.0	6.0/4.0		
1 Day Average	8.0/4.0	5.0/3.0	3.0	3.0
Max. Temperature(C)(3)	20	27	27	
Max. Temperature Change (C)(3)	2	4	4	
pH (Range)	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0
Turbidity Increase (NTU)	10	10	15	15
METALS (4) (DISSOLVED, UG/L)(5)				
Aluminum				
4 Day Average (6)	87	87	87	87
1 Hour Average	750	750	750	750
Arsenic (Trivalent)				
4 Day Average	150	150	150	150
1 Hour Average	340	340	340	340
Cadmium (7)				
4 Day Average	0.25	0.25	0.25	0.25

1 Hour Average	2.0	2.0	2.0	2.0
Chromium (Hexavalent)				
4 Day Average	11	11	11	11
1 Hour Average	16	16	16	16
Chromium (Trivalent) (7)				
4 Day Average	74	74	74	74
1 Hour Average	570	570	570	570
Copper (7)				
4 Day Average	9	9	9	9
1 Hour Average	13	13	13	13
Cyanide (Free)				
4 Day Average	5.2	5.2	5.2	
1 Hour Average	22	22	22	22
Iron (Maximum)	1000	1000	1000	1000
Lead (7)				
4 Day Average	2.5	2.5	2.5	2.5
1 Hour Average	65	65	65	65
Mercury				
4 Day Average	0.012	0.012	0.012	0.012
1 Hour Average	2.4	2.4	2.4	2.4
Nickel (7)				
4 Day Average	52	52	52	52
1 Hour Average	468	468	468	468
Selenium				
4 Day Average	4.6	4.6	4.6	4.6
1 Hour Average	18.4	18.4	18.4	18.4
Silver				
1 Hour Average (7)	1.6	1.6	1.6	1.6
Zinc (7)				
4 Day Average	120	120	120	120
1 Hour Average	120	120	120	120
INORGANICS (MG/L) (4)				
Total Ammonia as N (9)				
30 Day Average	(9a)	(9a)		
1 Hour Average	(9b)	(9b)	(9b)	(9b)
Chlorine (Total Residual)				
4 Day Average	0.011	0.011	0.011	0.011
1 Hour Average	0.019	0.019	0.019	0.019
Hydrogen Sulfide (13) (Undissociated, Max. UG/L)	2.0	2.0	2.0	2.0
Phenol (Maximum)	0.01	0.01	0.01	0.01
RADIOLOGICAL				
(MAXIMUM pCi/L)				
Gross Alpha (10)	15	15	15	15
ORGANICS (UG/L) (4)				
Aldrin				
1 Hour Average	1.5	1.5	1.5	1.5
Chlordane				
4 Day Average	0.0043	0.0043	0.0043	0.0043

1 Hour Average	1.2	1.2	1.2	1.2
4,4' -DDT				
4 Day Average	0.0010	0.0010	0.0010	0.0010
1 Hour Average	0.55	0.55	0.55	0.55
Dieldrin				
4 Day Average	0.056	0.056	0.056	0.056
1 Hour Average	0.24	0.24	0.24	0.24
Alpha-Endosulfan				
4 Day Average	0.056	0.056	0.056	0.056
1 Hour Average	0.11	0.11	0.11	0.11
beta-Endosulfan				
4 Day Average	0.056	0.056	0.056	0.056
1 Day Average	0.11	0.11	0.11	0.11
Endrin				
4 Day Average	0.036	0.036	0.036	0.036
1 Hour Average	0.086	0.086	0.086	0.086
Heptachlor				
4 Day Average	0.0038	0.0038	0.0038	0.0038
1 Hour Average	0.26	0.26	0.26	0.26
Heptachlor epoxide				
4 Day Average	0.0038	0.0038	0.0038	0.0038
1 Hour Average	0.26	0.26	0.26	0.26
Hexachlorocyclohexane (Lindane)				
4 Day Average	0.08	0.08	0.08	0.08
1 Hour Average	1.0	1.0	1.0	1.0
Methoxychlor (Maximum)	0.03	0.03	0.03	0.03
Mirex (Maximum)	0.001	0.001	0.001	0.001
Parathion				
4 Day Average	0.013	0.013	0.013	0.013
1 Hour Average	0.066	0.066	0.066	0.066
PCB's				
4 Day Average	0.014	0.014	0.014	0.014
Pentachlorophenol (11)				
4 Day Average	15	15	15	15
1 Hour Average	19	19	19	19
Toxaphene				
4 Day Average	0.0002	0.0002	0.0002	0.0002
1 Hour Average	0.73	0.73	0.73	0.73
POLLUTION INDICATORS (11)				
Gross Beta (pCi/L)	50	50	50	50
BOD (MG/L)	5	5	5	5
Nitrate as N (MG/L)	4	4	4	
Total Phosphorus as P (MG/L) (12)	0.05	0.05		

FOOTNOTES:

(1) Not to exceed 110% of saturation.

(2) These limits are not applicable to lower water levels in deep impoundments. First number in column is for when early life stages are present, second number is for when all other life stages present.

(3) The temperature standard shall be at background where it can be shown that natural or un-alterable conditions prevent its attainment. In such cases rulemaking will be undertaken to modify the standard accordingly.

Site Specific Standards for Temperature

Ken's Lake: From June 1st - September 20th, 27 degrees C.

(4) Where criteria are listed as 4-day average and 1-hour average concentrations, these concentrations should not be exceeded more often than once every three years on the average.

(5) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by atomic absorption spectrophotometry or inductively coupled plasma (ICP).

(6) The criterion for aluminum will be implemented as follows: Where the pH is equal to or greater than 7.0 and the hardness is equal to or greater than 50 ppm as CaC03 in the receiving water after mixing, the 87 ug/l chronic criterion (expressed as total recoverable) will not apply, and aluminum will be regulated based on compliance with the 750 ug/l acute aluminum criterion (expressed as total recoverable).

(7) Hardness dependent criteria. 100 mg/l used. Conversion factors for ratio of total recoverable metals to dissolved metals must also be applied. In waters with a hardness greater than 400 mg/l as CaC03, calculations will assume a hardness of 400 mg/l as CaC03. See Table 2.14.3 for complete equations for hardness and conversion factors.

(8) Reserved

(9) The following equations are used to calculate Ammonia criteria concentrations:

(9a) The thirty-day average concentration of total ammonia nitrogen (in mg/l as N) does not exceed, more than once every three years on the average, the chronic criterion calculated using the following equations.

Fish Early Life Stages are Present:

$$\text{mg/l as N (Chronic)} = ((0.0577/1+10^{7.688-pH}) + (2.487/1+10^{pH-7.688})) * \text{MIN}(2.85,\ 1.45*10^{0.028*(25-T)})$$

Fish Early Life Stages are Absent:

$$\text{mg/l as N (Chronic)} = ((0.0577/1+10^{7.688-pH}) + (2.487/1+10^{pH-7.688})) * 1.45*10^{0.028*(25-\text{MAX}(T,7))}$$

(9b) The one-hour average concentration of total ammonia nitrogen (in mg/l as N) does not exceed, more than once every three years on the average the acute criterion calculated using the following equations.

Class 3A:

$$\text{mg/l as N (Acute)} = (0.275/(1+10^{7.204-pH})) + (39.0/1+10^{pH-7.204}))$$

Class 3B, 3C, 3D:

$$\text{mg/l as N (Acute)} = 0.411/(1+10^{7.204-pH})) + (58.4/(1+10^{pH-7.204}))$$

In addition, the highest four-day average within the 30-day period should not exceed 2.5 times the chronic criterion. The "Fish Early Life Stages are Present" 30-day average total ammonia criterion will be applied by default unless it is determined by the Division, on a site-specific basis, that it is appropriate to apply the "Fish Early Life Stages are Absent" 30-day average criterion for all or some portion of the year. At a minimum, the "Fish Early Life Stages are Present" criterion will apply from the beginning of spawning through the end of the early life stages. Early life stages include the pre-hatch embryonic stage, the post-hatch free embryo or yolk-sac fry stage, and the larval stage for the species of fish expected to occur at the site. The division will consult with the Division of Wildlife Resources in making such determinations. The Division will maintain information regarding the waterbodies and time periods where application of the "Early Life Stages are Absent" criterion is determined to be appropriate.

(10) Investigation should be conducted to develop more information where these levels are exceeded.

(11) pH dependent criteria. pH 7.8 used in table. See Table 2.14.4 for equation.

(12) Total Phosphorus as P (mg/l) indicator for lakes and reservoirs shall be 0.025.

(13) Formula to convert dissolved sulfide to un-disassociated hydrogen sulfide is: H_2S = Dissolved Sulfide * $e^{((-1.92 + pH) + 12.05)}$

TABLE
1-HOUR AVERAGE (ACUTE) CONCENTRATION OF
TOTAL AMMONIA AS N (MG/L)

pH	Class 3A	Class 3B, 3C, 3D
6.5	32.6	48.8
6.6	31.3	46.8
6.7	29.8	44.6
6.8	28.1	42.0
6.9	26.2	39.1
7.0	24.1	36.1
7.1	22.0	32.8
7.2	19.7	29.5
7.3	17.5	26.2
7.4	15.4	23.0
7.5	13.3	19.9
7.6	11.4	17.0
7.7	9.65	14.4
7.8	8.11	12.1
7.9	6.77	10.1
8.0	5.62	8.40
8.1	4.64	6.95
8.2	3.83	5.72
8.3	3.15	4.71
8.4	2.59	3.88
8.5	2.14	3.20
8.6	1.77	2.65
8.7	1.47	2.20
8.8	1.23	1.84
8.9	1.04	1.56
9.0	0.89	1.32

TABLE
30-DAY AVERAGE (CHRONIC) CONCENTRATION OF
TOTAL AMMONIA AS N (MG/l)

Fish Early Life Stages Present

Temperature, C

pH	0	14	16	18	20	22	24	26	28	30
6.5	6.67	6.67	6.06	5.33	4.68	4.12	3.62	3.18	2.80	2.46
6.6	6.57	6.57	5.97	5.25	4.61	4.05	3.56	3.13	2.75	2.42
6.7	6.44	6.44	5.86	5.15	4.52	3.98	3.50	3.07	2.70	2.37
6.8	6.29	6.29	5.72	5.03	4.42	3.89	3.42	3.00	2.64	2.32
6.9	6.12	6.12	5.56	4.89	4.30	3.78	3.32	2.92	2.57	2.25
7.0	5.91	5.91	5.37	4.72	4.15	3.65	3.21	2.82	2.48	2.18
7.1	5.67	5.67	5.15	4.53	3.98	3.50	3.08	2.70	2.38	2.09
7.2	5.39	5.39	4.90	4.31	3.78	3.33	2.92	2.57	2.26	1.99
7.3	5.08	5.08	4.61	4.06	3.57	3.13	2.76	2.42	2.13	1.87
7.4	4.73	4.73	4.30	3.78	3.32	2.92	2.57	2.26	1.98	1.74
7.5	4.36	4.36	3.97	3.49	3.06	2.69	2.37	2.08	1.83	1.61
7.6	3.98	3.98	3.61	3.18	2.79	2.45	2.16	1.90	1.67	1.47
7.7	3.58	3.58	3.25	2.86	2.51	2.21	1.94	1.71	1.50	1.32
7.8	3.18	3.18	2.89	2.54	2.23	1.96	1.73	1.52	1.33	1.17
7.9	2.80	2.80	2.54	2.24	1.96	1.73	1.52	1.33	1.17	1.03
8.0	2.43	2.43	2.21	1.94	1.71	1.50	1.32	1.16	1.02	0.90
8.1	2.10	2.10	1.91	1.68	1.47	1.29	1.14	1.00	0.88	0.77
8.2	1.79	1.79	1.63	1.43	1.26	1.11	0.97	0.86	0.75	0.66
8.3	1.52	1.52	1.39	1.22	1.07	0.94	0.83	0.73	0.64	0.56
8.4	1.29	1.29	1.17	1.03	0.91	0.80	0.70	0.62	0.54	0.48
8.5	1.09	1.09	0.99	0.87	0.76	0.67	0.59	0.52	0.46	0.40
8.6	0.92	0.92	0.84	0.73	0.65	0.57	0.50	0.44	0.39	0.34
8.7	0.78	0.78	0.71	0.62	0.55	0.48	0.42	0.37	0.33	0.29
8.8	0.66	0.66	0.60	0.53	0.46	0.41	0.36	0.32	0.28	0.24
8.9	0.56	0.56	0.51	0.45	0.40	0.35	0.31	0.27	0.24	0.21
9.0	0.49	0.49	0.44	0.39	0.34	0.30	0.26	0.23	0.20	0.18

TABLE
30-DAY AVERAGE (CHRONIC) CONCENTRATION OF
TOTAL AMMONIA AS N (MG/l)

Fish Early Life Stages Absent

Temperature, C

pH	0-7	8	9	10	11	12	13	14	16
6.5	10.8	10.1	9.51	8.92	8.36	7.84	7.36	6.89	6.06
6.6	10.7	10.1	9.37	9.37	8.79	8.24	7.72	7.24	6.36
6.7	10.5	9.99	9.20	8.62	8.08	7.58	7.11	6.66	5.86
6.8	10.2	9.81	8.98	8.42	7.90	7.40	6.94	6.51	5.72
6.9	9.93	9.31	8.73	8.19	7.68	7.20	6.75	6.33	5.56
7.0	9.60	9.00	8.43	7.91	7.41	6.95	6.52	6.11	5.37
7.1	9.20	8.63	8.09	7.58	7.11	6.67	6.25	5.86	5.15
7.2	8.75	8.20	7.69	7.21	6.76	6.34	5.94	5.57	4.90
7.3	8.24	7.73	7.25	6.79	6.37	5.97	5.60	5.25	4.61
7.4	7.69	7.21	6.76	6.33	5.94	5.57	5.22	4.89	4.30

7.5	7.09	6.64	6.23	5.84	5.48	5.13	4.81	4.51	3.97
7.6	6.46	6.05	5.67	5.32	4.99	4.68	4.38	4.11	3.61
7.7	5.81	5.45	5.11	4.79	4.49	4.21	3.95	3.70	3.25
7.8	5.17	4.84	4.54	4.26	3.99	3.74	3.51	3.29	2.89
7.9	4.54	4.26	3.99	3.74	3.51	3.29	3.09	2.89	2.54
8.0	3.95	3.70	3.47	3.26	3.05	2.86	2.68	2.52	2.21
8.1	3.41	3.19	2.99	2.81	2.63	2.47	2.31	2.17	1.91
8.2	2.91	2.73	2.56	2.40	2.25	2.11	1.98	1.85	1.63
8.3	2.47	2.32	2.18	2.04	1.91	1.79	1.68	1.58	1.39
8.4	2.09	1.96	1.84	1.73	1.62	1.52	1.42	1.33	1.17
8.5	1.77	1.66	1.55	1.46	1.37	1.28	1.20	1.13	0.990
8.6	1.49	1.40	1.31	1.23	1.15	1.08	1.01	0.951	0.836
8.7	1.26	1.18	1.11	1.04	0.976	0.915	0.858	0.805	0.707
8.8	1.07	1.01	0.944	0.885	0.829	0.778	0.729	0.684	0.601
8.9	0.917	0.860	0.806	0.758	0.709	0.664	0.623	0.584	0.513
9.0	0.790	0.740	.694	0.651	0.610	0.572	0.536	0.503	0.442

pH	18	20	22	24	26	28	30
6.5	5.33	4.68	4.12	3.62	3.18	2.80	2.46
6.6	5.25	4.61	4.05	3.56	3.13	2.75	2.42
6.7	5.15	4.52	3.98	3.50	3.07	2.70	2.37
6.8	5.03	4.42	3.89	3.42	3.00	2.64	2.32
6.9	4.89	4.30	3.78	3.32	2.92	2.57	2.25
7.0	4.72	4.15	3.65	3.21	2.82	2.48	2.18
7.1	4.53	3.98	3.50	3.08	2.70	2.38	2.09
7.2	4.41	3.78	3.33	2.92	2.57	2.26	1.99
7.3	4.06	3.57	3.13	2.76	2.42	2.13	1.87
7.4	3.78	3.32	2.92	2.57	2.26	1.98	1.74
7.5	3.49	3.06	2.69	2.37	2.08	1.83	1.61
7.6	3.18	2.79	2.45	2.16	1.90	1.67	1.47
7.7	2.86	2.51	2.21	1.94	1.71	1.50	1.32
7.8	2.54	2.23	1.96	1.73	1.52	1.33	1.17
7.9	2.24	1.96	1.73	1.52	1.33	1.17	1.03
8.0	0.94	1.71	1.50	1.32	1.16	1.02	0.897
8.1	0.68	1.47	1.29	1.14	1.00	0.879	0.733
8.2	0.43	1.26	1.11	0.073	0.855	0.752	0.661
8.3	0.22	1.07	0.941	0.827	0.727	0.639	0.562
8.4	0.03	0.906	0.796	0.700	0.615	0.541	0.475
8.5	0.870	0.765	0.672	0.591	0.520	0.457	0.401
8.6	0.735	0.646	0.568	0.499	0.439	0.396	0.339
8.7	0.622	0.547	0.480	0.422	0.371	0.326	0.287
8.8	0.528	0.464	0.408	0.359	0.315	0.277	0.244
8.9	0.451	0.397	0.349	0.306	0.269	0.237	0.208
9.0	0.389	0.342	0.300	0.264	0.232	0.204	0.179

TABLE 2.14.3a

EQUATIONS TO CONVERT TOTAL RECOVERABLE METALS STANDARD WITH HARDNESS (1) DEPENDENCE TO DISSOLVED METALS STANDARD BY APPLICATION OF A CONVERSION FACTOR (CF).

Parameter	4-Day Average (Chronic) Concentration (UG/L)

CADMIUM $CF * e^{(0.7409\ (In(hardness))\ -4.719}$
$CF = 1.101672 - (In\ hardness)\ (0.041838)$

CHROMIUM III $CF * e^{(0.8190(In(hardness))\ +\ 0.6848}$ $CF = 0.860$

COPPER $CF * e^{(0.8545(ln(hardness))\ -1.702)}$
$CF = 0.960$

LEAD $CF * e^{(1.273(ln(hardness))-4.705)}$
$CF = 1.46203 - (ln\ hardness)(0.145712)$

NICKEL $CF * e^{(0.8460(ln(hardness))+0.0584)}$
$CF = 0.997$

SILVER N/A

ZINC $Cf * e^{(0.8473(ln(hardness))+0.884)}$ $CF = 0.986$

TABLE 2.14.3b

EQUATIONS TO CONVERT TOTAL RECOVERABLE METALS STANDARD WITH HARDNESS (1) DEPENDENCE TO DISSOLVED METALS STANDARD BY APPLICATION OF A CONVERSION FACTOR (CF).

Parameter	1-Hour Average (Acute) Concentration (UG/L)
CADMIUM	$CF * e^{(1.0166(In(hardness))-3.924)}$ $CF = 1.136672 - (ln\ hardness)(0.041838)$
CHROMIUM (III)	$CF * e^{(0.8190(ln(hardness))\ +3.7256)}$ $CF = 0.316$
COPPER	$CF * e^{(0.9422(ln(hardness))-\ 1.700)}$ $CF = 0.960$
LEAD	$CF * e^{(1.273(ln(hardness))-1.460)}$ $CF = 1.46203 - (ln\ hardness)(0.145712)$
NICKEL	$CF * e^{(0.8460(ln(hardness))\ +2.255}$ $CF= 0.998$
SILVER	$CF * e^{(1.72(ln(hardness))-\ 6.59}$ $CF = 0.85$
ZINC	$CF * e^{(0.8473(ln(hardness))\ +0.884}$ $CF = 0.978$

FOOTNOTE:
(1) Hardness as mg/l $CaCO_3$.

TABLE 2.14.4

EQUATIONS FOR PENTACHLOROPHENOL
(pH DEPENDENT)

4-Day Average (Chronic) Concentration (UG/L)	1-Hour Average (Acute) Concentration (UG/L)
$e^{(1.005(pH))-5.134}$	$e^{(1.005(pH))-4.869}$

TABLE 2.14.5
SITE SPECIFIC CRITERIA FOR
DISSOLVED OXYGEN FOR JORDAN RIVER AND SURPLUS CANAL SEGMENTS
(SEE SECTION 2.13)

DISSOLVED OXYGEN:	
May-July	
7-day average	5.5 mg/l
30-day average	5.5 mg/l
Instantaneous minimum	4.5 mg/l
August-April	
30-day average	5.5 mg/l
Instantaneous minimum	4.0 mg/l

TABLE 2.14.6
LIST OF HUMAN HEALTH CRITERIA (CONSUMPTION)

	Chemical Parameter (ug/L) Class 1C	Water and Organism Organism Only (ug/L) Class 3A,3B,3C,3D
Antimony	5.6	640
Arsenic	A	A
Beryllium	C	C
Cadmium	C	C
Chromium III	C	C
Chromium VI	C	C
Copper	1,300	
Lead	C	C
Mercury	A	A
Nickel	100 MCL	4,600
Selenium	A	4,200
Silver		
Thallium	0.24	0.47
Zinc	7,400	26,000
Cyanide	140	140
Asbestos	7 million Fibers/L	
2,3,7,8-TCDD Dioxin	5.0 E -9 B	5.1 E-9 B
Acrolein	190	290
Acrylonitrile	0.051 B	0.25 B
Alachlor	2.0	
Atrazine	3.0	

Benzene	2.2 B	51 B
Bromoform	4.3 B	140 B
Carbofuran	40	
Carbon Tetrachloride	0.23 B	1.6 B
Chlorobenzene	100 MCL	1,600
Chlorodibromomethane	0.40 B	13 B
Chloroethane		
2-Chloroethylvinyl Ether		
Chloroform	5.7 B	470 B
Dalapon	200	
Di(2ethylhexl)adipate	400	
Dibromochloropropane	0.2	
Dichlorobromomethane	0.55 B	17 B
1,1-Dichloroethane		
1,2-Dichloroethane	0.38 B	37 B
1,1-Dichloroethylene	7 MCL	7,100
Dichloroethylene (cis-1,2)	70	
Dinoseb	7.0	
Diquat	20	
1,2-Dichloropropane	0.50 B	15 B
1,3-Dichloropropene	0.34	21
Endothall	100	
Ethylbenzene	530	2,100
Ethylene Dibromide	0.05	
Glyphosate	700	
Haloacetic acids	60 E	
Methyl Bromide	47	1,500
Methyl Chloride	F	F
Methylene Chloride	4.6 B	590 B
Ocamyl (vidate)	200	
Picloram	500	
Simazine	4	
Styrene	100	
1,1,2,2-Tetrachloroethane	0.17 B	4.0 B
Tetrachloroethylene	0.69 B	3.3 B
Toluene	1,000	15,000
1,2 -Trans-Dichloroethylene	100 MCL	10,000
1,1,1-Trichloroethane	200 MCL	F
1,1,2-Trichloroethane	0.59 B	16 B
Trichloroethylene	2.5 B	30 B
Vinyl Chloride	0.025	2.4
Xylenes	10,000	
2-Chlorophenol	81	150
2,4-Dichlorophenol	77	2902,4-Dimethylphenol
380 850		
2-Methyl-4,6-Dinitrophenol	13.0	280
2,4-Dinitrophenol	69	5,300
2-Nitrophenol		
4-Nitrophenol		
3-Methyl-4-Chlorophenol		
Penetachlorophenol	0.27 B	3.0 B
Phenol	21,000	1,700,000
2,4,6-Trichlorophenol	1.4 B	2.4 B
Acenaphthene	670	990

Acenaphthylene		
Anthracene	8,300	40,000
Benzidine	0.000086 B	0.00020 B
BenzoaAnthracene	0.0038 B	0.018 B
BenzoaPyrene	0.0038 B	0.018 B
BenzobFluoranthene	0.0038 B	0.018 B
BenzoghiPerylene		
BenzokFluoranthene	0.0038 B	0.018 B
Bis2-ChloroethoxyMethane		
Bis2-ChloroethylEther	0.030 B	0.53 B
Bis2-ChloroisopropylEther	1,400	65,000
Bis2-EthylhexylPhthalate	1.2 B	2.2 B
4-Bromophenyl Phenyl Ether		
Butylbenzyl Phthalate	1,500	1,900
2-Chloronaphthalene	1,000	1,600
4-Chlorophenyl Phenyl Ether		
Chrysene	0.0038 B	0.018 B
Dibenzoa, hAnthracene	0.0038 B	0.018 B
1,2-Dichlorobenzene	420	1,300
1,3-Dichlorobenzene	320	960
1,4-Dichlorobenzene	63	190
3,3-Dichlorobenzidine	0.021 B	0.028 B
Diethyl Phthalate	17,000	44,000
Dimethyl Phthalate	270,000	1,100,000
Di-n-Butyl Phthalate	2,000	4,500
2,4-Dinitrotoluene	0.11 B	3.4 B
2,6-Dinitrotoluene		
Di-n-Octyl Phthalate		
1,2-Diphenylhydrazine	0.036 B	0.20 B
Fluoranthene	130	140
Fluorene	1,100	5,300
Hexachlorobenzene	0.00028 B	0.00029 B
Hexachlorobutedine	0.44 B	18 B
Hexachloroethane	1.4 B	3.3 B
Hexachlorocyclopentadiene	40	1,100
Ideno 1,2,3-cdPyrene	0.0038 B	0.018 B
Isophorone	35 B	960 B
Naphthalene		
Nitrobenzene	17	690
N-Nitrosodimethylamine	0.00069 B	3.0 B
N-Nitrosodi-n-Propylamine	0.005 B	0.51 B
N-Nitrosodiphenylamine	3.3 B	6.0 B
Phenanthrene		
Pyrene	830	4,000
1,2,4-Trichlorobenzene	35	70
Aldrin	0.000049 B	0.000050 B
alpha-BHC	0.0026 B	0.0049 B
beta-BHC	0.0091 B	0.017 B
gamma-BHC (Lindane)	0.2 MCL	1.8
delta-BHC		
Chlordane	0.00080 B	0.00081 B
4,4-DDT	0.00022 B	0.00022 B
4,4-DDE	0.00022 B	0.00022 B
4,4-DDD	0.00031 B	0.00031 B

Dieldrin	0.000052 B	0.000054 B
alpha-Endosulfan	62	89
beta-Endosulfan	62	89
Endosulfan Sulfate	62	89
Endrin	0.059	0.060
Endrin Aldehyde	0.29	0.30
Heptachlor	0.000079 B	0.000079 B
Heptachlor Epoxide	0.000039 B	0.000039 B
Polychlorinated Biphenyls PCB's	0.000064 B,D	0.000064 B,D
Toxaphene	0.00028 B	0.00028 B

Footnotes:

A. See Table 2.14.2

B. Based on carcinogenicity of 10-6 risk.

C. EPA has not calculated a human criterion for this contaminant. However, permit authorities should address this contaminant in NPDES permit actions using the State's existing narrative criteria for toxics

D. This standard applies to total PCBs.

KEY: water pollution, water quality standards

Date of Enactment or Last Substantive Amendment: June 1, 2005

Notice of Continuation: October 7, 2002

Authorizing, and Implemented or Interpreted Law: 19-5

UTAH'S WATER QUALITY

Water Quality Inventory **Fall 2004**

UDEQ
Division of Water Quality
P.O. Box 144870
288 N. 1460 West
Salt Lake City, UT
84114-4870
www.waterquality.utah.gov

Utah monitors and assesses its surface waters, rivers and streams, and lakes and reservoirs on a regular basis to determine whether they are supporting their beneficial uses. Among other things, these assessments identify impacts from pollution sources so efforts can be taken to protect and improve water quality. A report to Congress on the quality of Utah's waters is also required to be provided to Congress every two years. This fact sheet contains a summary of information in the 2004 Water Quality Assessment Report to Congress.

Year 2004 305(b) Assessment

Water quality standards are established to protect the beneficial uses of the streams, rivers, lakes and reservoirs within the state. Beneficial uses include source of drinking water (Class 1C), and recreation (Classes 2A and 2B). Fishing and other aquatic life classifications include cold water game fish (3A), warm water game fish (3B), non-game fish (3C) and other aquatic life such as waterfowl and shore birds (3D). Waters used for irrigation and stock watering are classified as Class 4. Streams and lakes of the state are classified as one of the above or a combination of them. The quality of water is assessed as "fully supporting" (good to excellent water quality), "partially supporting" (meets the standards most of the time), and "not supporting" (frequently the water quality standards are not met). In addition, individual Assessment Units (AUs) were evaluated and placed in the new beneficial use assessment categories developed by EPA.

In assessing the quality of state waters, scientists look at general water chemistry and for the presence of nutrients and toxicants. Data are compared against state standards and pollution indicators. Stream structure and stream bank habitat may also be used to assess beneficial use support. Since a waterbody may have multiple uses, data collected must meet the criteria for each beneficial use for an assessment unit to be listed as fully supporting. For the most part, the Class 2A and 2B categories (recreation) were not assessed due to the difficulty in meeting quality control requirements for bacteriological samples.

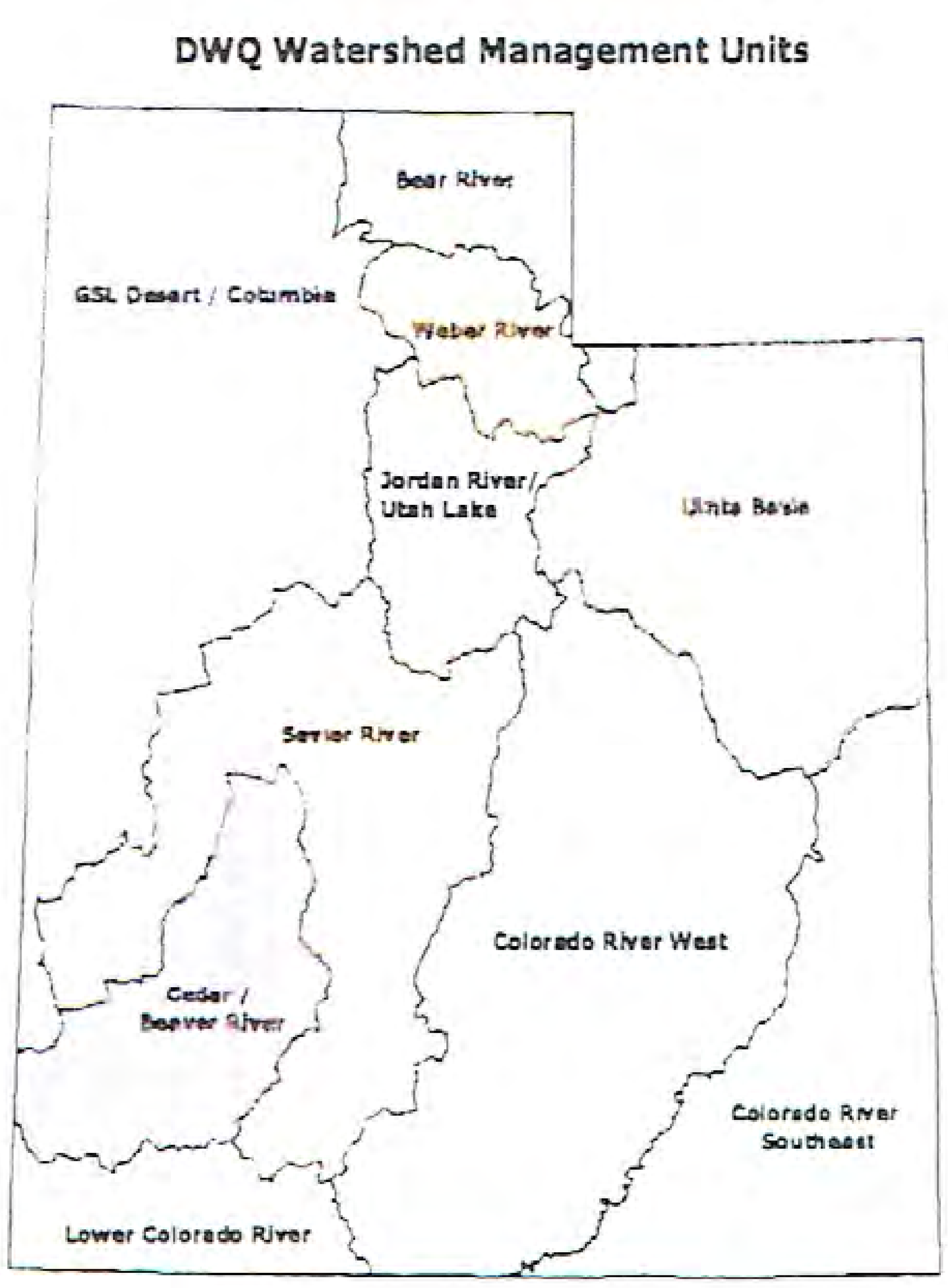


Figure 1. Watershed Management Units.

For the 2004 305(b) report, the statewide assessment consisted of the summary evaluations of six intensive monitoring surveys. The six watershed management units that had new surveys were the Uinta, Sevier River, Colorado River West, Colorado River Southeast, Lower Colorado River and the Cedar / Beaver. These were combined with previous surveys done in the Bear River, Weber River, and the Jordan River/Utah Lake (Figure 1). Some new assessments were made on some stream segments within these latter watershed units and the results their previous assessments were updated to complete the statewide assessment.

Major sources of data used were from the Division of Water Quality and agencies that have cooperative monitoring programs with the Division. These include several U.S. Forest Service national forests and BLM regional offices. Salt Lake City, Central Utah Conservancy District, and the Jordanelle Technical Advisory Committee also had cooperative programs with the Division. Data collected by the United States Geological Survey for the Great Salt Lake Basins NAWQA program were also used in the evaluation.

Rivers and Streams

Utah assessed approximately 10,606 miles of perennial streams. This is 74.4% of the 14,250 perennial stream miles in the state. Of the miles assessed for at least one beneficial use, 74.0% were assessed as fully supporting, 13.5% as partially supporting, and 12.5% as not supporting at least one beneficial use designation (Figure 2).

The majority of streams were not assessed for Class 2B (contact recreation). Therefore, the assessment is primarily based on Class 1C (source of drinking water), aquatic life beneficial uses (3A, 3B, 3C, and 3D), and Class 4 (agriculture use). Table 1 lists individual beneficial use class support.
The major causes of water quality impairment are total dissolved solids, nutrients, sediments, and stream habitat alterations (Figure 3). Stream habitat alterations include riparian habitat and in-stream habitat. Because riparian habitat and in-stream habitat are defined as **'pollution'** and not a pollutant, no TMDL is required for this causes of stream impairment. However, implementation of best management practices (BMPs) need to be implemented to restore the stream habitat. The major sources of pollutants are agriculture, natural sources, hydrological modification, and habitat modification (Figure 4).

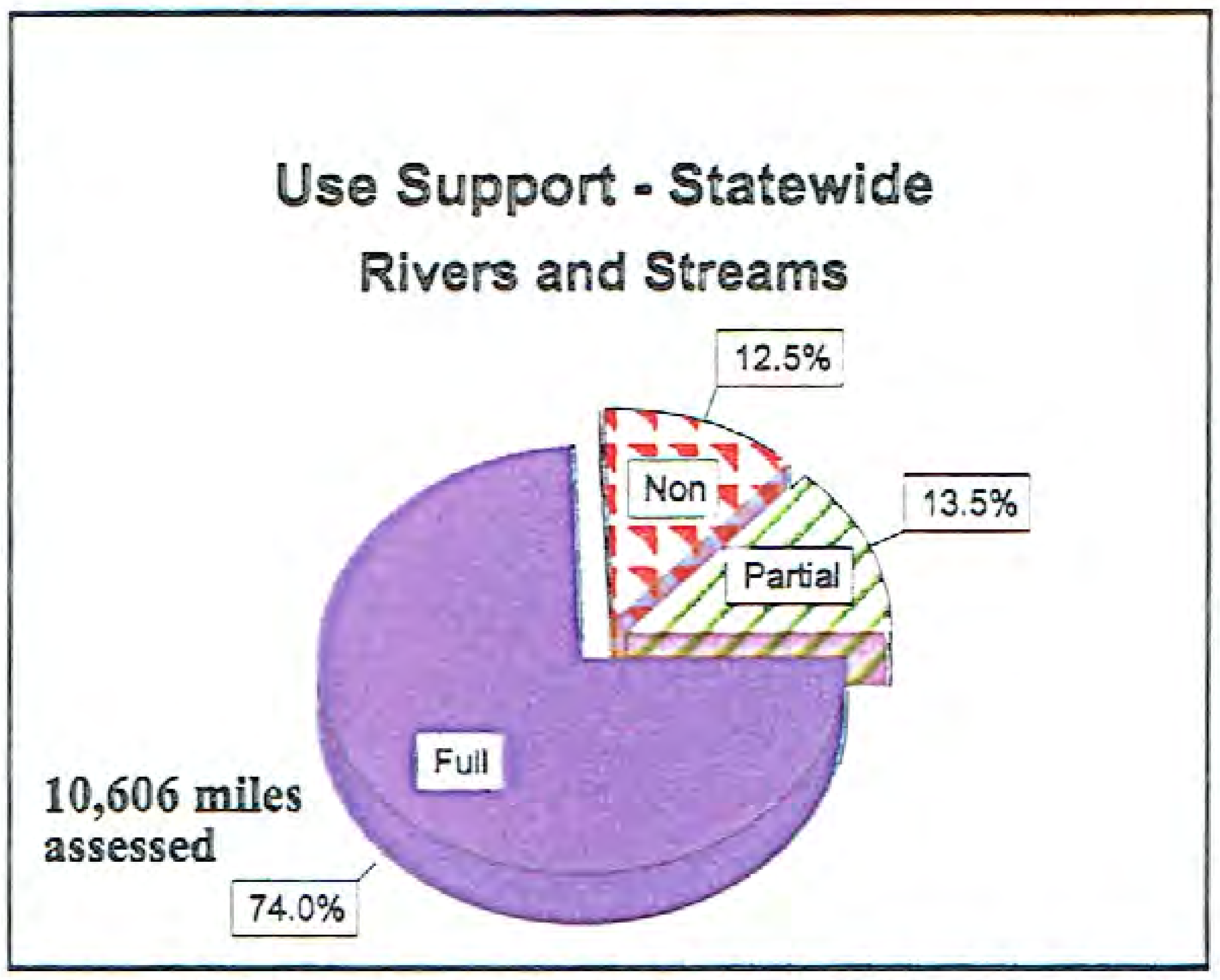


Figure 2. Statewide use support for rivers and streams based upon at least one beneficial use being assessed.

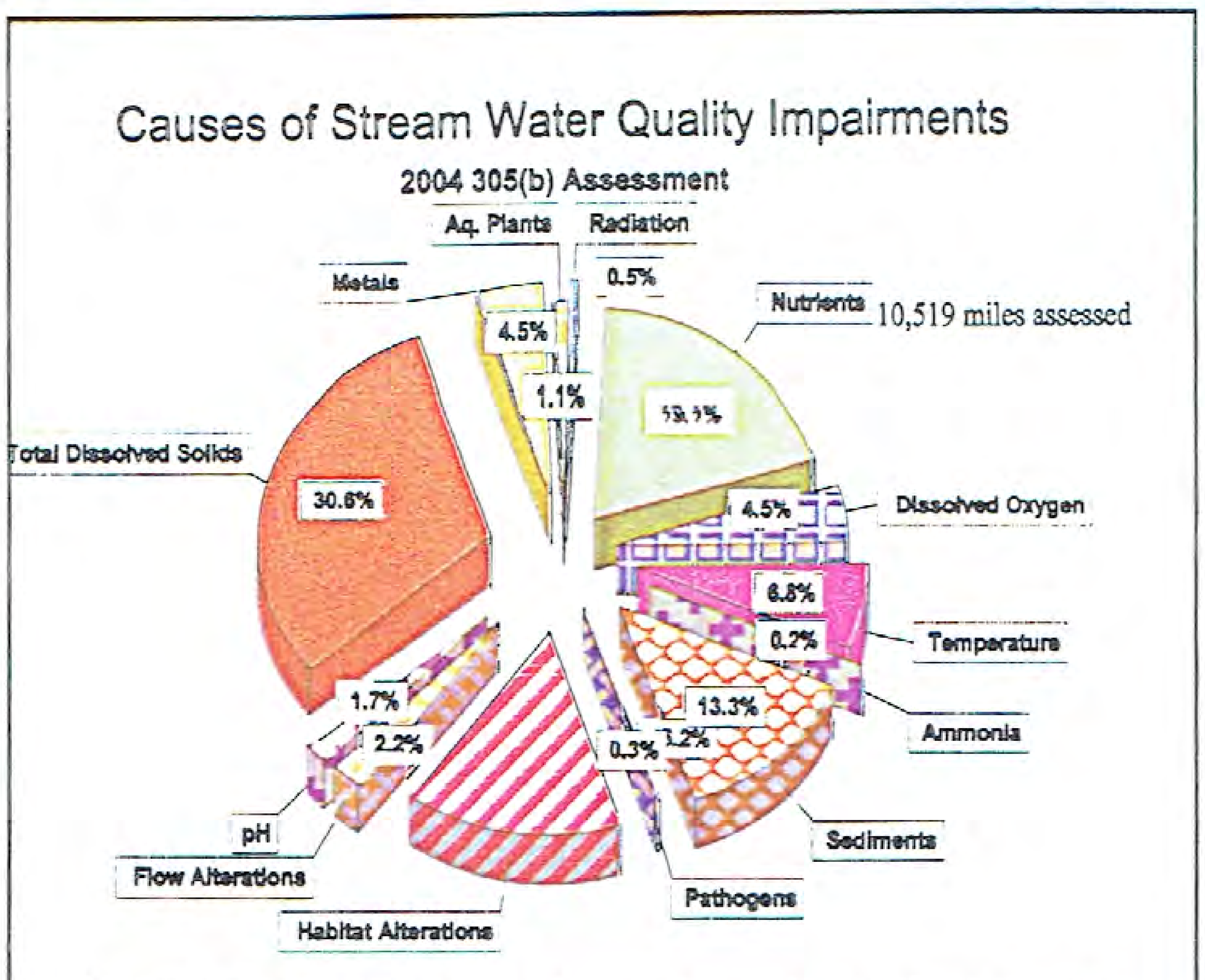


Figure 3. Relative contribution of causes to impairment of water quality.

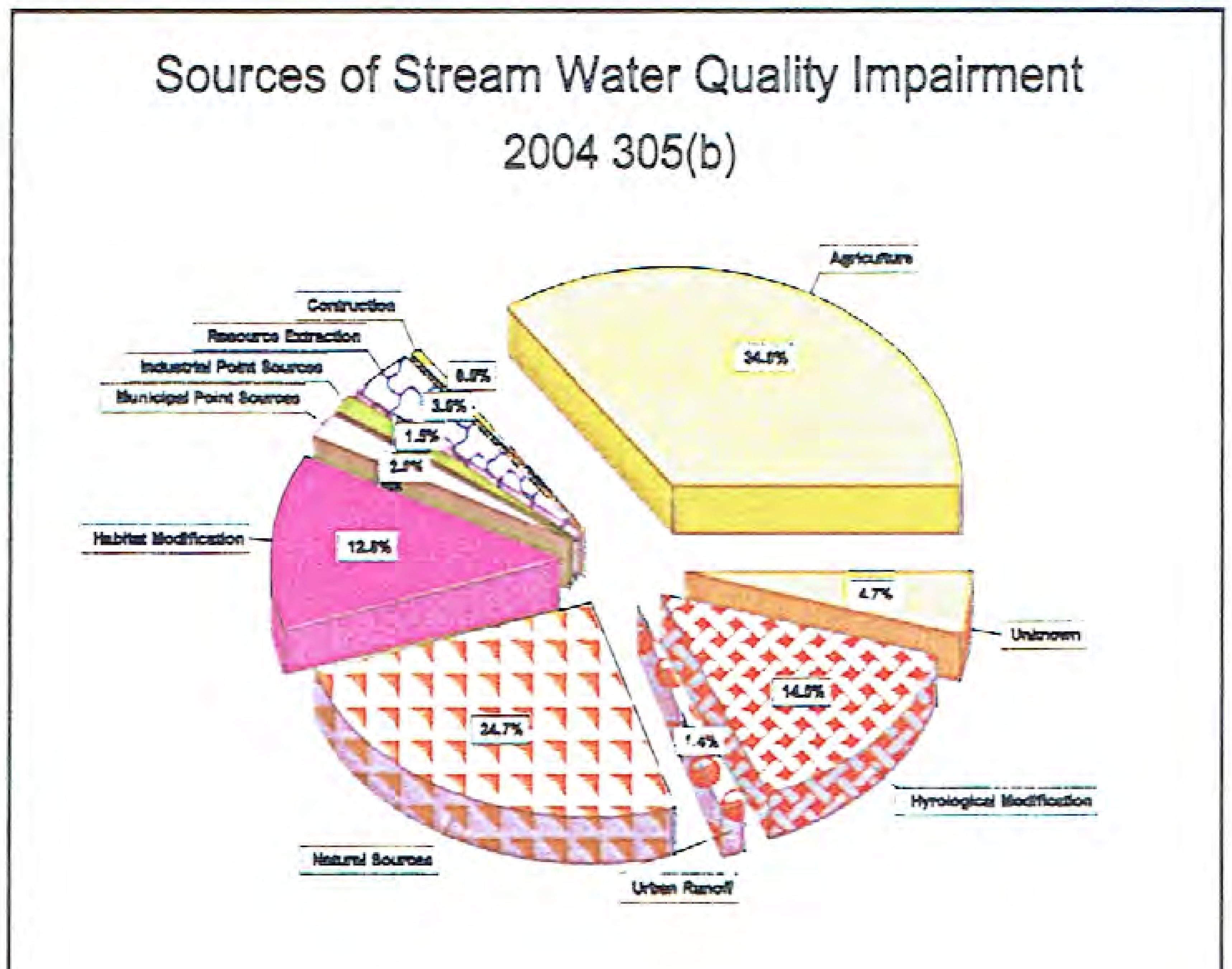


Figure 4. Relative contribution of sources to impairment of water quality.

Utah's proposed 303(d) list of impaired waters includes 57 stream segments. Because multiple factors affect some of these segments, 75 parameters were listed for Total Maximum Daily Load (TMDL) analysis.

Lakes / Reservoirs

The 132 key lakes assessed during this reporting cycle account for 97% (467,787 acres) of the total lake acreage in the state. Based upon acreage, 67.7% of the acreage was found supporting its designated uses, 31.8% partially supporting and 0.5% was not supporting designated uses (Figure 5). This was based upon at least one beneficial use being assessed.
Of the 132 lakes surveyed, 74 (56%) were fully supporting, 49 (37%) partially supporting, and 9 (7%) not supporting at least one beneficial use designation.

Table 1. Individual Beneficial Use Support Summary For Stream - Stream Miles							
Goals[a]	Use	Size Assessed	Size Fully Supporting	Size Fully Supporting but Threatened	Size Partially Supporting	Size Not Supporting	Size Not Attainable
Protect & Enhance Ecosystems	Aquatic Life	10,579.9	9,016.2 (85.2%)	0.0	1,205.9 (11.4%)	357.9 (3.4%)	0.0
Protect & Enhance Public Health	Fish Consumption	46.8	0.0	0.0	0.0	46.8 (100%)	0.0
	Swimming	675.1	634.5 (94.0%)	0.0	30.8 (4.6%)	9.8 (1.4%)	0.0
	Secondary Contact	675.1	634.5 (94.0%)	0.0	30.8 (4.6%)	9.8 (1.4%)	0.0
	Drinking Water	4,054.6	3,999.9 (98.7%)	0.0	12.4 (.3 %)	43.2 (1.0%)	0.0
Social and Economic	Agricultural	10,203.9	8,785.0 (86.1%)	0.0	376.7 (3.7%)	1,042.2 (10.2%)	0.0
	Overall Use Support	10,606.0	7,850.5 (74.0%)	0.0	1,425.9 (13.5%)	1,329.1 (12.5%)	0.0

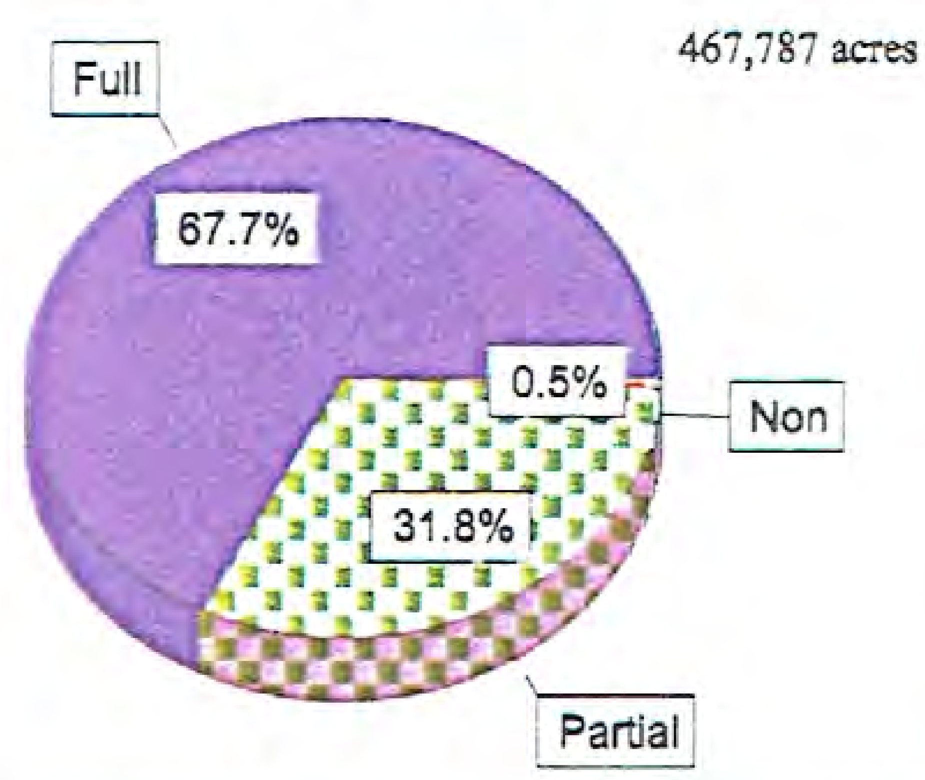


Figure 5. Statewide assessment of lakes and reservoirs based upon at least one beneficial use being assessed.

The causes of impairment of lakes and reservoirs continue to be nutrients, siltation, low dissolved oxygen, and noxious aquatic plants. This leads to problems in late summer, especially in reservoirs when the water is drawn down reducing the amount of water that is available as suitable habitat for fish. Higher temperatures and less water also create better conditions for algal blooms (aquatic plants) that can reduce oxygen levels, cause taste and odor problems, and create that green "scum" one sees on the surface of some lakes and reservoirs.

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

Thirty-seven (37) lakes remain on the 303(d) list, including a total of 52 parameters that need TMDL analysis. Cutler Reservoir and Pelican Lake were added to the list for the first time. TMDLs were completed for seven lakes and a request will be made to remove these in the next reporting cycle. The State will request that these be removed in the next reporting cycle. Nine additional lakes fell into the partially supporting category and one into the non-supporting category. Some of these 10 lakes have fluctuated in and out of full support status for several reporting cycles, while others came under additional stress due to the continuing drought conditions. Figure 7 shows the lake beneficial use assessment by category.

Assessment by Categories

Table 2 is a list of the new assessment categories developed by EPA for use in this and future 305(b) reports. This method of reporting provides a broader picture of the water quality assessment in the state. The river and stream miles for each category are listed in Table 3 and the lake and reservoir acreage in each category are listed in Table 4. Figure 6 is a map of the beneficial use assessment by the new categories for streams. For more detailed maps and information statewide, the reader is referred to the 2004 305(b) report in its entirety. Figure 7 is a map of the beneficial use assessment by categories for those lakes and reservoirs that were assessed..

Table 2. Beneficial Use Assessment by Categories for Rivers, Lakes and UPDES Discharge Permit Renewals

Category	Definition
1	All designated uses assigned to an assessment unit were assessed and are fully supported.
2	Some of the designated uses are fully supported, but there is insufficient data to determine beneficial use support for the remaining designated uses.
3	Insufficient or no data and information to determine if any designated use is attained
4A	TMDL has been completed for all pollutants
4B	Other pollution control requirements are reasonably expected to result in attainment of the water quality standard in the near future
4C	The impairment is not caused by a pollutant, e.g. habitat alteration
5A	Assessment unit is impaired by a pollutant and a TMDL is needed.
5B	AUs are listed in this category to identify those pollutants for which a TMDL has been approved, but TMDLs are still required for other pollutants identified, water quality standards are now being met, new delineation of assessment unit, changes in beneficial use classification result in meeting standards, change in listing methods results in meeting standards or change in water quality standards and standards now being met.
5C	UPDES permit renewals scheduled for completion from April 1, 2004 to March 31, 2006, waters not impaired.
5D	The assessment has identified impairment during one of the even or odd year monitoring cycles. If the AU is assessed as impaired during the next assessment period, it will be listed in Category 5A, TMDL required.

Table 3. River and Stream Miles by Assessment Category

Category	Definition	Steam Miles
1	All designated uses assigned to an assessment unit were assessed and are fully supported.	415
2	Some of the designated uses are fully supported, but there is insufficient data to determine beneficial use support for the remaining designated uses.	7,435
3	Insufficient or no data and information to determine if any designated use is attained	3,644
4A	TMDL has been completed for all pollutants	910
4B	Other pollution control requirements are reasonably expected to result in attainment of the water quality standard in the near future	0
4C	The impairment is not caused by a pollutant, e.g. habitat alteration	658
5A	Assessment unit is impaired by a pollutant and a TMDL is needed.	1,726
5B	AUs are listed in this category to identify those pollutants for which a TMDL has been approved, but TMDLs are still required for other pollutants identified, water quality standards are now being met, new delineation of assessment unit, changes in beneficial use classification result in meeting standards, change in listing methods results in meeting standards or change in water quality standards and standards now being met.	146

Table 4. Lake and Reservoir Beneficial Use Assessment by Category - Lake Acreage.		
Category	Definition	Lake Acreage
1	All designated uses assigned to an assessment unit were assessed and are fully supported.	162,700
2	Some of the designated uses are fully supported, but there is insufficient data to determine beneficial use support for the remaining designated uses.	156,919
3	Insufficient or no data and information to determine if any designated use is attained	13,851
4A	TMDL has been completed for all pollutants	8,235
4B	Other pollution control requirements are reasonably expected to result in attainment of the water quality standard in the near future	0
4C	The impairment is not caused by a pollutant, e.g. habitat alteration	0
5A	Assessment unit is impaired by a pollutant and a TMDL is needed.	135,710
5B	AUs are listed in this category to identify those pollutants for which a TMDL has been approved, but TMDLs are still required for other pollutants identified, water quality standards are now being met, new delineation of assessment unit, changes in beneficial use classification result in meeting standards, change in listing methods results in meeting standards or change in water quality standards and standards now being met.	3,478
5D	The assessment has identified impairment during one of the even or odd year monitoring cycles. If the AU is assessed as impaired during the next assessment period, it will be listed in Category 5A, TMDL required.	1,204

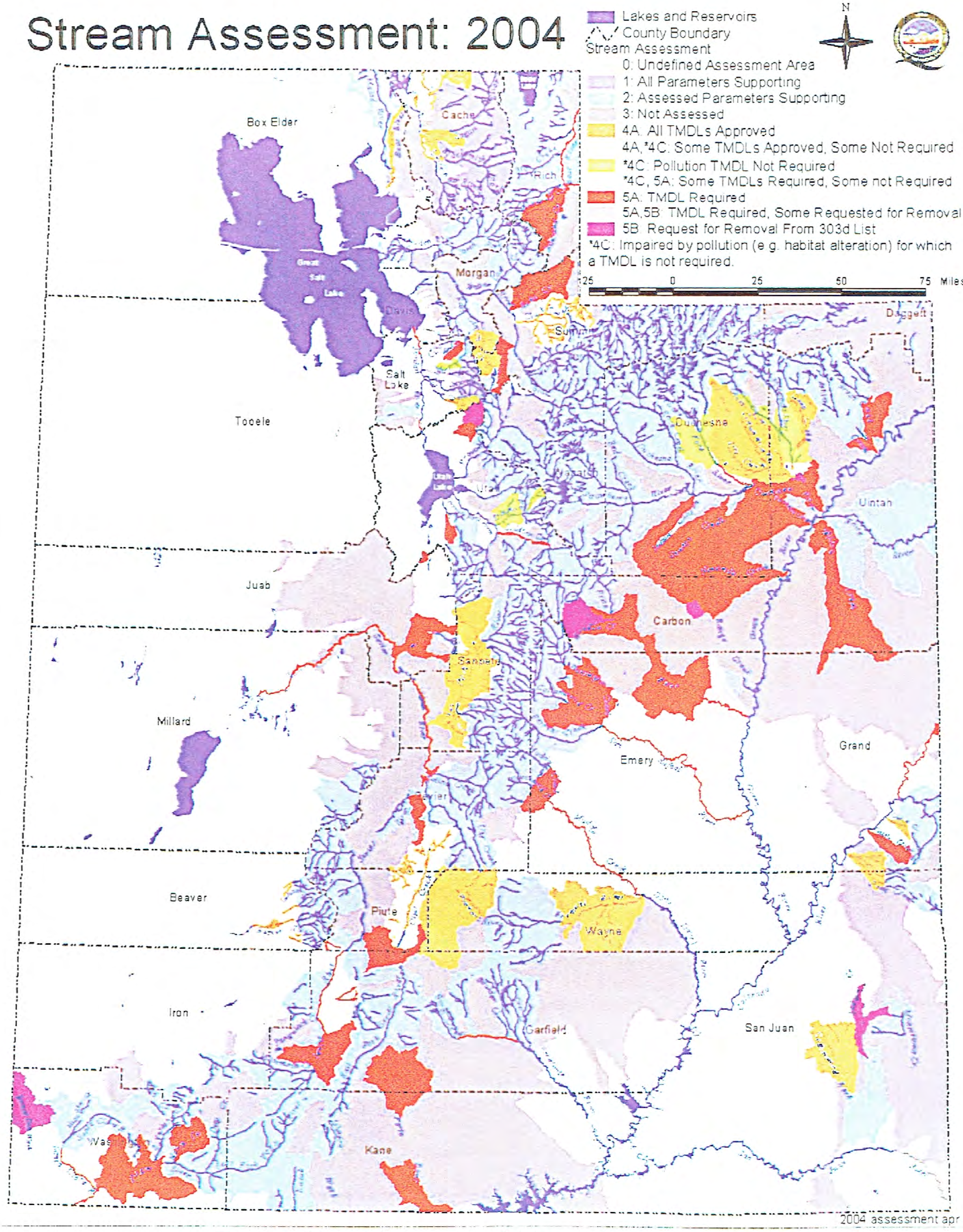


Figure 6. River and stream beneficial use support by category.

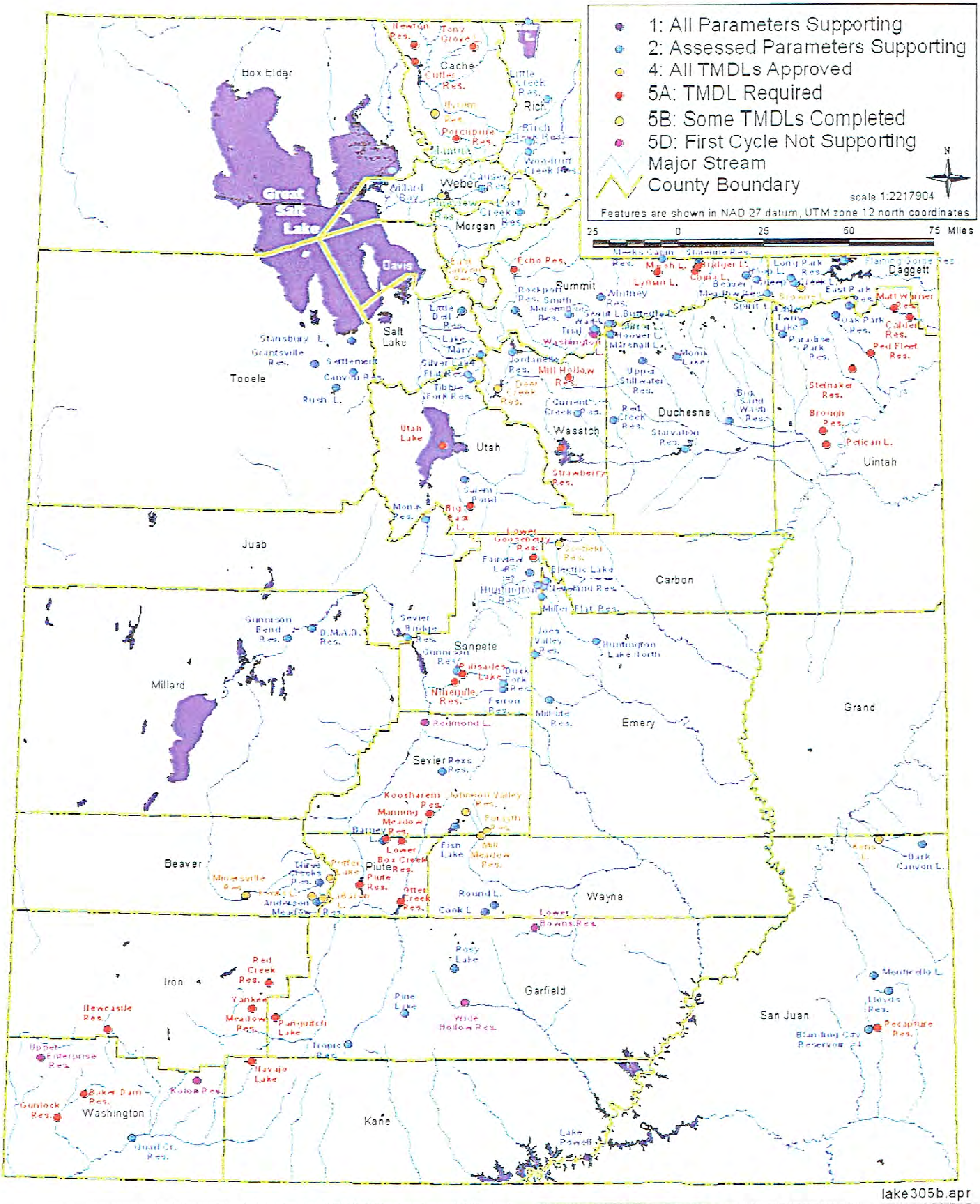


Figure 7. Lake and reservoir beneficial use by category.

Reports and information regarding the Division of Water Quality's water quality programs can be found at its web site (http://www.waterquality.utah.gov/.), For information regarding specific programs and watersheds within the State, you can contact the individuals listed below.

Water Quality Section			TMDL Section		
Name	**Program**	**Telephone Number**	**Name**	**Program**	**Telephone Number**
Mike Reichert	Manager	538-6954	Harry Judd	Manager	538-6057
William Moellmer	Water Quality Standards	538-6329	Mike Allred	Bear River Southeastern Colorado	538-6316
Theron Miller	NPS Projects Lake Assessment	538-6065	David Wham	Jordan River GSL Desert/Columbia	538-6052
Rand Fisher	NPS Program Coordinator	538-6065	Jim Harris	Sevier River Cedar/Beaver	538-6825
Tom Toole	305(b) Program 303(d) Program Stream Assessment	538-6859	Carl Adams	Uinta West Colorado	538-9215
Mark Stanger	GIS Coordinator	538-9217	John Whitehead	Weber River	538-6053
			Harry Judd	Lower Colorado West Colorado	538-6057

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ATTACHMENT 8

Explanation on Fish passage

The Jordanelle Dam Hydropower Plant is located at the base of Jordanelle dam. The dam was built with the understanding that fish passage would not be provided because of the high velocity water released from the valves. However, water temperature can be adjusted from the selective level inlet structure to provide for water quality and fish and wildlife benefits. Water is released from the dam through a selective level and or low level inlet structure through piping and tunnels to the outlet works. The outlet works consists of two 72 inch fixed cone valves and a bypass jet flow valve. Under the current condition fish are unable to swim past the fixed cone valves. After power plant construction, fish still will be unable to swim past the turbine and dam.

The hydropower plant will not change the status of the operation of the dam. Also, there are no anadromous and/or catadromous fish in the area. Any fish that may have historically moved from Utah Lake up the river to spawn, are blocked by multiple diversion structures that serve as fish passage barriers and Deer Creek Reservoir. All of which lay downstream of Jordanelle Dam and the hydropower plant.

The facility will have no impact on Riverine fish. Movement of fish through the outlet works of Jordanelle Dam is infrequent. The discharge of all or part of the release from Jordanelle Dam through hydroelectric turbines will not affect the potential or frequency of fish entrainment, nor is it expected to increase fish passage mortality.

Operating procedures established by the Bureau of Reclamation in 1993 for the selective level outlets works of the reservoir only allow velocities in excess of 10 feet per second in an emergency. Normal operations on any given gate are always less than 10 feet per second. The addition of a power plant will not change this criteria.

The environmental assessment for the Jordanelle Dam Hydroelectric Project was reviewed by federal, state and local wildlife agencies. No comments were received from any of these agencies concerning fish passage.

Affected Environment/Water Temperature and Phosphorous, Section3.8.3 –
Page 3-20

The language in this section that refers to impacts on water temperature ("it may be necessary" and "use of Monitoring and adaptive management") is very open ended. It implies that a considerable amount of time may pass in the process of determining specific actions that must be initiated to bring water temperature and Phosphorous levels back to established, water quality, limits. The UTU comments regarding Facility Operations (Section 2.9) are applicable to this section. Specifically, the facility should have a 'closed loop' control system. Closed loop is defined as the condition wherein plant control is based, in part, upon real-time telemetered water quality data.

We understand the concept of a run of the river hydro-electric facility. The premise is that generation is solely based on dam water releases necessary to meet established (non- power generation) water contracts. Other run of the river hydroelectric facilities have had the problem of a computer control system failure that results in severe/cyclical water releases from the dam. UTU recommends that operational controls be in place to prevent such a contingency.

We encourage your serious consideration of our recommendations. It would be unfortunate to negatively impact the Blue Ribbon fishery that now exists below Jordanelle.

If you have any questions regarding our comments, please do not hesitate to call me.

Sincerely,

Paul F. Dremann
Vice President, Conservation
Utah Council, Trout Unlimited

Cc: UTU Exec. Comm.
Don Wiley, UDWR
Mark Holden, URMCC
BRFAC

CHANNEL Surfing .NET

3.4.6 Mitigation

Woody vegetation would be protected and avoided to the extent practicable during construction. Any remaining patches of native vegetation would also be avoided, where possible. Patches of native vegetation near construction footprints would be encircled with orange construction fences and the construction footprints would be minimized to the extent practicable at these locations. Areas to be avoided would be shown on construction design drawings.

3.5 Wildlife

3.5.1 Introduction

This section addresses potential impacts on wildlife from implementation of the No Action Alternative and action alternatives.

3.5.2 Issues Addressed in the Impact Analysis

Osprey nesting, bird strikes on electrical lines, raptor electrocution, the Columbia spotted frog (*Rana luteiventris*), and migratory birds are the wildlife issues addressed in this impact analysis.

3.5.3 Affected Environment

The project area has been disturbed from construction of Jordanelle Dam and facilities. Native habitat has been removed, except for sparse vegetation along the outflow channel downstream of the site and scattered sagebrush and cottonwoods. Birds and mammals may occasionally move through or forage in the project area, but nesting and cover habitat is lacking. Amphibians would be expected to inhabit the river's edge.

An osprey pair is nesting along the reservoir, farther than 0.5 mile upstream of the dam. An osprey nest box is located below the dam, but it has not been used in 2 years.

The Columbia spotted frog, which is on the Utah Sensitive Species List, ranges from southeast Alaska through Alberta, Canada into Washington, Idaho, Wyoming, and disjunct areas of Nevada and Utah (Stebbins, 1985). Isolated populations are found in Utah in the West Desert and along the Wasatch Front (Bailey, 2003). It occurs upstream and downstream of Jordanelle Reservoir, with the largest Utah concentration located in wetlands near to the Provo River downstream of Jordanelle Dam (Bailey, 2003). This species was proposed for listing under the Endangered Species Act (ESA) in 1989. The U.S. Fish and Wildlife Service (FWS) determined that the species warranted listing in 1999, but was excluded as a candidate for listing under ESA, because of conservation efforts. The Wasatch Front population was removed from consideration for listing under ESA in 2002. The Mitigation Commission is working with several government agencies under a Conservation Agreement to reduce or eliminate threats to this species. The Provo River Restoration Project (PRRP) is part of the conservation effort. The PRRP is restoring the Provo River between Jordanelle Dam and Deer Creek Reservoir.

Many species of birds are found in the project area. Some are year-round residents, a few migrate south into the planning area during the winter, some breed in the planning area and winter to the south, and many pass through the area during spring and fall migration. Nearly all of these species are protected by the Migratory Bird Treaty Act of 1918 (MBTA) to which the U.S. is a signatory. All raptors are protected by the MBTA. Very little suitable habitat for migratory birds, other than raptors, would be directly or indirectly affected by any of the alternatives. Species richness and breeding bird densities are highest in riparian woodlands located along the major rivers, and somewhat lower in local wetland habitats due to their smaller size. It is unlikely that any nesting migratory birds other than raptors would be found in areas disturbed through project construction.

3.5.4 Impact Analysis

Alternative 1—No Action

No change from existing conditions would occur under this alternative.

Alternative 2

As discussed in *Section 3.4, Vegetation*, habitat at the project location is highly disturbed and of low quality. Nesting or other critical activities would not be expected to occur on the site. Human presence is currently well-established at the site and species that avoid humans are already excluded from use of the site. Those species using the site are habituated to human use or are not perturbed by human use. Therefore, additional impacts on wildlife would be minimal.

As discussed in *Section 3.5.6, Mitigation*, measures to avoid avian electrocution and transmission line strike hazards would be installed. This would minimize electrocution impacts on raptors perching on power poles and help birds avoid striking power lines.

The construction area is farther than 0.5 mile from the osprey nest as recommended by the FWS, and the construction area is not in the line of sight of the osprey nest. The construction site is not adjacent to preferred foraging habitat (reservoir). Impacts on osprey are not expected.

The spotted frog would not be expected to occur in the constructed river channel immediately downstream of the dam. There would be no change in water quality or quantity downstream of the dam. Lack of presence and no change in river conditions would result in no impacts to the spotted frog.

The densely populated areas in wetlands adjacent to Provo River downstream of Jordanelle Dam would not be affected. No direct construction or O&M impacts would occur in occupied or potentially suitable habitats. No effects on wetland habitats associated with the Provo River corridor would occur because the project would not alter or influence the operation of Jordanelle Dam and Reservoir for its CUP purposes. Placement of new power poles would not affect the frog, as new poles would be placed in the same locations as existing poles and there would be no wetland impacts associated with pole placement.

If new fences were to be constructed within the project area, they may act as minor barriers to movement by some migratory bird species, depending on the design. Migratory and resident birds will occasionally be killed by flying into fences. Fence posts also provide perch sites that are often used by foraging raptors that are attracted to mowed or open areas of the project where prey may be more visible than in surrounding areas. These perches and possibly increased visibility of prey are beneficial. However, raptors attracted to locations near moving vehicles can be killed by passing vehicles as they cross a road from one low fence post perch to another, as they pursue prey onto a road, or as they scavenge road-killed animals.

Alternative 3

Impacts under Alternative 3 would be the same as those described above for Alternative 2.

Alternative 4—Proposed Action

Impacts under the Proposed Action would be the same as those described above for Alternative 2.

3.5.5 Cumulative Impacts

Construction of the hydroelectric facilities would not contribute additional impacts on wildlife over those already existing through residential development and recreational use of the reservoir area.

3.5.6 Mitigation

All new power lines, either temporary or permanent, would conform with designs shown in the Avian Power Line Interaction Committee's 1994 and 1996 publications, released by the Edison Electric Institute/Raptor Research Foundation, Washington, D.C. These two publications, *Mitigating Bird Collisions with Power Lines: The State of the Art in 1994* and *Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996*, detail methods to avoid avian electrocution and strike hazards associated with power lines.

A wire cage would be constructed over the osprey nest below the dam before the start of construction. This will prevent osprey from trying to establish a nest in this location before construction starts. The cage would be removed following construction.

If migratory bird nests are located, construction will be timed to the extent practicable to avoid disturbance to the active nests. Appropriate permits would be acquired and nest searches would be conducted in accordance with MBTA requirements of the FWS, if suitable nesting habitat is located before construction.

3.6 Fishery Resources

3.6.1 Introduction

This section addresses the effects to fishery resources from the implementation of the No Action Alternative and action alternatives.

3.6.2 Issues Addressed in the Impact Analysis

The major issue associated with the fishery resource is how the project would affect downstream water quality and quantity. Any reduction in the existing water quality and quantity could negatively impact the blue-ribbon fishery.

3.6.3 Affected Environment

Jordanelle Reservoir

Jordanelle Reservoir is an impoundment of the Provo River that was completed in 1993. The dam and reservoir were originally constructed to provide long-term storage for water users and to create recreational opportunities, along with provisions for a hydroelectric facility. The recreation facilities on the reservoir were completed in 1995 and the reservoir currently meets its recreation capacity on busy weekends (UDEQ, 2004).

Fishing is a very popular recreation activity on the reservoir. The Utah Division of Wildlife Resources (UDWR) currently stocks the reservoir with rainbow trout (*Oncorhynchus mykiss)* and smallmouth bass (*Micropterus dolomieui;* UDEQ, 2004). The reservoir is most popular for its smallmouth bass and brown trout (*Salmo trutta)* fishery and is considered a world-class smallmouth bass fishery. Angler surveys conducted in 2003 estimated angler use that averaged 846 hours/day (Hepworth, 2004). The reservoir is listed by the State of Utah as a Blue-Ribbon fishery and holds the record for a catch-and-release brown trout captured in 2001 (UDWR, 2004a). Other fishes found within the reservoir include yellow perch (*Perca flavescens)*, walleye (*Sander vitreus*, formerly *Stizostedion vitreum*), rainbow trout, cutthroat trout (*Oncorhynchus clarki)*, Utah chub (*Gila atraria)*, Utah sucker (*Catostomus ardens*), black crappie (*Pomoxis nigromaculatus)* (Hepworth, 2004), and brook trout (*Salvelinus fontinalis*; UDEQ, 2004).

Fish habitat within the reservoir is not well described, but the water quality within Jordanelle Reservoir is considered good (UDEQ, 2004). The trophic status within the reservoir is currently described as mesotrophic (moderately productive), but still in the process of stabilizing, given the young age of the reservoir (UDEQ, 2004). Macrophytes are not abundant and debris is still surfacing from lands that were inundated for this Provo River impoundment. Although little descriptive information is available to provide insight into fish habitat, the success and popularity of the reservoir suggests that, currently, habitat adequately supports the game fish sought by anglers.

Provo River Below Jordanelle Reservoir

Impounding the Provo River above Jordanelle Dam modified the hydrologic regime of the river below the dam. The waters downstream of a reservoir are influenced by the quantity and timing of reservoir discharge as well as the released water temperatures, dissolved oxygen, and gas pressure (Summerfelt, 1999).

Riverine ecosystem function is determined in large part by hydrology of a riverine ecosystem interacting with the geomorphology of the river and its floodplain. The Provo River Restoration Project has been planned, designed and constructed to restore and create a functional riparian ecosystem. Certain magnitudes, patterns and timing of water need to be released from Jordanelle Dam in order to scour and deposit fine sediments from the stream onto adjacent floodplain and near-bank surfaces; to moisten the soil; to support germination and growth of seedling plants through a flow recession rate that is slow enough to prevent desiccation of developing seedlings because of low groundwater levels; and to support aquatic invertebrate, plant and fish communities. Hydroelectric power generation potential at the Jordanelle Hydroelectric Project would not constrain the ability of Jordanelle Dam operators to meet target flows for riparian vegetation support. Therefore, there would be no impact on riparian vegetation resources downstream of Jordanelle Dam because of the Jordanelle Hydroelectric Project.

The Mitigation Commission begun implementing the PRRP in 1999 to restore the natural pattern and function of the Provo River below Jordanelle Dam, focusing on improving ecosystem function and increasing biological diversity, including game fish habitat (URMCC, 2002). The studies by the Mitigation Commission include biological (fish and macro-invertebrate communities, bird, spotted frog, and vegetation studies) and physical studies (geology, hydrology, and river mechanics) and will be used in management decisions related to restoration activities (URMCC, 2002).

Four game fishes are known to exist in the Provo River below Jordanelle Dam. These are brown trout, rainbow trout, Bonneville cutthroat trout (*Oncorhynchus clarki utah*), and mountain whitefish (*Prosopium williamsoni*) (Hepworth, 2004). Other native fishes include leatherside chub (*Gila copei*), redside shiner (*Richardsonius balteatus*), mountain sucker (*Catostomus platyrhynchus*), Utah sucker, mottled sculpin (*Cottus bairdi*), and longnose dace (*Rhinichthus cataractae*) (Hepworth, 2004). Further, the June sucker (*Chasmistes liorus*) may be found in the lower reaches of the Provo River, immediately upstream of Utah Lake (Reclamation and COE, 1987). Bonneville cutthroat trout and leatherside chub are both Utah State sensitive species (UDWR, 2004c). Fish surveys conducted in 2004, below White Bridge, found that brown trout comprised over 90 percent of the sample with mottled sculpin, mountain whitefish, longnose dace, and a single Bonneville cutthroat trout comprising the remainder of the species present. Surveys of this study have demonstrated that the river restoration work of the PRRP has resulted in significant biomass and density increases of brown trout over the past 3 years (Hepworth, 2004a).

The Provo River below Jordanelle Reservoir is a very popular section of river with anglers and is considered a world-class fishery (Hepworth, 2004). The reach is listed by the State of Utah as a Blue-Ribbon fishery (UDWR, 2004b). UDWR conducted angler surveys in 2002 and estimated angler use at 436 hours/day (Hepworth, 2004).

Finally, in 2000 a bacteria was found to be responsible for a brown trout kill on the Provo River below Jordanelle Reservoir. Factors such as overcrowding, injury, water quality, spawning, or lack of food can result in a weakened condition that makes brown trout more susceptible to the bacteria (UDWR, 2000).

3.6.4 Impact Analysis

Alternative 1—No Action

No change in existing conditions would occur under this alternative.

Alternative 2

As discussed in *Section 3.4.4, Vegetation Impact Analysis* and *Section 3.8.4, Surface Water and Water Quality Impact Analysis*, there would be no change in downstream aquatic or riparian habitats or communities or water quality or quantity. Therefore, there would be no fishery impacts from implementation of Alternative 2. Hydroelectric power generation potential at the Jordanelle Hydroelectric Project would not constrain the ability of Jordanelle Dam operators to meet target flows for aquatic community and riparian vegetation support.

Therefore, no impact on aquatic habitats and communities downstream of Jordanelle Dam would result from the Jordanelle Hydroelectric Project.

Alternative 3

No impacts would occur under Alternative 3, as described above for Alternative 2.

Alternative 4—Proposed Action

No impacts would occur under the Proposed Action, as described above for Alternative 2.

3.6.5 Cumulative Impacts

No cumulative impacts would result from implementation of this project because there are no action alternative impacts or synergetic impacts with other projects.

3.6.6 Mitigation

Mitigation would consist of the measures presented in Section 3.8.6, *Surface Water and Water Quality Mitigation*, that would be implemented to ensure water quality or quantity impacts do not occur.

3.7 Threatened and Endangered Species

3.7.1 Introduction

This section addresses federal threatened and endangered (T&E) species effects from implementation of the No Action Alternative and action alternatives. Appendix D contains a letter from the FWS that lists the species to be addressed in this document and analysis. The species addressed include the threatened bald eagle (*Haliaeetus leucocephalus*), the endangered black-footed ferret (*Mestelo nigripes*), and the threatened Canada lynx (*Lynx canadensis*). Although not specifically required by law, and having no protection under the ESA, a candidate species, the western yellow-billed cuckoo (*Coccyzus americanus occidentalis*) will also be addressed. Addressing this species now could reduce scheduling impacts to the project in the event it is listed under the ESA during the project's construction period. Appendix E shows the letter received from UDWR that provides occurrence information for some special-status species in the project area.

The FWS also listed three sensitive species that have potential to occur in the project area and are managed under Conservation Agreements/Strategies. They are the Bonneville cutthroat trout, Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*), and the spotted frog. The Bonneville cutthroat trout and spotted frog are known to occur in or along the Provo River downstream of the project area. These species are discussed above in *Sections 3.5, Wildlife and 3.6 Fisheries* and will not be discussed further in this section. The Colorado River cutthroat trout is not known to exist between the Jordanelle Dam and Deer Creek Reservoir.

3.7.2 Issues Addressed in the Impact Analysis

The issue addressed in this section is whether the proposed project would effect federally listed or candidate T&E species.

3.7.3 Affected Environment

Bald Eagle

The bald eagle was listed as Endangered under the ESA in 1978 in the lower 48 states. This species was reclassified from Endangered to Threatened, because of recovery status on July 12, 1995. The FWS has proposed to de-list the bald eagle (1999), because of long-term positive population trends that are expected to continue.

Bald eagles concentrate in and around areas of open water where waterfowl and fish are available. They prefer solitude, late-successional forests, shorelines adjacent to open water, a large prey base for successful brood rearing, and large, mature trees for nesting and resting.

Threats to the bald eagle throughout its range are primarily from shooting or poisoning; however, these threats have been reduced since the species was federally listed in the 1970s. An additional threat to the species is from disturbance during nesting and fledging, which may cause reproductive failure. Individual birds vary widely in their response to human disturbance at nesting and roosting sites. Losing large trees for nesting and roosting habitat near large water bodies is a moderate threat (FWS, 1995).

The bald eagle is dispersed throughout Utah from October to April as a winter visitor and includes birds from many areas from Utah to Canada. Wintering eagles have been observed along the Provo River and Jordanelle Reservoir from Kamas to Utah Lake (Reclamation, 1977; USFS, 1973 and 1974). Historical records show that eagles have been observed within 1 mile of the project site (Appendix D). No communal winter roosts or areas of sizable winter concentration are known to exist in the project area. No listed critical habitat or known nest sites exist in the project area.

Annual surveys since 1997 tend to support this finding. For example, only 1 or 2 bald eagles have been observed each year during the annual survey for the last 3 years.

Black-Footed Ferret

The black-footed ferret was designated as Endangered on March 11, 1967, except where listed as an experimental, nonessential (XN) population. The black-footed ferret was designated as a XN population on March 11, 1967, in portions of Arizona, Colorado, Montana, South Dakota, Utah, and Wyoming.

Historically, black-footed ferrets inhabited grassland plains (shortgrass and midgrass prairies) surrounded by mountain basins up to 10,663 feet in elevation (FWS, 1998). This species is always found in association with another grassland species, the prairie dog (*Cynomys spp.*) (Burt and Grossenheider, 1980; Cahalane, 1954). Prairie dogs are the principal food of the black-footed ferret and prairie dog burrows provide the ferret's principal shelter, as they do not dig their own burrows (Anderson et al., 1986; Biggins et al., 1986; Clark et al., 1982; Forrest et al., 1988; Hillman, 1968; Miller et al., 1996). Data suggest that a ferret needs a prairie dog colony of at least 30.9 acres to survive for 1 year and a minimum of 123.5 acres to raise a litter (Caughley and Gunn, 1996). Ferret range is coincident with that of prairie dogs (Anderson et al., 1986). No documentation exists of black-footed ferrets breeding outside of prairie dog colonies. Specimen records of black-footed ferrets are available from ranges of three species of prairie dogs: the black-tailed prairie dog (*Cynomys ludovicianus*), white-tailed prairie dog (*Cynomys leucurus*), and Gunnison's prairie dog (*Cynomys gunnisoni*) (Anderson et al., 1986).

Ferrets have been decimated from all of their former range, and distribution is now limited to introduced populations in Arizona, Colorado, Wyoming, Montana, Utah, South Dakota, and Chihuahua, Mexico (FWS, 2004). Reintroduction efforts have been concentrated in these states because they still have protected areas with large prairie dog colonies. Although the Wyoming effort has been hampered by disease problems, the other states have shown some success (FWS, 1996). Ferret introduction was authorized for Utah on October 1, 1998 (Federal Register Vol. 63, No. 190, p.52824-52841), to include establishment of a XN in Duchesne and Uinta Counties. No ferrets have been introduced in the vicinity of this project, and ferrets are not known to occur in the project area.

Canada Lynx

The Canada lynx (*Lynx canadensis*) was federally listed as Threatened on March 24, 2000. In the contiguous U.S., the distribution of lynx is associated with the southern boreal forest, consisting of subalpine coniferous forest in the West and primarily mixed coniferous/deciduous forest in the East (Aubry et al., 1999). In Canada and Alaska, lynx habitat is the classic boreal forest ecosystem known as the taiga (McCord and Cardoza, 1982; Quinn and Parker, 1987; Ruggiero et al., 1999). Within these general forest types, lynx are most likely to persist in areas that receive deep snow, for which the lynx is highly adapted (Ruggiero et al., 1999).

According to the Forest Service (1993), lynx in the southern extension of their range require three primary habitat components. These include the following:

- Foraging habitat (15- to 35-year-old lodgepole pine) to support snowshoe hare, the primary food source, and provide hunting cover.
- Denning sites with patches of spruce and fir greater than 200 years old that provide abundant large woody debris.
- Dispersal and travel cover that is variable in vegetative composition and structure.

When the Canada lynx was federally listed as Threatened, the FWS concluded that the chief threat to the lynx in the contiguous U.S. was the "lack of guidance to conserve the species" in federal land management plans. In February 2000, the Forest Service and FWS signed a Lynx Conservation Agreement to implement the management standards contained in the Lynx Conservation Assessment Strategy (LCAS) and thus to promote the conservation of lynx and its habitat. The LCAS was prepared by a group of inter-agency biologists and provides detailed descriptions of lynx habitat, potential risk factors affecting lynx, and potential conservation measures. The Forest Service and Bureau of Land Management (BLM) are jointly preparing an EIS on a proposal to implement management direction contained in the LCAS for Canada lynx habitat on national forests and BLM units within the Northern Rocky Mountain area. The proposal would amend 18 land and resource management plans for national forests in Idaho, Montana, Utah, and Wyoming, and 18 BLM land use plans in Idaho and Utah.

Lynx are usually more active at night than during the day. The eyes of lynx are well adapted for night hunting. Preferred winter food consists primarily of snowshoe hares, along with rodents such as red squirrels and birds. Abundance of snowshoe hare is the limiting factor for lynx (Koehler, 1990; Reichel et al., 1992). Snowshoe hare distribution is limited by the availability of winter habitat that includes early successional lodgepole pine with trees that exceed the mean snow depths and provide snow interception and are interlocking canopy above the snow.

Denning habitat for lynx occurs in mature and late structural boreal forests with locally abundant large woody debris present. Fire suppression and logging have altered the mosaic of habitats needed for prey species and denning sites (FWS, 2000; Wisdom et al., 2000).

Canada lynx have not been reported in the project area. However, a recent sighting of a single individual on Heber Mountain has been reported (UDWR, 2004e). There have been historical sightings of lynx with the nearest occurrence located approximately 20 miles east of the project location (Appendix D).

Yellow-Billed Cuckoo (*Coccyzus americanus occidentalis*)

A petition to list this species was filed in 1998. The petitioners stated that "habitat loss, overgrazing, tamarisk invasion of riparian areas, river management, logging, and pesticides have caused declines in yellow-billed cuckoo." In the 90-day finding published on February 17, 2000 (Federal Register Vol. 65, p. 8104-8107), the FWS indicated that these factors may have caused loss, degradation, and fragmentation of riparian habitat in the western U.S., and that the loss of wintering habitat may be adversely affecting the cuckoo. Therefore, the yellow-billed cuckoo has status of Candidate species for protection under the ESA. In July 2001, the FWS announced a 12-month finding for a petition to list the yellow-billed cuckoo as threatened or endangered in the western U.S. As of August 1, 2002, this species continues to have Candidate status (Federal Register Vol. 67, p.40657-40679).

This species may go unnoticed because it is slow-moving and prefers dense vegetation. In the West, it favors areas with a dense understory of willow (*Salix* spp.) combined with mature cottonwoods (*Populus* spp.) and generally within 300 feet of slow or standing water (Gaines, 1974; Gaines, 1977; Gaines and Laymon, 1984). The yellow-billed cuckoo is also known to use non-riparian, dense vegetation such as wooded parks, cemeteries, farmsteads, tree islands, Great Basin shrub-steppe, and high elevation willow thickets (Finch, 1992; DeGraaf et al., 1991). It feeds on insects, mostly caterpillars, but also beetles, fall webworms, cicadas, and fruit (especially berries). Populations seem to fluctuate dramatically in response to fluctuations in caterpillar abundance. These fluctuations are erratic, but not necessarily cyclic (Kingery, 1981).

This secretive bird is a neo-tropical species that breeds in North America and winters primarily south of the U.S.-Mexico border. It once flourished in western cottonwood and willow riparian forests and thickets. However, it is now nearly extinct west of the Continental Divide, where it has disappeared from large portions of its former range and is extremely rare in the interior West. Most records are of isolated, non-breeding individuals or solitary unknown breeding status individuals. Historically, cuckoos were probably common to uncommon summer residents in Utah and across the Great Basin (Ryser, 1985 in UDWR, 2004d; Hayward et al., 1976 in UDWR, 2004d). The current distribution of yellow-billed cuckoos in Utah is poorly understood, though they appear to be an extremely rare breeder in lowland riparian habitats statewide (Walters, 1983 in UDWR, 2004d; Behle et al., 1985 in UDWR, 2004d; Benton, 1987 in UDWR, 2004d).

Yellow-billed cuckoos have not been observed in the Heber Valley (UDWR, 2004e). Mist-netting for the past 3-years has not resulted in the capture of any individuals and none have been heard (UDWR, 2004e). The nearest location that a yellow-billed cuckoo has been observed is along the Provo River approximately 4 miles south of the project area (Appendix D).

3.7.4 Impact Analysis

Alternative 1—No Action

There would be "No Effect" to any listed species from implementation of this alternative.

Alternative 2

Bald Eagle. Although Jordanelle Reservoir and the Provo River are suitable habitat for bald eagle, there are no known concentrations of bald eagles, no known nesting sites, no known night roost sites, and no critical habitat for bald eagle in the project area. Use of the project area is periodic for foraging activities or over-wintering. Implementation of the proposed project would not affect these activities. Therefore, there would be "No Effect" to bald eagle from implementation of this alternative.

Black-Footed Ferret. No known individuals exist in the project area and no extensive prairie dog towns required for their presence. There would be "No Effect" to black-footed ferret from implementation of this alternative.

Canada Lynx. Canada lynx habitat does not occur in the project area. There may be occasional individuals moving between habitats, but this in not likely to occur during the "outside" construction season. There would be "No Effect" to Canada lynx from implementation of this alternative.

Yellow-Billed Cuckoo. Dense woody vegetation required by this species is not present in the project area. Operation of Jordanelle Reservoir would not change with implementation of this alternative and potential changes in downstream water quality or quantity would not occur (see *Section 3.8.4, Surface Water and Water Quality Impact Analysis*). Therefore, suitable habitat supported by Jordanelle Reservoir or the Provo River would not be affected. There would be "No Effect" to yellow-billed cuckoo from implementation of this alternative.

Alternative 3

There would be "No Effect" to any T&E or Candidate species under Alternative 3, as described above for Alternative 2.

Alternative 4—Proposed Action

There would be "No Effect" to any T&E or Candidate species under the Proposed Action, as described above for Alternative 2.

3.7.5 Cumulative Impacts

No cumulative impacts would be associated with this proposed project, as there are no impacts on T&E or Candidate species from the project or synergistic impacts with other projects.

3.7.6 Mitigation

No mitigation is necessary for T&E or Candidate species.

3.8 Surface Water Resources and Water Quality

3.8.1 Introduction

This section addresses the effects to surface water resources and surface water quality from the implementation of the No Action Alternative and action alternatives.

3.8.2 Issues Addressed in the Impact Analysis

Major issues addressed in this section include long-term effects on downstream water quantity and quality during project operation and maintenance. Potential short-term effects during project construction are also addressed.

3.8.3 Affected Environment

Surface Water Resources and Existing Facilities

Surface water resources in the project area include Jordanelle Reservoir and the Provo River immediately downstream of Jordanelle Dam. Jordanelle Dam was completed in 1993, is approximately 3,500 feet long, and rises nearly 300 feet above the river's original streambed. Jordanelle Reservoir is L-shaped with two principal arms. The eastern arm extends about 5 miles up the Provo River and the northern arm extends about 4 miles up Drain Tunnel Creek and Ross Creek. The surface area of the reservoir is approximately 3,070 acres at a total storage capacity of 320,300 acre-feet, and approximately 37 acres at a minimum (conservation) pool of 200 acre-feet.

The facilities that would be used to release water from Jordanelle Reservoir through Jordanelle Dam to the turbines include the SLOW and LLOW as discussed in *Section 2.9, Facility Operation*. The minimum flow that can be discharged through one 78-inch valve is 300 cfs. When flows are less than 300 cfs, gates in the gate chamber are closed and the flow is discharged through a 36-inch bypass pipe that extends from the gate chamber to the outlet works of the dam, and then into the Provo River through a jet-flow valve.

Table 3-1 presents expected Provo River monthly average flows immediately downstream of Jordanelle Dam. River flows would typically range from a monthly minimum of 125 cfs from October through March to a monthly maximum of 1643 cfs in June. Typical average monthly river flows vary from 138 cfs in January to 909 cfs in June. The 125 cfs represents the minimum flow commitment of 125 cfs for the Provo River below Jordanelle Dam downstream to Deer Creek Reservoir. Some minimal releases for necessary irrigation or stock water rights are not included in these amounts. Historical daily reservoir releases have ranged as high as 2,400 cfs. Outflow channel elevations are controlled by the Timpanogos

State of Utah
Department of Natural Resources
Division of Wildlife Resources

Utah Sensitive Species List

October 17, 2006

This list has been prepared pursuant to Utah Division of Wildlife Resources Administrative Rule R657-48. By rule, wildlife species that are federally listed, candidates for federal listing, or for which a conservation agreement is in place automatically qualify for the *Utah Sensitive Species List*. The additional species on the *Utah Sensitive Species List*, "wildlife species of concern," are those species for which there is credible scientific evidence to substantiate a threat to continued population viability. It is anticipated that wildlife species of concern designations will identify species for which conservation actions are needed, and that timely and appropriate conservation actions implemented on their behalf will preclude the need to list these species under the provisions of the federal Endangered Species Act. Please see Appendix A for the rationale behind each wildlife species of concern designation.

Utah Sensitive Species List

Fishes

Federal Candidate Species
(None)

Federally Threatened Species

Lahontan cutthroat trout (introduced)	*Oncorhynchus clarkii henshawi*

Federally Endangered Species

humpback chub	*Gila cypha*
bonytail	*Gila elegans*
Virgin chub	*Gila seminuda*
Colorado pikeminnow	*Ptychocheilus lucius*
woundfin	*Plagopterus argentissimus*
June sucker	*Chasmistes liorus*
razorback sucker	*Xyrauchen texanus*

Conservation Agreement Species

Bonneville cutthroat trout	*Oncorhynchus clarkii utah*
Colorado River cutthroat trout	*Oncorhynchus clarkii pleuriticus*
Virgin spinedace	*Lepidomeda mollispinis mollispinis*
least chub	*Iotichthys phlegethontis*
roundtail chub	*Gila robusta*
bluehead sucker	*Catostomus discobolus*
flannelmouth sucker	*Catostomus latipinnis*

Wildlife Species of Concern

leatherside chub	*Gila copei*
desert sucker	*Catostomus clarkii*
Yellowstone cutthroat trout	*Oncorhynchus clarkii bouvieri*
Bear Lake whitefish	*Prosopium abyssicola*
Bonneville cisco	*Prosopium gemmifer*
Bonneville whitefish	*Prosopium spilonotus*
Bear Lake sculpin	*Cottus extensus*

See Appendix A for the rationale behind each wildlife species of concern designation.

Utah Sensitive Species List

Amphibians

Federal Candidate Species
relict leopard frog (extirpated) *Rana onca*

Federally Threatened Species
(None)

Federally Endangered Species
(None)

Conservation Agreement Species
Columbia spotted frog *Rana luteiventris*

Wildlife Species of Concern
western toad *Bufo boreas*
Arizona toad *Bufo microscaphus*

See Appendix A for the rationale behind each wildlife species of concern designation.

Utah Sensitive Species List

Reptiles

Federal Candidate Species
(None)

Federally Threatened Species

desert tortoise	*Gopherus agassizii*

Federally Endangered Species
(None)

Conservation Agreement Species
(None)

Wildlife Species of Concern

zebra-tailed lizard	*Callisaurus draconoides*
western banded gecko	*Coleonyx variegatus*
desert iguana	*Dipsosaurus dorsalis*
Gila monster	*Heloderma suspectum*
common chuckwalla	*Sauromalus ater*
desert night lizard	*Xantusia vigilis*
sidewinder	*Crotalus cerastes*
speckled rattlesnake	*Crotalus mitchellii*
Mojave rattlesnake	*Crotalus scutulatus*
cornsnake	*Elaphe guttata*
smooth greensnake	*Opheodrys vernalis*
western threadsnake	*Leptotyphlops humilis*

See Appendix A for the rationale behind each wildlife species of concern designation.

Utah Sensitive Species List

Birds

Federal Candidate Species	
Yellow-billed Cuckoo	*Coccyzus americanus*
Federally Threatened Species	
Bald Eagle	*Haliaeetus leucocephalus*
Mexican Spotted Owl	*Strix occidentalis lucida*
Federally Endangered Species	
California Condor (experimental)	*Gymnogyps californianus*
Whooping Crane (extirpated)	*Grus americana*
Southwestern Willow Flycatcher	*Empidonax traillii extimus*
Conservation Agreement Species	
Northern Goshawk	*Accipiter gentilis*
Wildlife Species of Concern	
Grasshopper Sparrow	*Ammodramus savannarum*
Short-eared Owl	*Asio flammeus*
Burrowing Owl	*Athene cunicularia*
Ferruginous Hawk	*Buteo regalis*
Greater Sage-grouse	*Centrocercus urophasianus*
Black Swift	*Cypseloides niger*
Bobolink	*Dolichonyx oryzivorus*
Lewis's Woodpecker	*Melanerpes lewis*
Long-billed Curlew	*Numenius americanus*
American White Pelican	*Pelecanus erythrorhynchos*
Three-toed Woodpecker	*Picoides tridactylus*
Sharp-tailed Grouse	*Tympanuchus phasianellus*

See Appendix A for the rationale behind each wildlife species of concern designation.

Utah Sensitive Species List

Mammals

Federal Candidate Species
(None)

Federally Threatened Species

Utah prairie-dog	*Cynomys parvidens*
brown/grizzly bear (extirpated)	*Ursus arctos*
Canada lynx	*Lynx canadensis*

Federally Endangered Species

black-footed ferret (experimental, non-essential in Duchesne and Uintah counties)	*Mustela nigripes*
gray wolf (extirpated)	*Canis lupus*

Conservation Agreement Species
(None)

Wildlife Species of Concern

Preble's shrew	*Sorex preblei*
Townsend's big-eared bat	*Corynorhinus townsendii*
spotted bat	*Euderma maculatum*
Allen's big-eared bat	*Idionycteris phyllotis*
western red bat	*Lasiurus blossevillii*
fringed myotis	*Myotis thysanodes*
big free-tailed bat	*Nyctinomops macrotis*
pygmy rabbit	*Brachylagus idahoensis*
Gunnison's prairie-dog	*Cynomys gunnisoni*
white-tailed prairie-dog	*Cynomys leucurus*
silky pocket mouse	*Perognathus flavus*
dark kangaroo mouse	*Microdipodops megacephalus*
Mexican vole	*Microtus mexicanus*
kit fox	*Vulpes macrotis*

See Appendix A for the rationale behind each wildlife species of concern designation.

Utah Sensitive Species List

Mollusks

Federal Candidate Species

Ogden rocky mountainsnail	*Oreohelix peripherica wasatchensis*
fat-whorled pondsnail	*Stagnicola bonnevillensis*

Federally Threatened Species

(None)

Federally Endangered Species

Kanab ambersnail	*Oxyloma kanabense*
desert valvata (extirpated)	*Valvata utahensis*

Conservation Agreement Species

(None)

Wildlife Species of Concern

southern tightcoil	*Ogaridiscus subrupicola*
Eureka mountainsnail	*Oreohelix eurekensis*
lyrate mountainsnail	*Oreohelix haydeni*
Brian Head mountainsnail	*Oreohelix parawanensis*
Deseret mountainsnail	*Oreohelix peripherica*
Yavapai mountainsnail	*Oreohelix yavapai*
cloaked physa	*Physa megalochlamys*
Utah physa	*Physella utahensis*
wet-rock physa	*Physella zionis*
longitudinal gland pyrg	*Pyrgulopsis anguina*
smooth Glenwood pyrg	*Pyrgulopsis chamberlini*
desert springsnail	*Pyrgulopsis deserta*
Otter Creek pyrg	*Pyrgulopsis fusca*
Hamlin Valley pyrg	*Pyrgulopsis hamlinensis*
carinate Glenwood pyrg	*Pyrgulopsis inopinata*
Ninemile pyrg	*Pyrgulopsis nonaria*
bifid duct pyrg	*Pyrgulopsis peculiaris*
Bear Lake springsnail	*Pyrgulopsis pilsbryana*
Black Canyon pyrg	*Pyrgulopsis plicata*
sub-globose Snake pyrg	*Pyrgulopsis saxatilis*
southern Bonneville pyrg	*Pyrgulopsis transversa*
northwest Bonneville pyrg	*Pyrgulopsis variegata*
California floater	*Anodonta californiensis*
western pearlshell	*Margaritifera falcata*

See Appendix A for the rationale behind each wildlife species of concern designation.

The U.S. Fish and Wildlife Service (Service) announces a 12-month finding on a petition to amend the List of Endangered and Threatened Wildlife. After review of all available scientific and commercial information, the Service has determined that, pursuant to the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.) (Act), listing the Wasatch Front population of the Columbia spotted frog (Rana luteiventris) is not warranted.

Summary (August 2002)

The overall level of threats to the long-term persistence of the Wasatch Front spotted frog has decreased in recent years, particularly since 1998. Although most of the human activities that contributed to these threats still occur to some extent throughout the Wasatch Front, there is no longer the same level of impacts on the spotted frog that resulted in past wide-spread habitat destruction and the loss of spotted frog populations. Much of the occupied habitat for the spotted frog is under State or Federal ownership and ongoing management of these lands emphasizes the long-term persistence of the spotted frog. This is not to say that threats have been eliminated. Localized areas continue to be affected by specific problem activities. However, mechanisms are in place through Federal, State, and local conservation and land-use plans to identify these activities, correct the problems, and protect spotted frog populations. To date, these actions have been successful at reducing threats to extant populations, largely by acquiring important habitats and implementing management actions that improve habitat conditions. Success is evidenced by the stable to improving status of the spotted frog throughout the Wasatch Front in the most recent time period evaluated.

Based on this analysis of the effects of conservation actions already in place, the trajectory of the Wasatch Front spotted frog status continues to be towards more secure populations, reduced threats, and improved habitat conditions. Although some threats continue and may increase, most threats have been or are being addressed through completed or ongoing actions and at this time do not threaten the long-term persistence of the spotted frog. Our analysis of the five factors under section 4(a)(1), individually and collectively, indicates that the spotted frog is not in danger of extinction or likely to become in danger of extinction in the foreseeable future throughout all or a significant portion of the Wasatch Front.
Therefore, the Service finds that the Wasatch Front spotted frog is ``not warranted'' for listing under the Act. If new information indicating that the level of threats have become more severe or the status of the spotted frog or its habitat degenerates in the future, the status of the spotted frog will be reevaluated.

Chak-

What would be the impacts on fish, fish habitat and other aquatic resources from the PRRP?

Impact Assessment: The Proposed Action and Existing Channel Modification and Instream Structures alternatives would increase trout biomass in the Provo River between Jordanelle Dam and Deer Creek Reservoir and also benefit non-game fish and other aquatic resources. In each case, it would take about 5 to 20 years to reach the predicted level of trout standing crop described below. The Proposed Action would increase trout biomass by about 25,212 pounds a year, or 481 percent. It also would increase aquatic habitat surface area by 13.8 acres, or 15 percent, compared to baseline conditions because of the longer channel length. The Existing Channel Modification Alternative would increase trout biomass by about 7,904 pounds per year, or 151 percent, but would decrease aquatic habitat surface area by 17.9 acres, or 20 percent, compared to baseline conditions. The Instream Structures Alternative would increase trout biomass by about 3,076 pounds per year, or 59 percent, and would not change aquatic habitat surface area from baseline conditions. Nongame fish species and other aquatic resources are expected to have similar impacts as described for trout species. These changes will occur over a period of two to 20 years as the Project Area responds to changes made to the river and floodplain under the Alternatives.

yrsort.

S.5.5 Threatened and Endangered Species

Question: What impacts would the Proposed Action and alternatives have on spotted frogs,Ute ladies'-tresses and bald eagles?

The Hydro addition NOT

Impact Analysis: ~~None of the PRRP Alternatives~~ will have significant adverseimpacts on any threatened, endangered or candidate species. The Proposed Action would temporarily disturb 24.3 acres of spotted frog habitat during construction, which would be restored by Standard Operating Procedures. It would permanently remove 62.3 acres of spotted frog habitat, which would be offset by creation and enhancement of 90.4 acres of open water, emergent marsh and wet meadow by restoring natural functions to the riparian corridor. Ponds would be constructed in Reaches 7 and 9 to replace and expand potential overwintering habitats that would be impacted by the Proposed Action. The Existing Channel Modification Alternative would temporarily disturb 100.9 acres of spotted frog habitat, which would be restored by Standard Operating Procedures. This alternative would permanently remove 22.9 acres of spotted frog habitat. Conservation measures would be used to avoid taking of this species during construction. A long-term monitoring plan is proposed to monitor potential indirect impacts of the Proposed Action. The Proposed Action and Existing Channel Modification Alternative would fully replace potential Ute ladies'-tresses habitat that would be removed during construction. The Proposed Action and Existing Channel Modification Alternative would have long-term beneficial effects on Ute ladies'-tresses habitat because of the development of a floodplain with periodic scouring and sediment deposition.

The Proposed Action would increase the habitat for peregrine falcon prey, and bald eagles would benefit from increased trout populations and more roosting habitat. The U.S. Fish and Wildlife Service has determined that the Proposed Action is not likely to adversely affect any threatened or endangered species.

INTRODUCTION

Columbia spotted frog (*Rana luteiventris*) is classified as a Utah Sensitive Species (Utah Division of Wildlife Resources 1997a) due to declines in population sizes and distribution. In Utah, historic Columbia spotted frog (spotted frog) distribution included areas within the Bonneville Basin along the Wasatch Front and in the West Desert (Table 1, Figure 1). Museum records and anecdotal information for the Wasatch Front suggest that spotted frog occurred historically in the Upper Weber River, Utah Lake, Spanish Fork River, Provo River, Jordan River, and San Pitch River drainages (Toone 1991, Turner 1960, Tanner 1931). In the West Desert, spotted frog occurred historically in several spring complexes in Snake Valley, Tule Valley, and Ibapah Valley. Currently, spotted frog populations persist in all of these areas except for the Upper Weber River and Jordan River drainages. However, the number of populations in most of these areas has diminished, and many of the extant populations, particularly those along the Wasatch Front, are small due to recent population declines. The declines have been attributed to urbanization, water development projects, livestock grazing, and the introduction and proliferation of nonnative species.

The Spotted Frog Conservation Agreement and Strategy (SFCAS; Perkins and Lentsch 1998a) was developed in 1998 as a collaborative and cooperative effort among resource agencies to expedite the implementation of conservation actions for spotted frog. The goal of the SFCAS is to ensure the long-term persistence of the species by eliminating or significantly reducing threats and restoring populations throughout the historic range. To achieve this goal, nine classes of required actions are described in the SFCAS, including: 1) surveys; 2) genetic analysis; 3) research; 4) habitat protection and enhancement; 5) nonnative species control; 6) range expansion; 7) population monitoring; 8) mitigation; and 9) regulation.

The SFCAS requires annual assessments of actions that are implemented for the conservation of spotted frog. This progress report fulfills this requirement for calendar year 2000. The report is organized according to the four Geographic Management Units (GMUs) and associated subunits (U.S. Geological Survey 1974) that were defined in the SFCAS (Table 1, Figure 1). Descriptions of the unit, conservation actions, status of threats, and population trends are provided for each GMU. An assessment of progress follows, and the report concludes with a description of future actions.

WASATCH FRONT GEOGRAPHIC MANAGEMENT UNIT

GMU Description

Six subunits comprise the Wasatch Front GMU (Table 1, Figure 1). Historic records suggest that spotted frog occurred in the Upper Weber River, Utah Lake, Spanish Fork River, Provo River, and Jordan River subunits. Currently, one population occurs in the Utah Lake subunit (Mona/Burraston), two populations occur in the Spanish Fork River subunit (Springville/T-bone Bottoms and Holladay Spring), and two populations occur in the Provo River subunit (Heber Valley and Jordanelle/Francis) (Table 1, Figure 1). Major threats to spotted frog throughout this GMU include urbanization, water development, livestock impacts, and detrimental interactions with nonnative species.

Conservation Actions

Surveys:

Surveys are required in all subunits. In 1998 and 1999, surveys were conducted in the Upper Weber River, Lower Weber River, Utah Lake, Spanish Fork River, and Provo River subunits (Thompson 2000, Thompson 1999, Wilson and Balcombe 1999). No additional surveys were conducted in 2000.

Research:

The SFCAS requires research to determine spotted frog habitat and life-history requirements. Prior to the development of the SFCAS, Perkins and Lentsch (1998b) completed a study of habitat use in Heber Valley. University of Nevada Reno (UNR) and UDWR also initiated research efforts along the Provo River in Heber Valley. Research continued in 2000:

UNR and UDWR characterized spotted frog use of wetlands for breeding in Heber Valley according to permanence, hydrology, and wetland type. A summary of preliminary results is provided in Ammon and Wilson (2000).

UDWR and UNR continued a spotted frog movement study in Heber Valley. To track movements among wetlands, spotted frogs have been captured in pitfall traps and subsequently marked with Passive Integrated Transponder tags. By fall 2000, 439 frogs had been tagged and 97 of the tagged frogs had been recaptured. Ninety-four percent of the recaptured frogs were caught in the site of their original capture. A summary of this ongoing effort is provided in Ammon and Wilson (2000).

UDWR initiated a study to determine if spotted frogs can be identified by individual spotting patterns. Study organisms were obtained when tadpoles found in one Heber Valley wetland were taken into captivity in September 2000. Metamorphosis of these tadpoles had not yet occurred due to unusually cold water in this wetland, and the tadpoles would not have survived the winter. The purpose of obtaining the tadpoles was to record the spotting patterns on individual frogs from metamorphosis to adulthood. If the spotting pattern on each frog remains consistent throughout its life, then it will be possible to identify individual frogs in natural habitats without invasive and potentially harmful marking or tagging. Each frog was held in a separate tank and photographed at regular intervals to record spotting patterns. This effort will continue through 2001. Each wild frog that was tagged in association with the movement study was also photographed after each capture. If the results of the study suggest that spotting patterns remain consistent, the photographs of the wild frogs may be useful to test the efficacy of using spotting patterns to identify frogs in the field.

UNR and UDWR conducted an experimental translocation of spotted frog egg masses in Heber Valley. The source sites for the egg masses were two ponds that were scheduled to be impacted by Provo River Restoration Project (PRRP) construction. To prevent the loss of these egg masses and to evaluate a translocation method, 34 egg masses were moved into two sites in the middle section of the Provo River.

Prior to this translocation, spotted frogs had not been detected within two kilometers of the sites, and given the unlikely probability that spotted frogs would colonize the sites naturally, any subsequent presence of spotted frogs would indicate that the translocation had been successful. Despite a substantial flood that occurred after the egg masses were transferred, tadpoles were observed in the translocation sites in May. Metamorphs were observed in August, and juvenile spotted frogs from the 2000 year class were observed at both sites on subsequent visits.

Habitat Protection and Enhancement:

Habitat protection and enhancement projects are required in all subunits. To date, habitat projects have been implemented in the Utah Lake and Provo River subunits:

In 1998, the Utah Reclamation Mitigation and Conservation Commission (URMCC) and UDWR acquired a portion of the Mona spring complex and associated property (34.5 hectares) in the Utah Lake subunit to protect three Utah Sensitive Species, including spotted frog, least chub (*Iotichthys phlegethontis*), and California floater (*Anodonta californiensis*). This acquisition protected these species from the rapid development occurring along the Wasatch Front. At the time of the acquisition, however, the Mona spring complex had already been severely degraded by livestock (Figure 2, Figure 3). In 2000, UDWR implemented habitat enhancement actions on the property to: 1) improve riparian conditions; 2) slow spring succession; and 3) improve water quality. The fence surrounding the property was repaired to prevent livestock access outside of the permitted grazing period (as part of the purchase agreement, livestock are permitted on the property between May and November until 2004). To prevent direct livestock access to spotted frog habitat, a two-strand electric fence was constructed around the spring complex on the property. UDWR removed all cow carcasses and manure from the electric fence interior. In addition, UDWR continued negotiations to acquire additional properties surrounding the currently unprotected portion of the Mona spring complex. Acquisition of two additional land parcels (16.2 hectares) would enable UDWR to protect and enhance habitat throughout the entire spring complex.

In 1999, URMCC created 22 new wetlands along the Provo River between Jordanelle Dam and Deer Creek Reservoir as part of the PRRP pilot project. These wetlands were constructed to provide and enhance spotted frog habitat and to mitigate for impacts that would occur in association with other PRRP actions. In 2000, URMCC and the U.S. Bureau of Reclamation (BOR) maintained these wetlands. Ten of the 22 wetlands contained egg masses in spring 2000 (Table 2), indicating that spotted frogs are using the ponds for breeding. Thirty-eight of the 167 aquatic sites in Heber Valley are currently occupied by spotted frog. These 38 sites cover 16.8 hectares and comprise 35 percent of the total wetland area in the Provo River corridor (Ammon and Wilson 2000).

URMCC completed additional land acquisitions in the Provo River subunit in conjunction with PRRP. In 1998 and 1999, URMCC acquired 82.1 hectares that contain wetlands that are either occupied by spotted frog or that represent potential spotted frog habitat. The acquisition of these lands protects spotted frog habitat from development along the Provo River corridor. In 2000, URMCC acquired an additional 78.9 hectares acres of land for this purpose.

Nonnative Species Control:

Control of nonnative species is required in all subunits. Prior to 2000, limited nonnative species control efforts were implemented in the Mona spring complex in the Utah Lake subunit (Wilson and Thompson 1999). Funded by BOR, UDWR conducted a more extensive nonnative fish removal project at the Mona spring complex in fall 2000. Prior to this project, mosquitofish (*Gambusia affinis*) and several other nonnative fish species were abundant throughout the spring complex. The objectives of the project were to: 1) eliminate or significantly reduce threats posed by nonnative fishes; 2) evaluate mechanical trapping as a technique to control nonnative fishes; and 3) monitor spotted frog and least chub population responses. To remove nonnative fishes, approximately 400 minnow traps were set daily for 19 nights. Fish were identified and enumerated and nonnative fishes were removed from the spring complex. A total of 41,054 fish were captured. Nonnative fishes comprised 90 percent (n = 36,968) of the catch. Mosquitofish comprised 61 percent (n = 25,080) of all captured nonnative fishes. Monitoring will be conducted in 2001 to determine how quickly nonnative fish re-populate the spring complex and to assess the response of the native species populations. The removal effort will likely be repeated in fall 2001.

Range Expansion:

Range expansion actions are required in all subunits. Limited range expansion has occurred in Heber Valley in the Provo River subunit because spotted frogs have colonized a portion of the wetlands that were created in 1999. In addition, an experimental translocation was conducted in Heber Valley along the Provo River. No other frog transfers have occurred to date. Statewide range expansion actions are discussed in a subsequent section.

Population Monitoring:

The SFCAS requires annual monitoring of all spotted frog populations in the Wasatch Front GMU. UDWR began annual monitoring in 1992 and continued this effort in 2000. Methodology and results are described in Wilson and Balcombe (2000). Monitoring data are presented in Figures 5, 6, and 7. Additional monitoring has also been conducted in Heber Valley every year since 1994, in conjunction with ongoing research efforts in this area (Ammon and Wilson 2000).

Status of Threats

Prior to the development of the SFCAS, potential residential development threatened the Mona/Burraston population. Due to the purchase of property surrounding a portion of the Mona spring complex, this threat has been reduced significantly. Livestock grazing was another threat to habitat in the Mona spring complex. Banks were severely trampled and riparian vegetation was scarce. Livestock trampling had also accelerated spring succession. Cow carcasses and manure were abundant in and around the spring complex, potentially compromising water quality. The impacts to spotted frog may have included tadpole and adult mortality due to direct trampling, slower growth rates caused by a diminished prey base, and a decrease in reproductive success due to alteration of water temperature, water chemistry, and habitat structure (Reaser 1996). Since the implementation of the SFCAS, livestock impacts have been significantly reduced and habitat conditions have significantly improved in the protected area of the spring complex. The banks no longer exhibit evidence of livestock trampling and the riparian vegetation has returned (Figure 2, Figure 3). Spring succession is no longer accelerated. Water quality has been improved by the removal of excess nutrients previously provided by livestock. However, habitats in other unprotected areas of the spring complex are still threatened by livestock and accelerated spring succession.

Nonnative fish also pose a threat in the Mona spring complex. Nonnative fish at the site include: mosquitofish, rainwater killifish (*Lucania parva*), plains killifish (*Fundulus zebrinus*), fathead minnow (*Pimephales promelas*), common carp (*Cyprinus carpio*), and green sunfish (*Lepomis cyanellus*). Mosquitofish is a particular threat to spotted frog, because it is a known predator on amphibian eggs and larvae (Grubb 1972) and it may selectively prey on amphibians despite the availability of other potential prey items (Goodsell and Kats 1999). In a study by Lawler et al. (1999), red-legged frog (*Rana aurora*) tadpoles suffered more injuries in ponds containing mosquitofish, and weighed 34 percent less at metamorphosis compared to tadpoles in fishless ponds. Mosquitofish may cause similar impacts to spotted frog in the Mona spring complex. The threats posed by mosquitofish and other nonnative fishes have been reduced through the mechanical removal project conducted in fall 2000. Monitoring will be conducted to determine how quickly nonnative fishes will re-populate the complex and to assess the response of native populations. It is probable that it will be necessary to repeat the removal effort regularly to maintain nonnative fish populations in low numbers.
A potential future threat to the Mona/Burraston population is groundwater withdrawal is north Juab Valley. A simulation by Thiros (1999) suggested that, at 1992 rates of withdrawal, groundwater levels near this population would be lowered by approximately five feet and groundwater discharge rates would experience a 38 percent reduction by 2022. Withdrawals that exceed the 1992 rate would further deplete groundwater

levels and rates of discharge. Therefore, water withdrawals may decrease the size of available spring habitat in north Juab Valley.

The threats to spotted frog populations in the Spanish Fork River subunit include urbanization, low water levels, and livestock impacts. Both the Springville/T-bone Bottoms and Holladay Spring populations occur in areas that are experiencing rapid residential development. The Springville habitat occurs on property owned by UDWR, and therefore experiences some degree of protection. The T-bone Bottoms and Holladay Spring sites, however, are on private lands and are subject to impacts from potential development. Water levels decline throughout the breeding season in the T-bone Bottoms and Holladay Spring habitats, subjecting egg masses to potential desiccation, or potentially causing habitats to dry prior to tadpole metamorphosis. The T-bone Bottoms population also experiences livestock impacts similar to those that were previously occurring at the Mona spring complex. Funds have been secured to develop a habitat management plan for the Spanish Fork River subunit to identify strategies to eliminate these threats and to improve spotted frog habitat. UDWR will initiate plan development in 2001.

Spotted frog populations in the Provo River subunit were threatened by loss of habitat due to residential development and water development projects. Through habitat acquisitions associated with PRRP, the threat to spotted frog posed by residential development has been significantly reduced. The construction of 22 new wetlands has also significantly increased the amount of suitable spotted frog habitat along the Provo River corridor. Although some modification in wetland maintenance and irrigation practices may be necessary, URMCC and BOR have committed to provide sufficient water to these wetlands during the spotted frog breeding season. Habitats not yet acquired are still threatened by residential development, and further efforts are necessary to secure these areas.

Rapid urbanization, agricultural practices, water development projects, and nonnative species continue to impact historic habitats elsewhere in the Wasatch Front GMU. Residential developments continue to expand into historically occupied areas. Livestock use has degraded wetlands within the historic distribution. The diversion of springs and streams, the pumping of groundwater, and inundation of reservoirs have altered natural flows, depleted groundwater discharges, and rendered many areas unsuitable for spotted frog. These practices have also fragmented historic habitats, limiting, if not eliminating, opportunities for natural re-colonization. Groundwater level declines due to withdrawal for human use, similar to those predicted for north Juab Valley, will likely occur in other areas as well. Several nonnative species that occur in the Mona spring complex have also been introduced into other historic spotted frog habitats. Other species that are potential spotted frog predators, including, but not limited to, rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), brook trout (*Salvelinus fontinalis*), largemouth bass (*Micropterus salmoides*), white bass (*Morone chrysops*), and walleye (*Stizostedion vitreum*), have been introduced into areas within the historic spotted frog distribution. Removal efforts would be necessary prior to the re-introduction of spotted frog into areas where these species occur.

Population Trends

Population trends are assessed in terms of observed egg mass numbers at standard monitoring sites. Egg mass data for recently discovered breeding sites are provided, but remain separate from the standard site data to allow comparisons among years. The Mona/Burraston population has been monitored since 1992 (Figure 5). Fifteen egg masses were observed at standard monitoring sites during the first year of monitoring. The number of observed egg masses declined to only five in 1994 and then surged to as high as 148 in 1997. The number of observed egg masses at standard monitoring sites declined to 78 in 1998 and 61 in 1999, and then increased once again to 111 in 2000. Therefore, the number of egg masses observed for this population in 2000 is more than seven times greater than it was in 1992 when monitoring began. Additional breeding sites were discovered in 1999, and the total number of egg masses observed for this population in 2000 was 120. It is also important to note that several conservation actions have been recently implemented in the Mona spring complex and there will likely be a time lag between implementation and an observable positive population response. Therefore, it is anticipated that the numbers of egg masses observed annually will continue to exhibit a generally increasing trend.

The populations in the Spanish Fork River subunit have also been monitored since 1992 (Figure 6). The number of egg masses at the Springville/T-bone Bottoms site was 12 in 1992, and increased to as high as 87 in 1998. Fifty egg masses were observed at the Springville site in 2000. The T-bone Bottoms area was not monitored. The number of egg masses observed at the Holladay Spring site was 36 in 1992, increased to as high as 144 in 1999, and was 135 in 2000 at standard monitoring sites. The egg mass data indicate that reproductive output for both populations in this subunit have increased since monitoring began. Additional breeding sites were discovered near Holladay Spring in 1999, and the egg mass totals for 1999 and 2000 are 192 and 160, respectively. It is probable that surveys conducted in 2001 and 2002 to develop a habitat management plan for this subunit will discover additional breeding sites and egg masses.

The Heber Valley population in the Provo River subunit is the largest population in the Wasatch Front GMU (Figure 7). In 1992, 272 egg masses were observed. The smallest number of egg masses (n = 89) was observed in the following year. In 1997, 483 egg masses were observed, representing the largest reproductive output since monitoring began. In 2000, there were 409 observed egg masses. These data suggest that the reproductive output increased significantly from 1992 to 1997, and has since been generally stable. The number of observed egg masses at the Jordanelle/Francis site increased from 63 to as high as 93 from 1992 to 1994, and then declined to as few as 20 in 1999. In 2000, the number of egg masses observed at standard monitoring sites rebounded to 59. These data indicate that this population has been generally stable since monitoring began. Additional breeding sites were also found at the Jordanelle/Francis site. These additional sites produced 43 and 40 egg masses, in 1999 and 2000, respectively. The total number of egg masses observed at this site in 2000 was 99.

WEST DESERT GEOGRAPHIC MANAGEMENT UNIT

GMU Description

The West Desert GMU includes nine subunits (Table 1, Figure 1). Historic records suggest that spotted frog occurred in the Snake Valley, Tule Valley, and Ibapah Valley subunits. Extant spotted frog populations are currently found in Miller Spring/Leland Harris Springs, Gandy Salt Marsh, and Bishop Springs in the Snake Valley subunit, in Coyote Springs, Willow Springs, North Tule Springs, and South Tule Springs in the Tule Valley subunit, and in Ibapah Valley in the Ibapah Valley subunit (Table 1, Figure 1). Major threats to spotted frog in this GMU include water diversion, livestock grazing, nonnative species, and proposed gas and oil exploration.

Conservation Actions

Surveys:

The SFCAS requires additional surveys in all subunits. In 1998 and 1999, surveys were conducted in the Snake Valley, Tule Valley (Hogrefe and Fridell 2000), and West Great Salt Lake (Thompson 1999) subunits. In 2000, UDWR surveyed numerous wetlands in Box Elder County in the West Great Salt Lake subunit. Although the primary focus of the surveys was to define boreal toad (*Bufo boreas boreas*) distribution, data were collected for all observed amphibians. No spotted frogs were observed.

Habitat Protection and Enhancement:

Habitat enhancement is required in the Snake Valley, Tule Valley, and Ibapah Valley subunits. To date, habitat projects have been implemented in the Snake Valley subunit. In 1998, the U.S. Fish and Wildlife Service (FWS), UDWR, and a private landowner developed an agreement to improve habitat conditions at Miller Spring. This site supports one of the largest spotted frog populations, but it had been degraded due

May 19, 2004

Mr. Terry Hickman
Central Utah Water Conservancy District
355 West University Parkway
Orem, Utah 84058-7303

RE: Jordanelle Dam Hydroelectric Project, Wasatch County, Utah. Sagebrush Consultants, L.L.C. Report No. 1335.

Dear Terry,

This document represents a letter report on the cultural resources survey for the Central Utah Water Conservancy District (CUWCD), Jordanelle Dam Hydroelectric Project in Wasatch County, Utah. The project area is located in T. 2S., R. 5E., Sec 31 on the USGS 7.5' Quadrangle Heber City, Utah (1955) (Figure 1). The proposed project consists of the construction of a hydroelectric power plant, at the base of the Jordanelle Dam, where water is released into the Provo River. From the power plant, there are two proposed alternative powerline corridors. The first alternative powerline consists of approximately 1130 ft of new powerline. The second alternative consists of 570 feet of new powerline and 1004 ft following existing powerlines. Fieldwork for this project was undertaken on May 19, 2004, under the authority of Utah State Antiquities Project Permit No. U-04-SJ-0459w.

The entire project area was surveyed by the Bureau of Reclamation in 1987, prior to the construction of the Jordanelle Reservoir Project (McCarty et al. 1987). There were no cultural resources found in the current project area during that survey. Since 1987, the landscape has been greatly altered at the proposed site from the construction of the Jordanelle Dam. Although it was not likely that any intact cultural resources would be found in the proposed project area, due to the drastic alteration of the landscape during construction, Sagebrush conducted a field visit to the project area to determine if there were any existing cultural resources in the project area.

The proposed project area is located in the northern end of the Heber Valley on the east side of the Wasatch Mountain Range. The elevation of the proposed site is approximately 1791 m (5875 ft) a.s.l. The project area falls within the Wasatch Hinterlands subdivision of the Middle Rocky Mountains Physiographic Province. The climate of the Heber Valley is relatively mild, characterized by cool summers and cold winters. Soils are represented primarily by brown clay silt alluvial deposits with medium to large rounded cobbles. The proposed site is relatively flat, except for areas built up along the banks of the Provo River and areas where boulders were placed during dam construction. Because of the extensive clearing and construction in the project area, much of the native vegetation has been significantly altered. The site is either cleared of vegetation or consists of medium height marsh grasses with one or two low sagebrush growing in the project area.

Fifty foot wide corridors were surveyed for the two powerline alternatives. The pad where the hydroelectric power plant will be constructed lies at the base of the dam in an area covered with small boulders (part of the dam construction) (Figure 2). The powerline corridors are located just south of the Jordanelle Dam structure in an area that was used as a staging area for the construction of the dam (Figure 3). Additionally, the Provo River runs along the eastern extent of the project area. Banks have been built up along the river and the course has been somewhat altered with the dam construction (Figure 4).

The project area was assessed and surveyed by the author on May 19, 2004. No cultural resources were observed in the project area.

Sincerely,

Wendy Simmons Johnson
Senior Archaeologist

Attachment

References Cited

McCarty, Tara, Richard McCarty, Denise Evans and Carol Wiens
1987 *Cultural Resources Survey of the Jordanelle Reservoir Area, Wasatch and Summit Counties, Utah.* Bureau of Reclamation, Upper Colorado Region. Manuscript on file at the Utah State Historic Preservation Office.

State of Utah

JON M. HUNTSMAN, JR.
Governor

GARY R. HERBERT
Lieutenant Governor

Department of Community and Culture

YVETTE DONOSSO DIAZ
Executive Director

Division of State History / Utah State Historical Society

PHILIP F. NOTARIANNI
Division Director

April 4, 2005

Terry J. Hickman
Environmental Programs Manager
Central Utah Water Conservancy District
355 West University Parkway
Orem UT 84058-7303

RE: Jordanelle Dam Hydroelectric Project Sagebrush Report 1335 U-04-Sj-0459

In Reply Please Refer to Case No. 05-0413

Dear M. Hickman:

The Utah State Historic Preservation Office received the above information on March 29, 2005. The report states that no cultural resources were located in the project area. We, therefore, concur with the report's recommendation of No Historic Properties Affected.

This information is provided on request to assist with Section 106 responsibilities as specified in §36CFR800. If you have questions, please contact me at (801) 533-3555. My email address is: jdykman@utah.gov

As ever,

James L. Dykmann
Deputy State Historic
Preservation Officer - Archaeology

JLD:05-0413 OFR/NPA

c: Sagebrush Archaeological Consultants, 3670 Quincy Avenue, Suite 203, Ogden UT 84403

ATTACHMENT 11

Explanation of Recreation Management in the Area

The Jordanelle Dam has been providing recreational flow releases for downstream fisheries. The same flow releases will continue to be provided once the hydropower plant is in place.

Jordanelle Dam is the key feature of the Municipal and Industrial System of the Central Utah Project. Its primary purpose is to store surplus flows on the Provo River and water from Strawberry reservoir exchanged through Utah Lake for Municipal and Industrial use in Salt Lake County, Wasatch County, Summit County, and northern Utah County, Utah. Additional project purposes include flood control, recreation, Heber Valley irrigation storage, and fish and wildlife enhancement. The Central Utah Water Conservancy District has primary Jurisdiction of the Jordanelle Dam. This area is approx. 300 feet upstream and 1000 feet downstream of the dam. This area is considered by The Bureau of Reclamation as "high security." No unauthorized access is permitted in this area. Jurisdiction of the reservoir upstream of the high security zone has been turned over to the Utah State Parks. The river below the high security is controlled by the Utah Reclamation and Mitigation Commission. The Jordanelle Hydroelectric Power Plant will be constructed in the High security zone therefore there will be no public access.

The river, outside the restricted area, below the dam is managed by Utah Division of Wildlife and the Utah Reclamation and Mitigation Commission. Free recreation access and facilities are provided.

The reservoir is managed by Utah Division of Wildlife and Utah State Parks. Utah State Parks charges fees for access to the reservoir and facilities. Central Utah Water Conservancy District and Heber Light and Power have no authority over recreation access to the reservoir.