2009 Salt Lake Countywide Water Quality Stewardship Plan

ADDENDUM
STREAM FUNCTION INDEX
Midvale City Report

Water Quality Stewardship Plan

SALT LAKE COUNTY

2009
SALT LAKE COUNTYWIDE
WATER QUALITY STEWARDSHIP PLAN

ADDENDUM
STREAM FUNCTION INDEX REPORT

Midvale City Report

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WATER QUALITY STEWARDSHIP PLAN

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1.0 INTRODUCTION

Armed with the widely supported 2009 Salt Lake Countywide Water Quality Stewardship Plan (WaQSP), regulatory and municipal authorities in Salt Lake County seek to work collaboratively to monitor and improve watershed and stream health. After examining the current conditions, numerous water quality and watershed improvement recommendations were made in the 2009 WaQSP. However, written recommendations and well laid plans are only as good as the implementation efforts that result. With the completion of the WaQSP, Salt Lake County and its partners now enter the most challenging and rewarding phase of watershed management—implementation. A key challenge in the implementation phase is to measure the success and/or failure of implementation efforts. Therefore, to inform future planning decisions, and to assure a successful, iterative, planning and implementation process, Salt Lake County developed a monitoring tool for the WaQSP known as the Stream Function Index (SFI). The SFI was developed in 2006 with the assistance of several environmental consulting firms. The primary consultant on this effort was Cirrus Ecological, based in Logan, UT.

It is anticipated that SFI data will be collected along with each update of the WaQSP that will occur every six years. It is also anticipated that reports, such as this one, will be written for each municipal government at that same frequency. Successful implementation of WaQSP recommendations should lead to improved SFI scores. However, if BMPs do not lead to improved SFI scores, they will be re-examined for effectiveness in the local environment.

Great Blue Heron on the Jordan River in Midvale.

1.1 COMPONENTS OF THE STREAM FUNCTION INDEX (SFI) AND ECOSYSTEM HEALTH INDEX (EHI)

Streams and rivers, although single components of the larger watershed, may serve as indicators of overall watershed health. To maximize resources and time, Salt Lake County decided to focus on monitoring stream and river corridors to indicate overall watershed function. However, a broader examination of watershed function may be accomplished in the future with increased funds and staff. For the purposes of this document, data collected in stream and river corridors are used to indicate watershed function.

To monitor stream and river health, the SFI measures physical, chemical, biological, and social functions of stream and river corridors in Salt Lake County. The four watershed functions that are examined in the SFI include: habitat (aquatic and terrestrial), hydraulics (flood conveyance and stream stability), water quality and social (recreation and aesthetics). Metrics used to determine scores for each of the four watershed functions are included in Table 1. Recreation and aesthetics monitoring is included in the SFI to indicate the degree to which stream and river corridors provide appropriate, or resource compatible, recreation and aesthetic opportunities. However, recreational facilities may, if incompatible with the resource, detrimentally effect stream ecology.

In order to examine ecological health independent of social function, Salt Lake County created an Ecological Health Index (EHI). The EHI is a sub-component of the SFI that includes habitat, hydraulics, and water quality evaluations. The EHI may be compared with the SFI to determine possible effects of social (i.e. recreational and aesthetic) functions on stream ecology.

See the “Stream Function Index Main Report” Appendices for the complete SFI Methodology Report.

1.2 DATA COLLECTION

The majority of 2009 SFI numbers were based on data gathered between 2007 and 2008. However, water quality data spans a greater time period (2001 to 2008). In future SFI updates, it is anticipated that water quality data collected between updates will be used to assess stream

Salt Lake County—Stream Function Index (SFI)
Midvale City

Metric	Sub-Group	Functional Group	Ecosystem Health Index	Stream Function Index
Pool/Riffle ratio	Stream Channel	Habitat	EHI	SFI
Water Depth				
Fish Passage				
Habitat Structures				
Flow Diversion				
Riparian Width	Riparian Corridor			
Riparian Density				
Floodplain Development	Flood Conveyance	Hydraulics		
Floodplain Connectivity				
Bank Stability	Stream Stability			
Hydraulic Alteration				
303(d) list	Regulatory	Water Quality		
Macroinvertebrate	Aquatic			
Total P	Monitoring			
Temperature				
TDS				
DO				
E. coli				
Management	Aesthetics	Social		
Visual Aesthetics				
Location	Amenities (Nodes)			
Accessibility (ADA Approved)				
Restrooms				
Resource Compatibility (Nodes)				
Trail Corridor	Amenities (Trails)			
Connectivity				
Resource Compatibility (Trails)				

Table 1. Stream Function Index Metrics Flow Chart

health. Although previous stream stability and fish habitat assessments were conducted on a few streams and the Jordan River in the mid 1980's, the 2009 SFI represents the first comprehensive assessment of all major waterways in Salt Lake County. Therefore, this dataset is considered a baseline.

The SFI is intended to give watershed and stream managers an overview of current stream conditions. However, as improvement projects are identified, more detailed studies may be required to fully assess the condition of the stream.

Right—Site of the Midvale Slag Superfund Site along the Jordan River (looking NE.) The site has been capped and is currently being developed in stages. Bank stabilization and riparian restoration work is underway by EPA and Salt Lake County.

2.0 MIDVALE CITY—INFORMATION

Midvale City, located in the central portion of Salt Lake County, is a relatively old city (incorporated in 1900) and is home to approximately 27,182 residents. Contained within Midvale's boundaries is a small section of Little Cottonwood Creek and a section of the Jordan River. Additionally, parts of two sub-watersheds are found within Midvale City boundaries: Jordan River Corridor and Lower Little Cottonwood Creek Sub-Watersheds. This report summarizes the health of the river and stream sections within Midvale City and provides guidance for future water quality improvement and watershed preservation efforts. Midvale City will also receive a copy of the 2009 WaQSP Addendum Stream Function Index Main Report, and will receive electronic files of the report and Geographic Information System (GIS) shapefiles depicting information collected as part of the SFI.

Little Cottonwood Creek through the Fort Union complex in Midvale City

2.1 WATER QUALITY STRESSORS IN MIDVALE CITY

Although the SFI is a measure of stream corridor health, it is imperative that water quality and watershed health be approached comprehensively. Therefore, this section is provided to review water quality stressors identified in the 2009 WaQSP for the sub-watersheds in Midvale City.

As part of the 2009 WaQSP, a computer-based GIS analysis was conducted in each of the 27 sub-watersheds in Salt Lake County to determine existing and potential future water quality stressors. In Chapter 5 of the WaQSP document, these water quality stressors are outlined and Best Management Practices (BMPs) recommended to address potential concerns. Below is a review of the stressors and recommendations identified for sub-watersheds within Midvale City.

Water quality stressors that were identified in the Jordan River Sub-Watershed include:

- Stream channel modification
- Lack of developed recreation
- Stream flow diversions
- Loss of open space
- High number of Industrial Stormwater Discharge Permits
- Floodplain encroachment
- Densification of residential land use
- Urban development and redevelopment pressures

Water Quality stressors that were identified in Lower Little Cottonwood Creek Sub-Watershed include:

- Lack of developed recreation opportunities
- Stream flow diversions
- Floodplain encroachment
- Lack of stream corridor preservation

BMPs that were recommended to address these potential water quality stressors include:

- Bioengineered bank stabilization
- Grade control structures
- Channel restoration/enhancement
- Streambank revegetation
- 401 permitting
- Diversion structures modification
- Canal water diversion

Midvale City		3,753 Acres
Sub-Watersheds	Lower Little Cottonwood Creek	109 Acres
	Jordan River Corridor	3,644 Acres
Streams	Little Cottonwood Creek	1,202 Feet
	Jordan River	13,779 Feet

Table 2. Midvale City Watershed Areas and Stream Lengths

- Leadership in Energy and Environmental Design criteria
- Minimum flow protection
- Water rights acquisition
- Identify community recreation needs and opportunities
- Wetlands restoration/enhancement
- Manufactured treatment systems
- Participate in new and/or existing planning efforts
- Floodplain re-establishment
- Trash racks
- Land acquisition for preservation
- Volunteer programs
- Recreational facilities that are accessible and resource compatible.

Pelicans at a constructed wetland along the Jordan River in Midvale. The wetlands are located on the Midvale Slag Superfund Site and part of habitat mitigation efforts (looking east across the river).

3.0 STREAM FUNCTION INDEX (SFI)

Similar to the 2009 WaQSP effort to identify water quality/watershed stressors, four watershed functions were examined for each stream: water quality, habitat, hydraulics, and social/aesthetics services. In order to assess the ability of streams to provide these four functions, Salt Lake County developed what is called the Stream Function Index (SFI). The SFI is a rapid assessment protocol that assesses stream habitat, hydraulics, water quality and social factors. Based on established methodology, the SFI measures 27 metrics to determine overall stream health. These metrics are categorized by watershed function (water quality, habitat, hydraulics, social/aesthetic) and can therefore be examined individually or by functional group.

The SFI is a tool to help identify the results of water quality stressors along main stream channels and the Jordan River. These areas are candidates for enhancement projects. The SFI provides the framework for a more detailed baseline and monitoring techniques that may be used on those projects. The first complete dataset was collected during the 2007 and 2008 field seasons and is considered the baseline. The SFI will be repeated every 6 years in conjunction with the Water Quality Stewardship Plan Update.

4.0 WATERSHED FUNCTION GROUPS

This section summarizes scores for the four watershed functions countywide and to review data and scores within The Midvale City boundaries. Additional information on SFI methodology can be found in the SFI Main Report.

4.1 WATER QUALITY FUNCTIONAL GROUP SCORE

The SFI water quality functional group is comprised of seven metrics or measures: 303(d) list status, macroinvertebrates, Total Phosphorus, Temperature, Total Dissolved Solids (TDS), Dissolved Oxygen (DO), and Coliform (*E. Coli*). Based on 2009 SFI scores, the streams with the best water quality are concentrated in the upper regions of both the Wasatch and Oquirrh streams, with the notable exception of upper Little Cottonwood Creek (currently listed as water quality impaired by the State Division of Water Quality) for zinc. Additionally, lower Emigration Creek and Red Butte Creek received high rankings for water quality. Notably, these scores are based entirely on data contained in the Environmental Protection Agency's (EPA) STORET database. Although this data represents a large portion of water quality data collected in Salt Lake County, it does not represent all data. However, it was decided that the SFI would rely on STORET data to assure consistent methodologies and that certified water quality assurance (QA) and water quality control (QC) measures were taken.

In addition to noting areas of high, or good, water quality, it is important to note areas of low, or poor water quality. As can be seen from the Countywide data presented in Figure 1, segments with low water quality values include: upper and lower

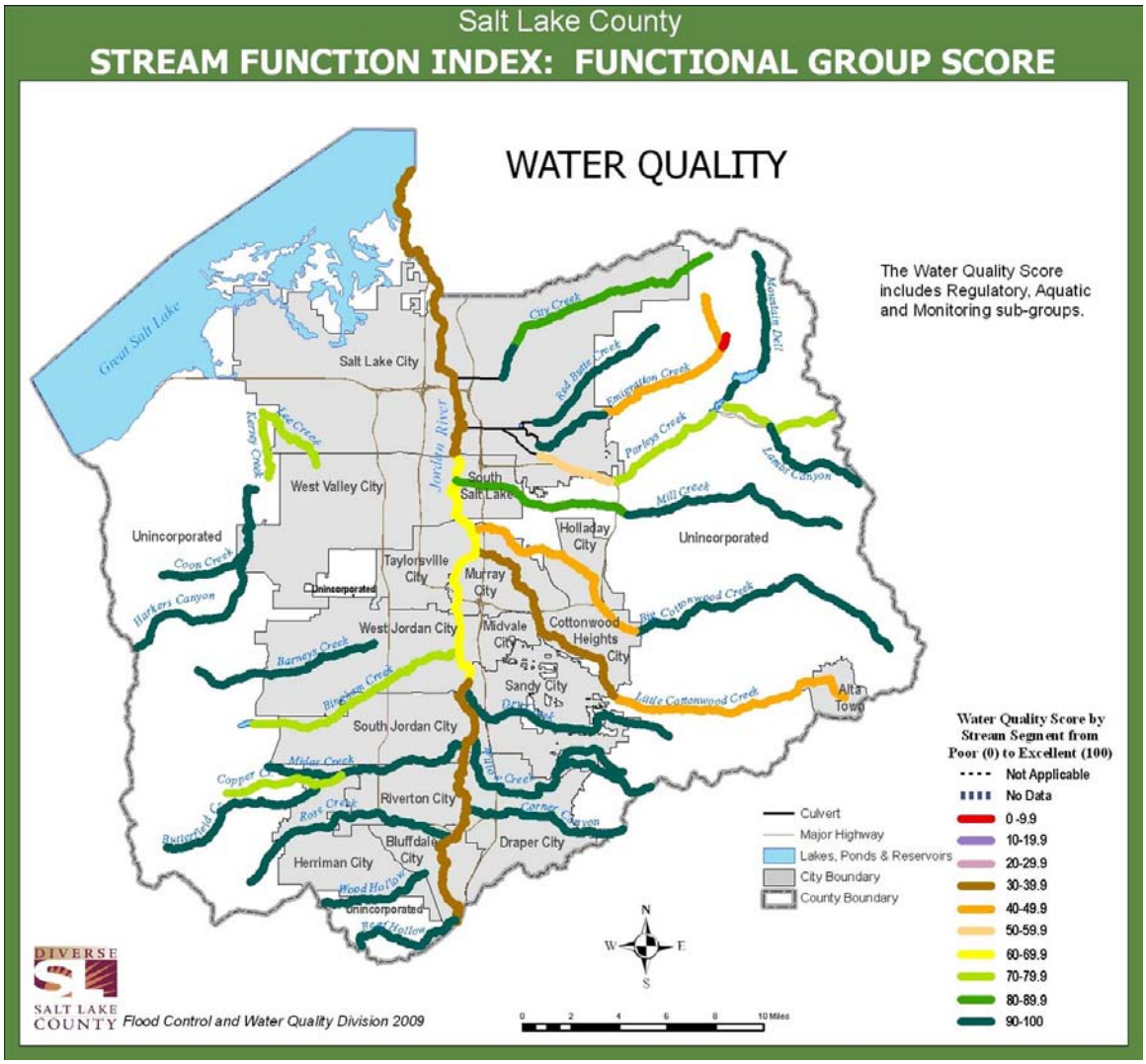

Figure 1. Water Quality Functional Group Scores Countywide

Jordan River, lower and upper Little Cottonwood Creek, lower Big Cottonwood Creek, and upper Emigration Creek. All of these segments scored as meeting water quality standards in <50% of samples taken. Many of these water quality concerns are currently being addressed through the State Division of Water Quality's (DWQ) Total Maximum Daily Load (TMDL) program. TMDL studies are currently underway for the Jordan River, upper Emigration Creek, and upper Little Cottonwood Creek. Additionally, lower Big and Little Cottonwood Creeks are listed as impaired on DWQ's 303(d) list of impaired water bodies.

As can be seen in Figure 1, water quality concerns in Midvale City are focused on the Jordan River and Little Cottonwood Creek. Pollutants of concern in the Jordan River include Total Dissolved Solids (TDS), temperature, Dissolved Oxygen (DO), Total Phosphorus (TP), and *E. Coli*. Water Quality concerns in Little Cottonwood Creek focus on temperature.

To address these concerns, it is recommended that Midvale City actively participate in the Jordan River TMDL process by attending Jordan River Watershed Council (JRWC) meetings and reviewing documents that are published in conjunction with the Jordan River TMDL. Additionally, it is recommended that Midvale City actively participate in discussions regarding water right exchanges with the State Division of Water Rights (DWRi), Division of Water Quality (DWQ), Salt Lake City, and Salt Lake County to address these concerns.

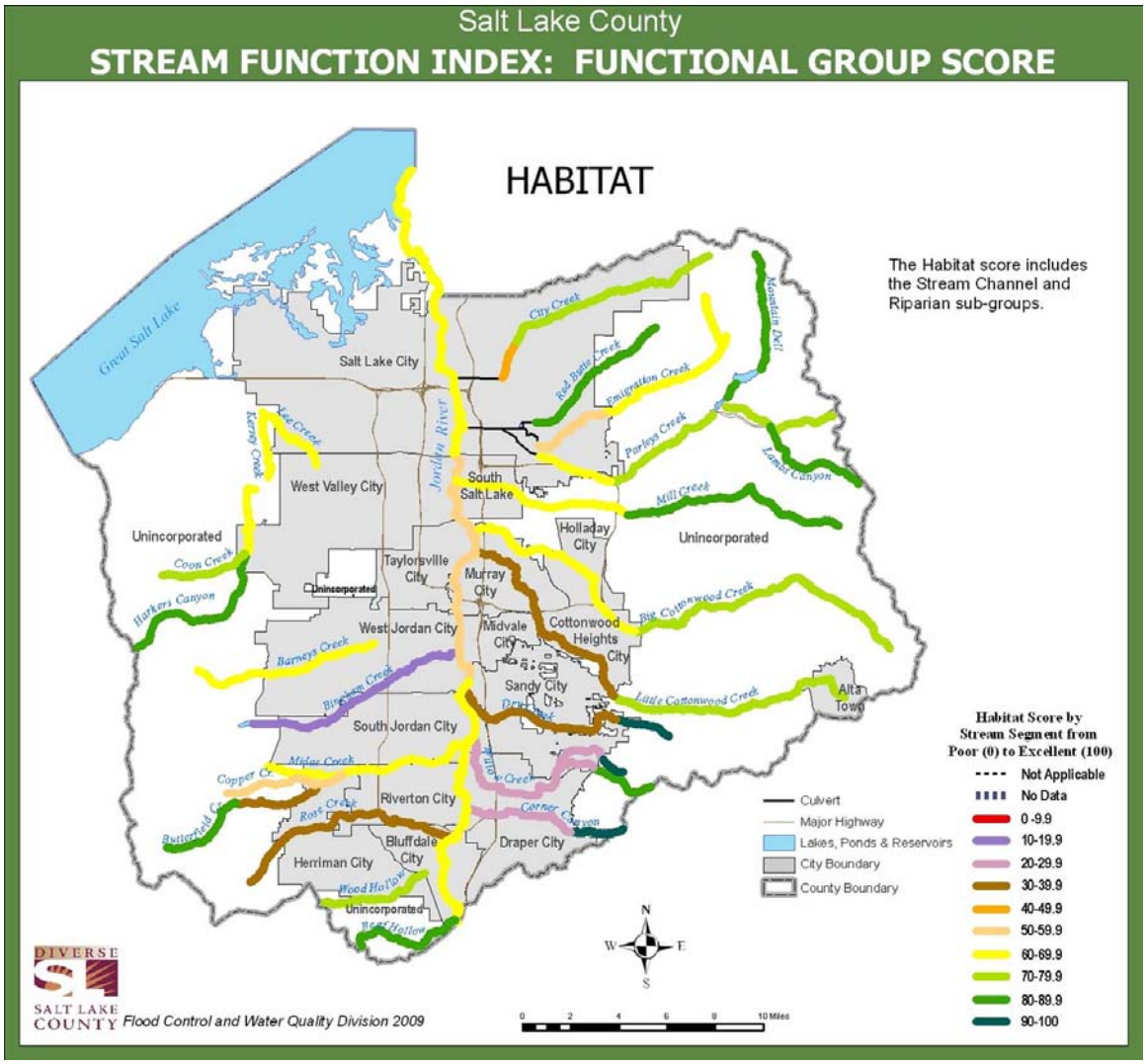

Figure 2. Habitat Functional Group Scores Countywide

4.2 HABITAT FUNCTIONAL GROUP SCORE

In the SFI, the habitat function was characterized by: pool/riffle ratio, fish passage, habitat structure, flow diversion, riparian width, and riparian density. Of note, stream channel habitat metrics were only assessed for streams that have been identified, by the State Division of Wildlife Resources (DWR) as supporting fish habitat. Flow diversion and riparian metrics were assessed for all streams.

Similar to the Water Quality Functional Group Score, the streams with the best, or highest scoring, habitat function are concentrated in the upper regions of both the Wasatch and Oquirrh mountains. However, in contrast to water quality, not all sections of upper Oquirrh Mountain streams rank high for habitat. Of note, Copper Creek and Rose Creek both scored <60% for overall habitat function. Other areas of particular habitat concern include lower Big and Little Cottonwood Creeks and the section of Butterfield Creek upstream from its confluence with Midas Creek.

As can be seen from Figure 2, Midvale City contains a small section of Little Cottonwood Creek that scored between 30 and 39.9 for habitat. Additionally, the section of the Jordan River adjacent to Midvale City scored between 50 and 59.9. These scores are primarily due to lack of habitat structure and flow diversions.

Recommendations to improve habitat function in Midvale should be coordinated with surrounding municipalities and Salt Lake County and will be further explored in the following sections that examine specific habitat concerns.

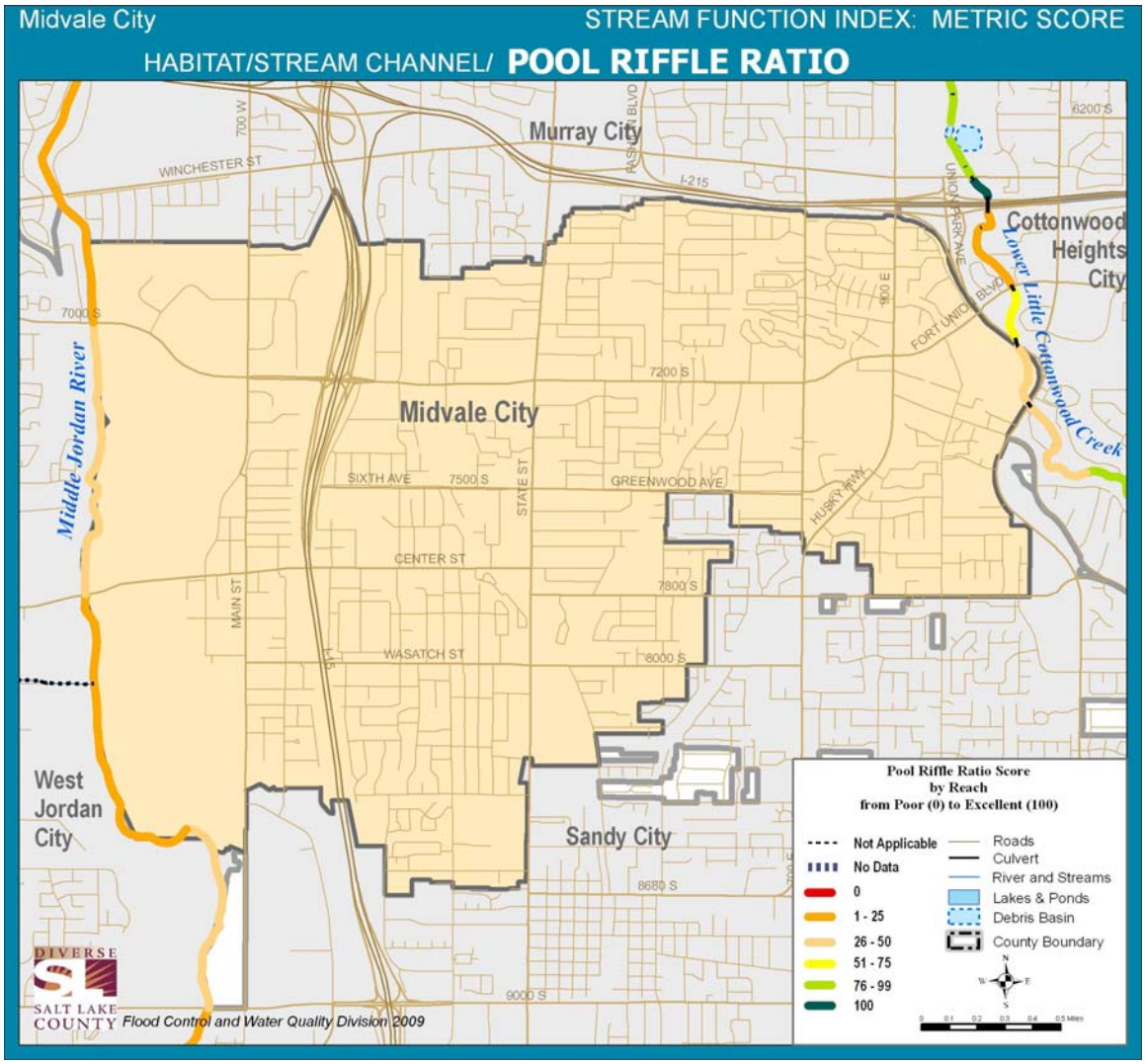

Figure 3. Habitat Function—Pool/Riffle Ratio in Midvale City

4.2.1 Pool/Riffle Ratio in Midvale City

An important component of stream habitat function is the ratio between pools and riffles. For the SFI, the number of pools and riffles were counted for each stream reach. Pools were defined as mid-channel areas with low velocity that were at least 1 foot deep. Riffles were defined as mid-channel shallow turbulent areas of higher velocity. The number of pools was compared to the expected number for the given stream type (see SFI Main Report for an explanation of stream type.) Subsequently, the pool/riffle ratio was determined. A score of "Not Applicable" (N/A) indicates that the stream does not support a fishery.

The majority of the Jordan River section adjacent to Midvale City scored between 1 and 50 for pool/ riffle ratios (Figure 3). This is largely due to the channelized nature of the Jordan River through this section. Additionally, the section of Little Cottonwood Creek within Midvale City scored between 26 and 50.

Recommended actions to improve pool/riffle ratio are similar to those for habitat structure (discussed in Section 4.2.4): 1) participate in river restoration projects that incorporate habitat enhancement measures to improve pool/riffle ratio, and 2) participate in discussions regarding opportunities to accommodate flood control, water rights, recreation, and habitat needs.

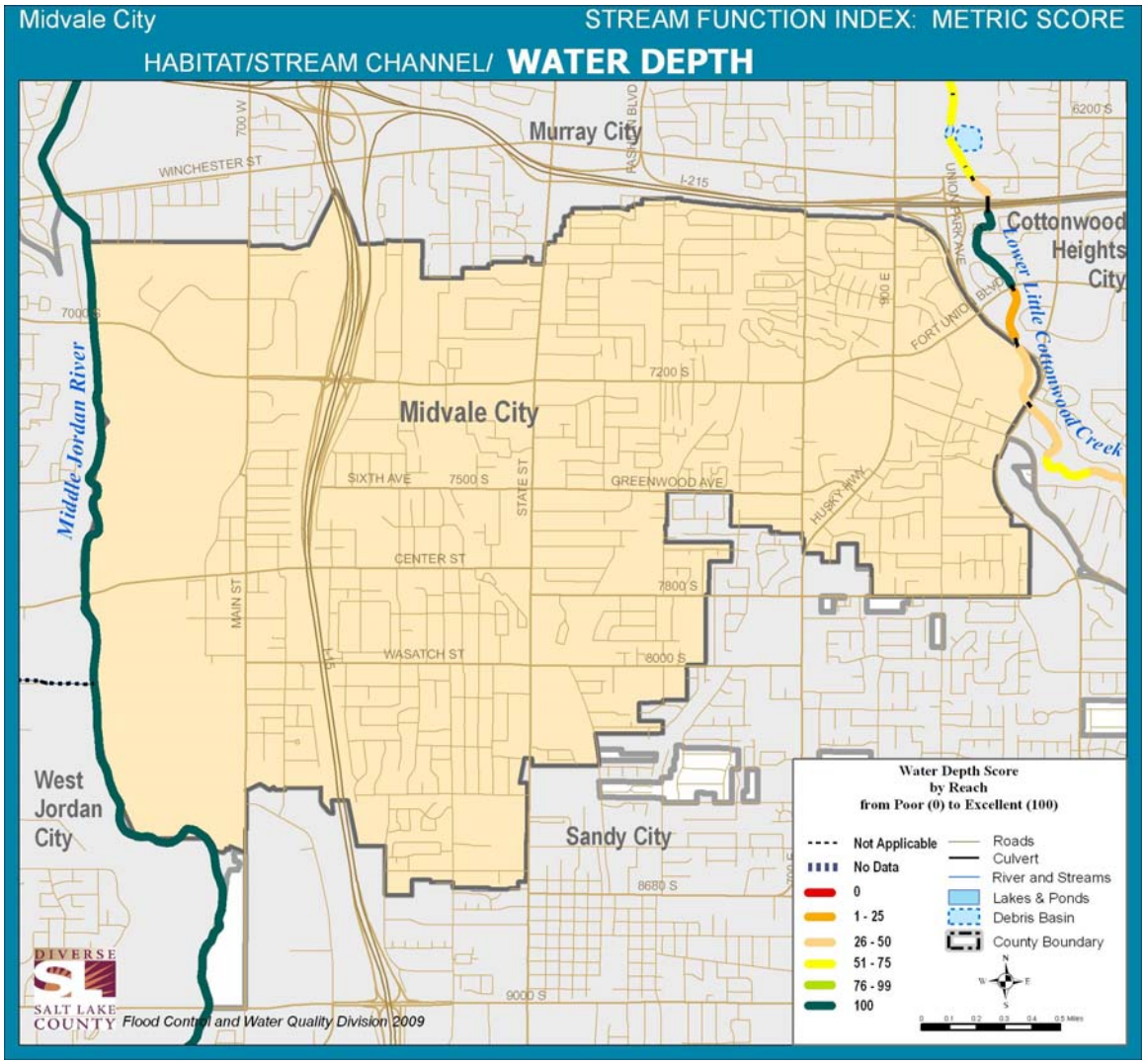

Figure 4. Habitat Function—Water Depth in Midvale City

4.2.2 Water Depth in Midvale City

In Salt Lake County, many streams have experienced altered or reduced stream flow or may naturally have minimal stream flow. In order to assess the extent to which streams have sufficient water depth to support aquatic habitat, Salt Lake County staff measured stream depth at representative locations within each stream reach during late summer low flow. Targets for this metric were set based on minimum depth requirements for trout and native sucker species established by the Utah Division of Wildlife Resources (DWR).

As can be seen in Figure 4, the section of the Jordan River adjacent to Midvale City scored high (100) for water depth. Although the flow through this section of the Jordan River is highly altered, the remaining water depth appears sufficient to support fish habitat. Therefore, no immediate action is required for this metric in this section of the Jordan

However, the section of Little Cottonwood Creek within Midvale City scored relatively low (between 26 and 50) for this same parameter. It is recommended that Midvale City work closely with the State Division of Water Rights (DWRi), Salt Lake City, Salt Lake County, and other water rights holders to identify opportunities to increase flow through this section of Little Cottonwood Creek. Additionally, stream restoration/enhancement projects may alter stream geometry and consequently improve water depth.

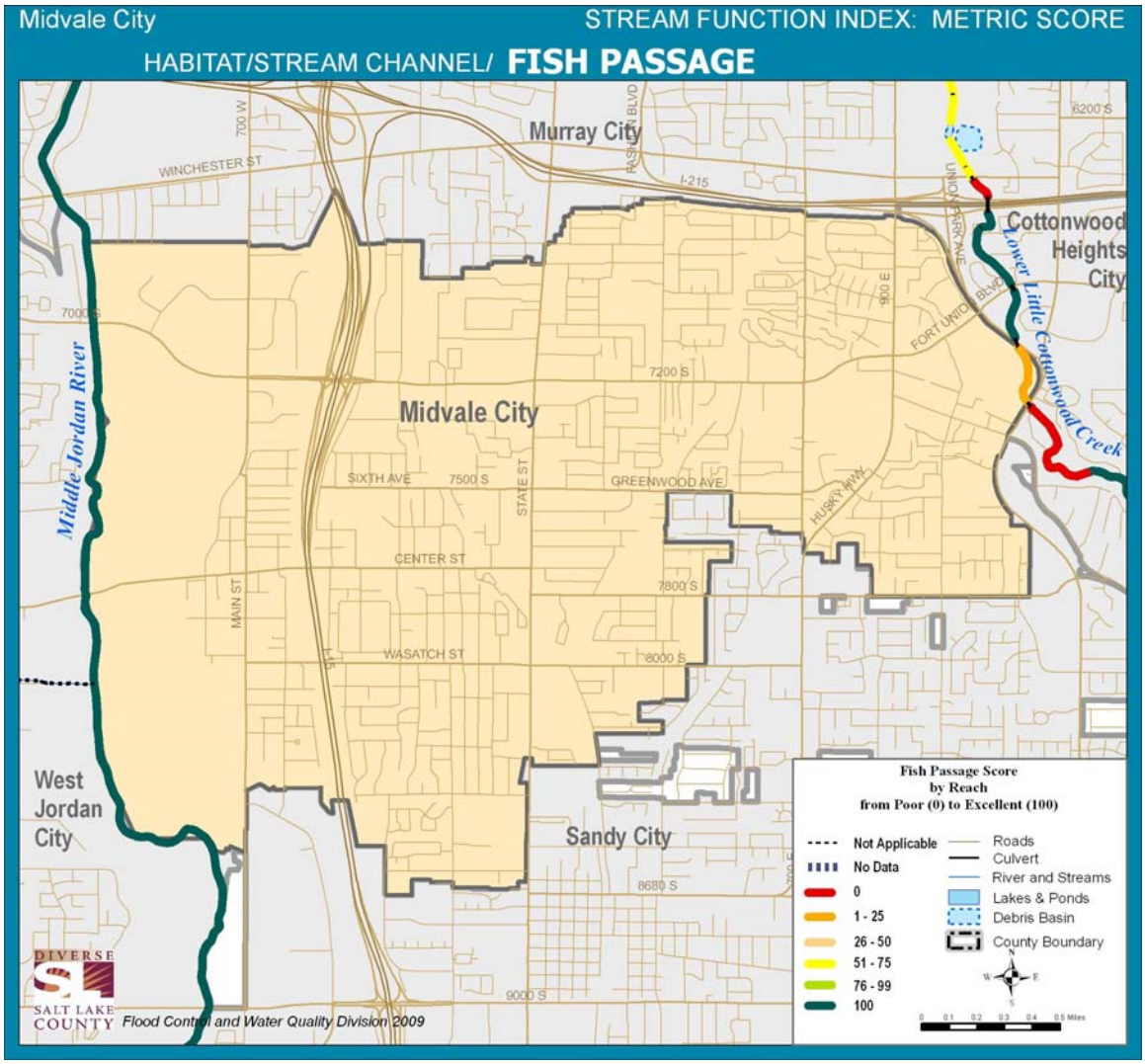

Figure 5. Habitat Function—Fish Passage in Midvale City

4.2.3 Fish Passage in Midvale City

For the purposes of the SFI, fish passage was scored based on the distance between barriers to fish passage. Barriers were tallied for each stream reach and analyzed for overall function during late summer low flow. Barrier criteria included height of barrier, depth of plunge pool, water depth, and beaver dam density. The optimum value for this metric was to have at least 1/4 of a mile between barriers.

As can be seen from Figure 5, the section of the Jordan River adjacent to Midvale City received a high score for fish passage (100). Therefore, no immediate action is recommended for this metric. However, the section of Little Cottonwood Creek within Midvale City boundaries received a low score of 1 to 25 for fish passage.

To address fish passage concerns in Little Cottonwood Creek, it is recommended that Midvale City partner with State and local agencies to identify opportunities to retrofit existing barriers to accommodate passage. Additionally, it is recommended that Midvale City work closely with developers and other regulatory agencies to assure that any new instream structure accommodate fish passage.

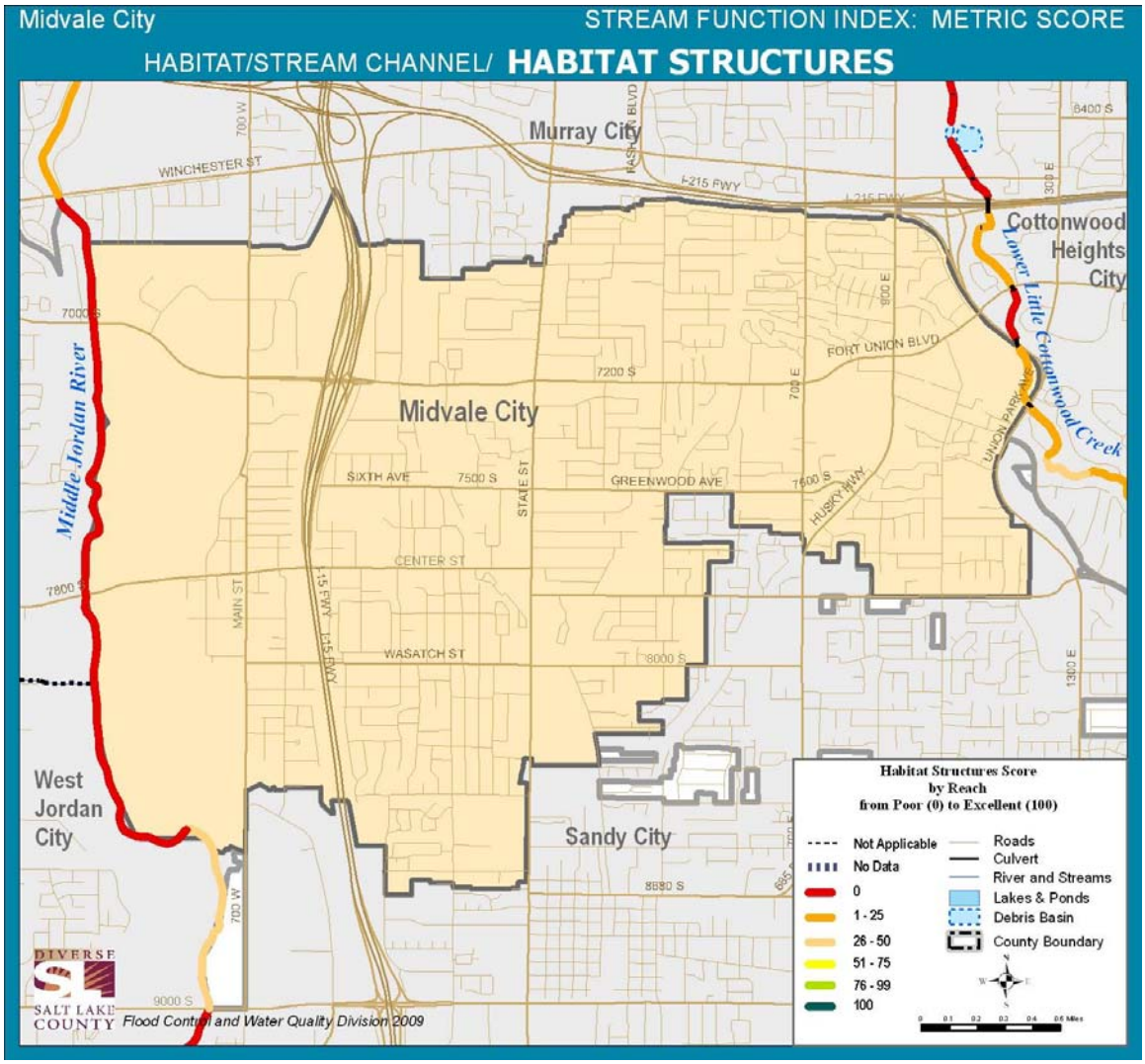

Figure 6. Habitat Function—Habitat Structures in Midvale City

4.2.4 Habitat Structure in Midvale City

For the purposes of the SFI, habitat structures are defined as instream natural, or man-made, objects that provide cover, resting, and feeding resources for fish species. To measure the function of habitat structures, the number of embedded logs, rootwads, boulders, undercut banks, beaver dams, and man-made structures were tallied for each reach. Targets were set based on the number of habitat structures anticipated to occur in specific stream types.

As can be seen from Figure 6, the Jordan River section adjacent to Midvale City scored low for habitat structure (0) and the section of Little Cottonwood Creek within Midvale City boundaries scored only slightly higher (between 1 and 25). Habitat structure is therefore one of the lowest scoring metrics within Midvale City.

Recommended actions to improve habitat structure resources in Midvale City include: 1) participating in river restoration projects that incorporate habitat enhancement measures, and 2) participate in discussions regarding opportunities to accommodate flood control, water rights, recreation, and habitat needs. As with many metrics, habitat structures are essential to stream function, but need to be balanced with other stream functions such as flood conveyance.

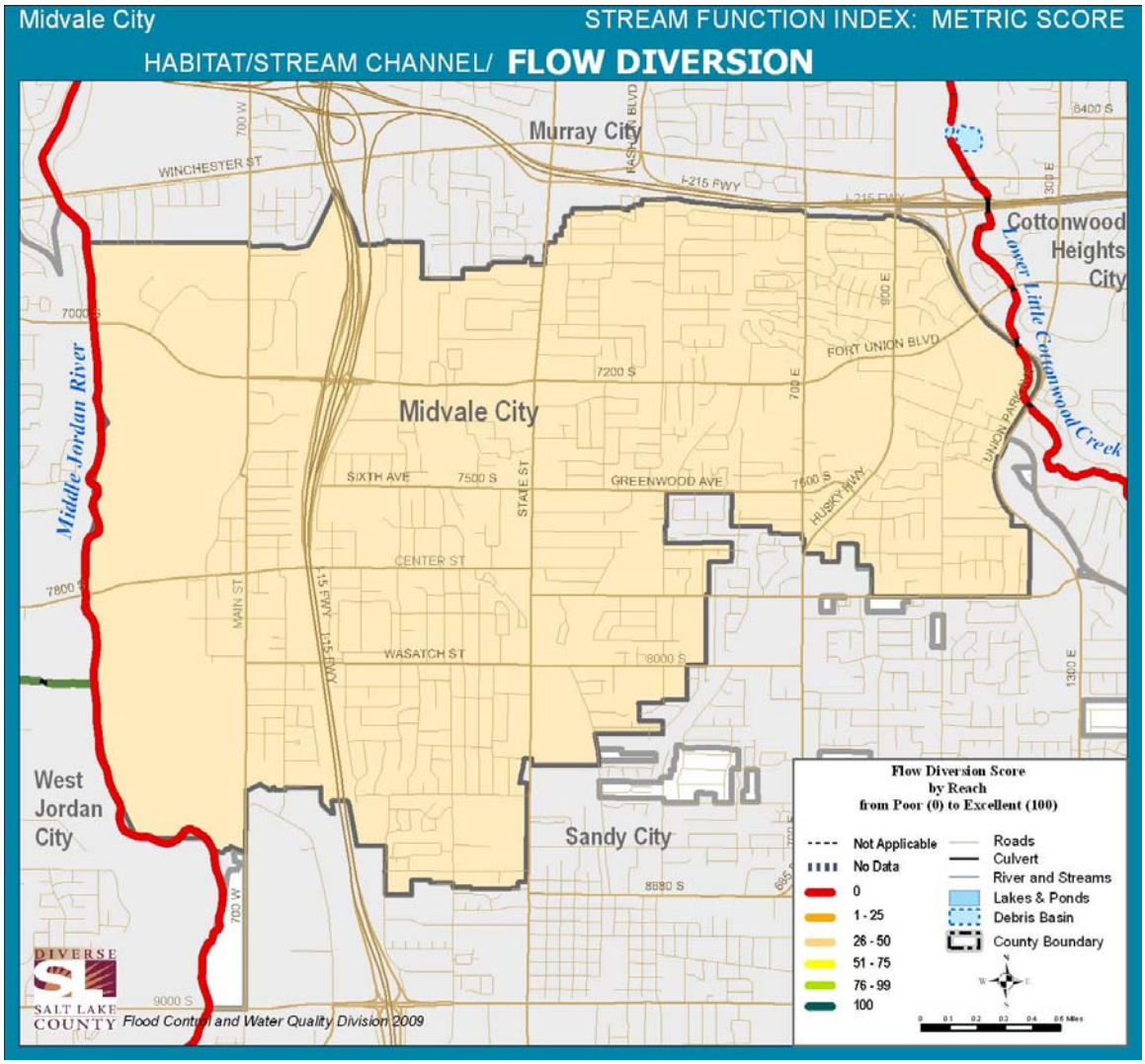

Figure 7. Habitat Function—Flow Diversion in Midvale City

4.2.5 Flow Diversion in Midvale City

In the arid environment of Salt Lake County, many streams have been greatly impacted due to altered surface and groundwater flows. To include potential effects on habitat in the SFI, Salt Lake County developed a flow diversion metric. The flow diversion metric measured the degree to which natural surface stream flows have been reduced or interrupted. This metric includes both the amount of time over a year and the length of stream that is maintaining natural flows. The target for this metric was set at 100%, i.e. a natural flow for 100% of the year.

As can be seen in Figure 7, the section of the Jordan River adjacent to Midvale City scored extremely low for flow diversion (0). A similar condition was observed for the section of Little Cottonwood Creek within Midvale City boundaries (0).

To address concerns, it is recommended, that Midvale City participate in any discussions that may be facilitated by the JRWC or the State Engineer's office to examine flow management of the Jordan River. Additionally, it is recommended that Midvale City partner with Salt Lake City, Salt Lake County, and appropriate State agencies to explore ways to accommodate habitat and water right needs in both the Jordan River and Little Cottonwood Creek.

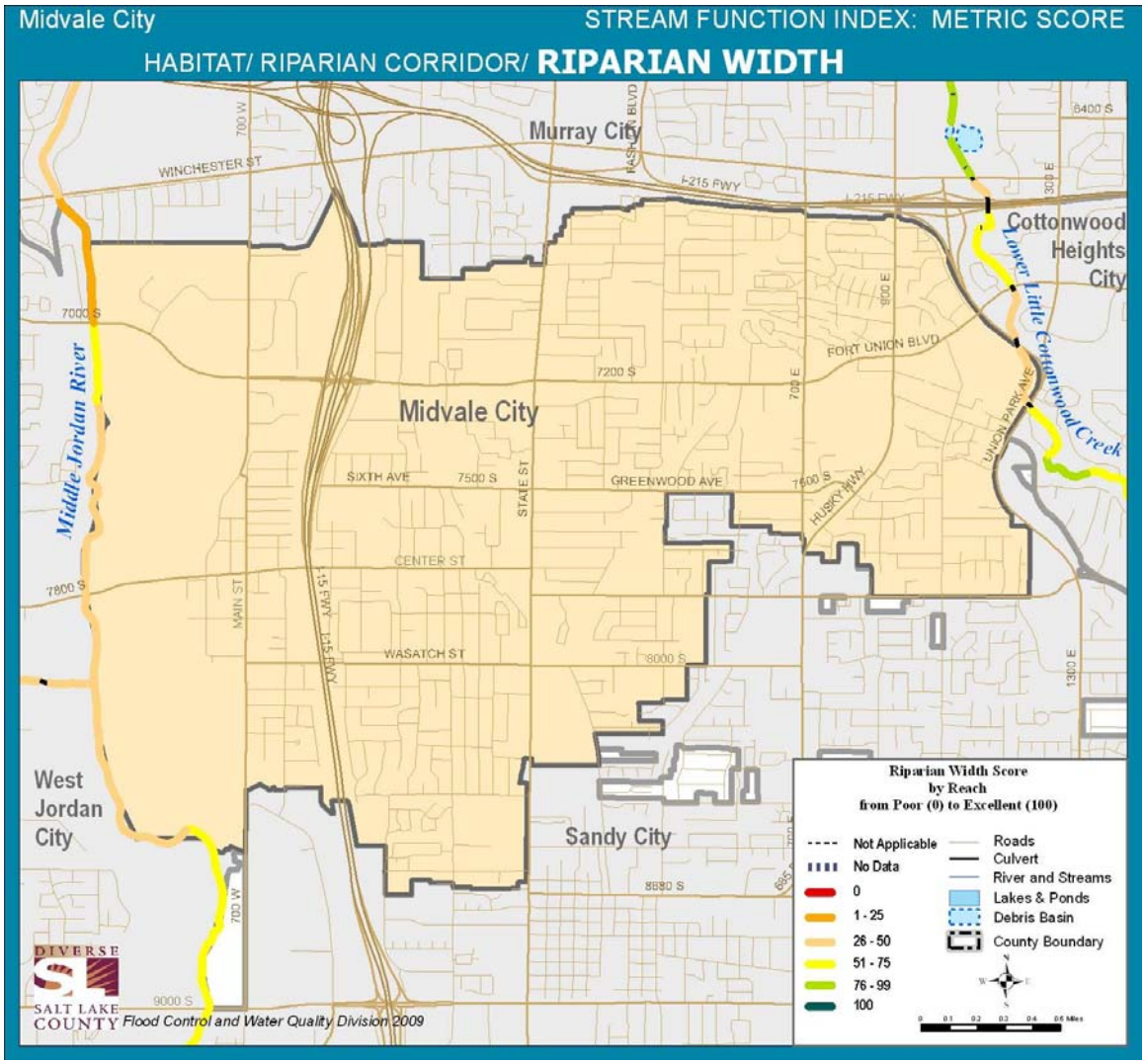

Figure 8. Habitat Function—Riparian Width in Midvale City

4.2.6 Riparian Width in Midvale City

The SFI also examined habitat beyond the stream channel with Riparian habitat metrics. The first metric examined was the width of riparian corridors. For the purposes of the SFI, riparian width was measured as the continuous and contiguous areas of uninterrupted vegetation growth along streams. The target riparian width was established by Salt Lake County to be 100 feet, i.e. ideally, all streams/river in the County would be bordered on both sides by 100 feet of uninterrupted vegetative growth. The actual amount of riparian vegetation was then compared with the target.

As can be seen in Figure 8, the section of the Jordan River adjacent to Midvale City scored between 1 and 75 for riparian width, with the majority in the 26-50 range. The section of Little Cottonwood Creek within Midvale City boundaries scored between 26 and 50.

To improve riparian habitat function of the streams and river in Midvale City, it is recommended that: 1) the City pass a land use ordinance to limit development within 100 feet of streams and river (this may also be included in development codes), and 2) the City work with other authorities to promote vegetative growth along the streams and river.

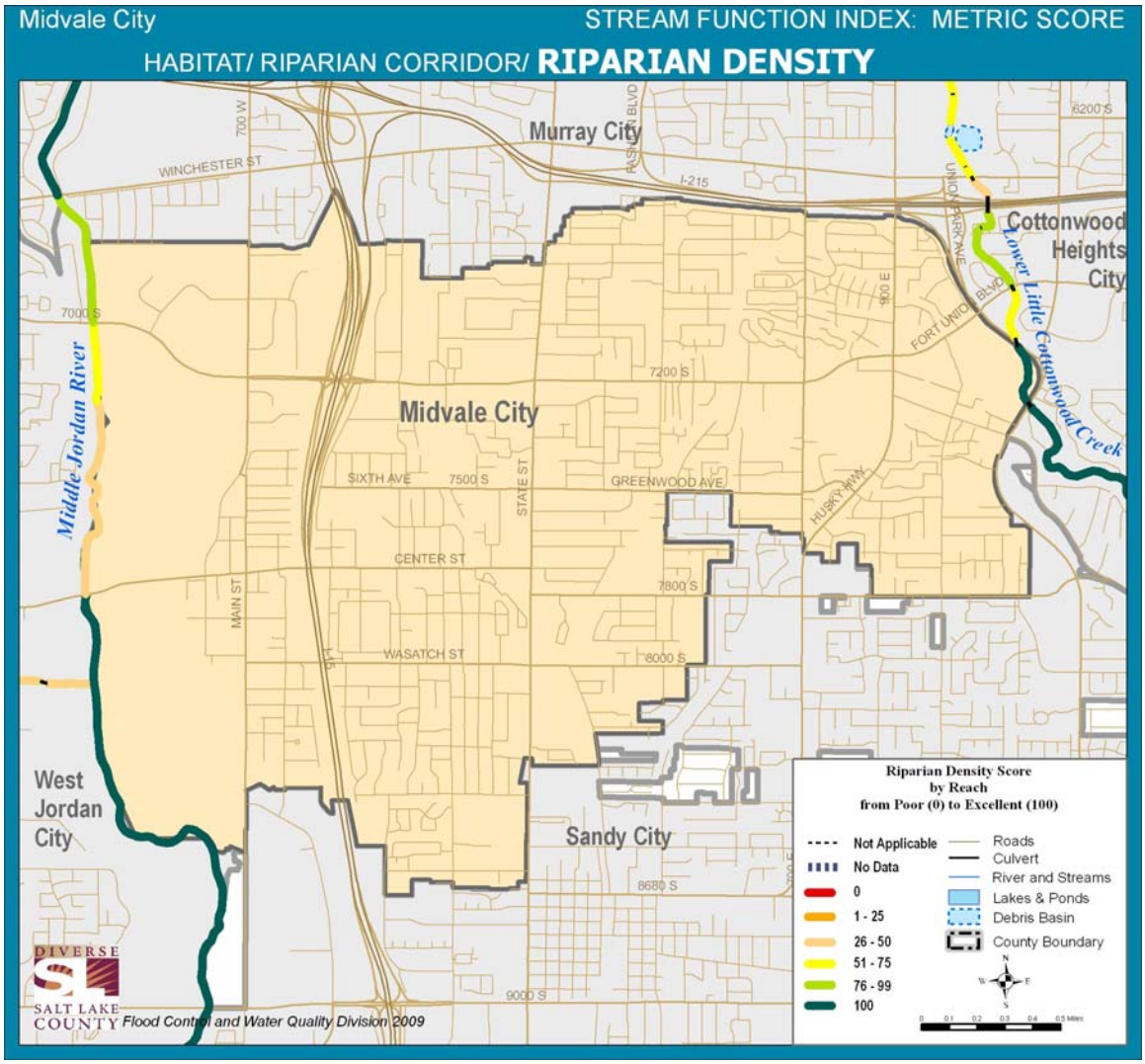

Figure 9. Habitat Function—Riparian Density in Midvale City

4.2.7 Riparian Density in Midvale City

In addition to riparian width, the density of riparian vegetation is a strong indicator of overall stream health. This metric scores the percent coverage of the canopy, middle story, and understory to determine overall riparian density. As opposed to examining plant species, this metric assumes that the highest functioning riparian areas will have at least 80% coverage at all levels of the canopy.

As can be seen in Figure 9, a large portion of the section of the Jordan River adjacent to Midvale City scored well for riparian density (between 76 and 100). The other sections of the River scored between 26 and 75. Little Cottonwood Creek within Midvale City boundaries also scored very well for this metric (100).

To improve stream function and augment habitat resources, it is recommended that Midvale City participate with other State and local authorities to: 1) sponsor river/stream restoration efforts that incorporate robust re-vegetation and irrigation efforts, and 2) notify residents of tree planting efforts and encourage their participation. Including the public in restoration efforts is key to long-term stewardship success. In addition to working with other authorities and nonprofit organizations, it is recommended that Midvale City actively manage recreation areas to encourage growth of riparian vegetation.

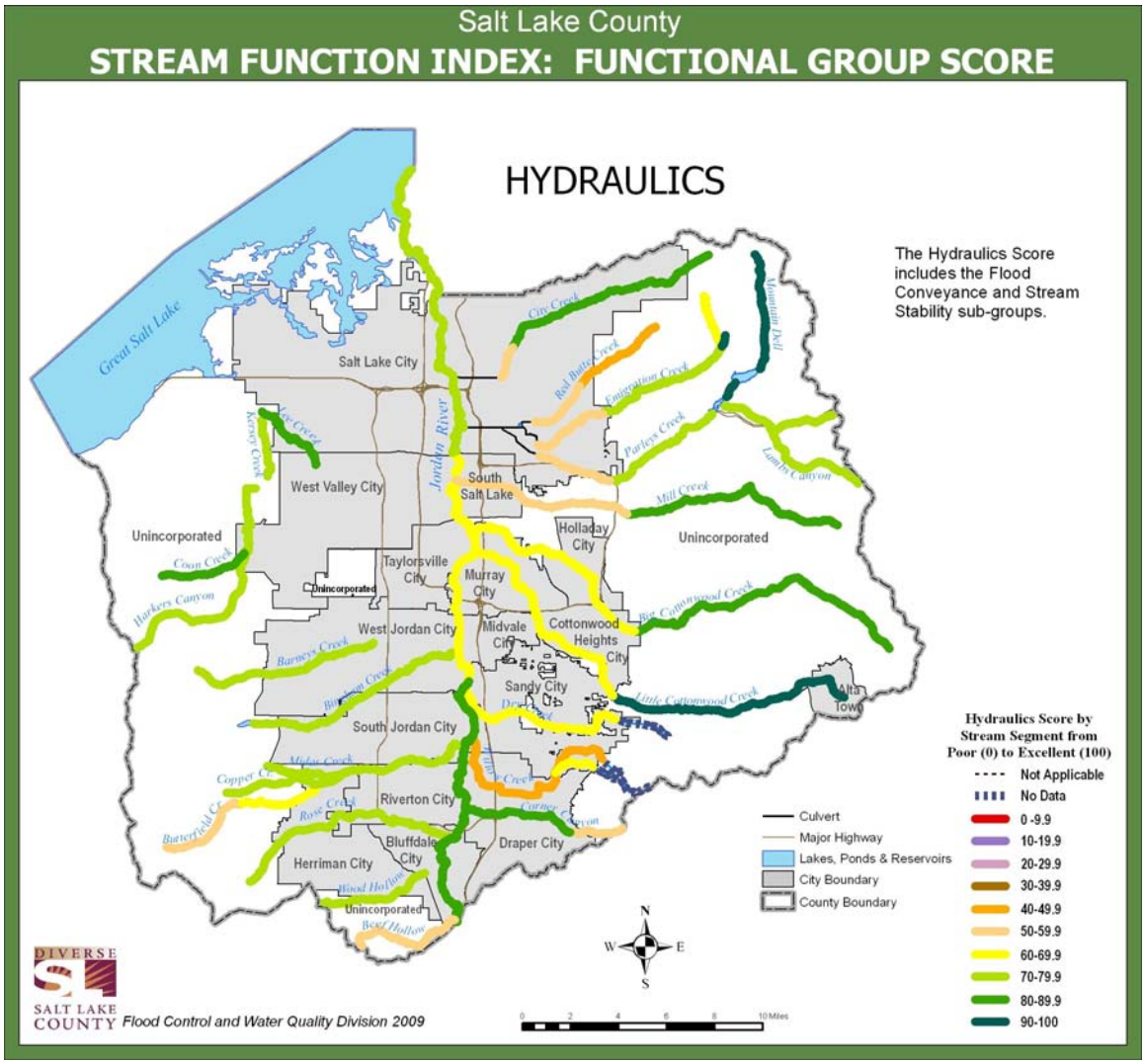

Figure 10. Hydraulics Functional Group Scores Countywide

4.3 HYDRAULICS FUNCTIONAL GROUP SCORE

The third watershed function examined for the purposes of the SFI was hydraulics function. This functional group is comprised of four metrics: floodplain development, floodplain connectivity, bank stability (as scored using Pfankuch methodology), and hydraulic alteration.

As can be seen in Figure 10, the majority of streams in Salt Lake County scored > 50 for the hydraulics function; however, an appropriate target for this functional group is closer to 75. Countywide, the streams with low hydraulics function scores were concentrated in the lower sections of the Wasatch Mountain streams. Namely, City Creek, Red Butte Creek, Emigration Creek, and Parley's Creek showed low hydraulics function. This may be due to the highly developed nature of these streams and the extensive culverts on each of them.

The Jordan River and Little Cottonwood Creek within Midvale City boundaries showed hydraulics function scores between 60 and 69.9. The following information is provided to review hydraulics function metrics within Midvale City and identify opportunities to improve stream function by addressing concerns.

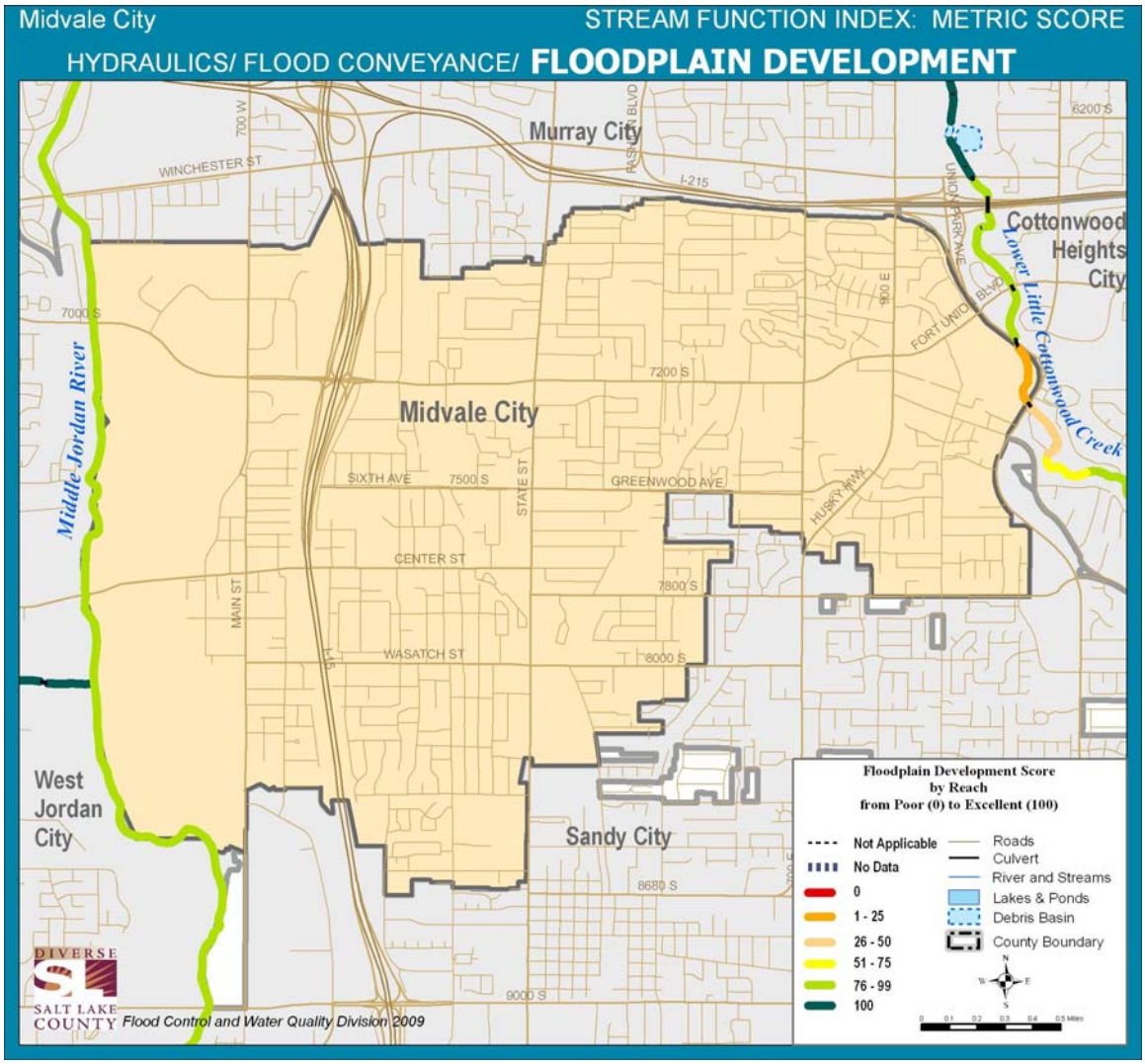

Figure 11. Hydraulics Function—Floodplain Development in Midvale City

4.3.1 Floodplain Development in Midvale City

The floodplain development metric evaluates the percent of impervious surface within the 100 year floodplain as defined by the FEMA Flood Insurance Program. For the purposes of the SFI, the target was that 100% of the floodplain be pervious, or free from development that would limit groundwater infiltration.

As can be seen in Figure 11, the majority of the Jordan River adjacent to Midvale City scored between 76 and 99 for floodplain development. The section of Little Cottonwood Creek within Midvale City score between 1 and 25 for this metric.

The relative lack of impervious areas along the Jordan River adjacent to Midvale City is a great opportunity. The challenge will be to assure that only appropriate development occurs in the floodplain [i.e. encouraging Leadership in Energy and Environmental Design (LEED) certified techniques and/or limiting development]. This could be done either through development codes or land use ordinances. Of note, the 2009 WaQSP recommends that all cities within Salt Lake County develop and adopt ordinances that will both limit impervious surface and development along stream and river corridors.

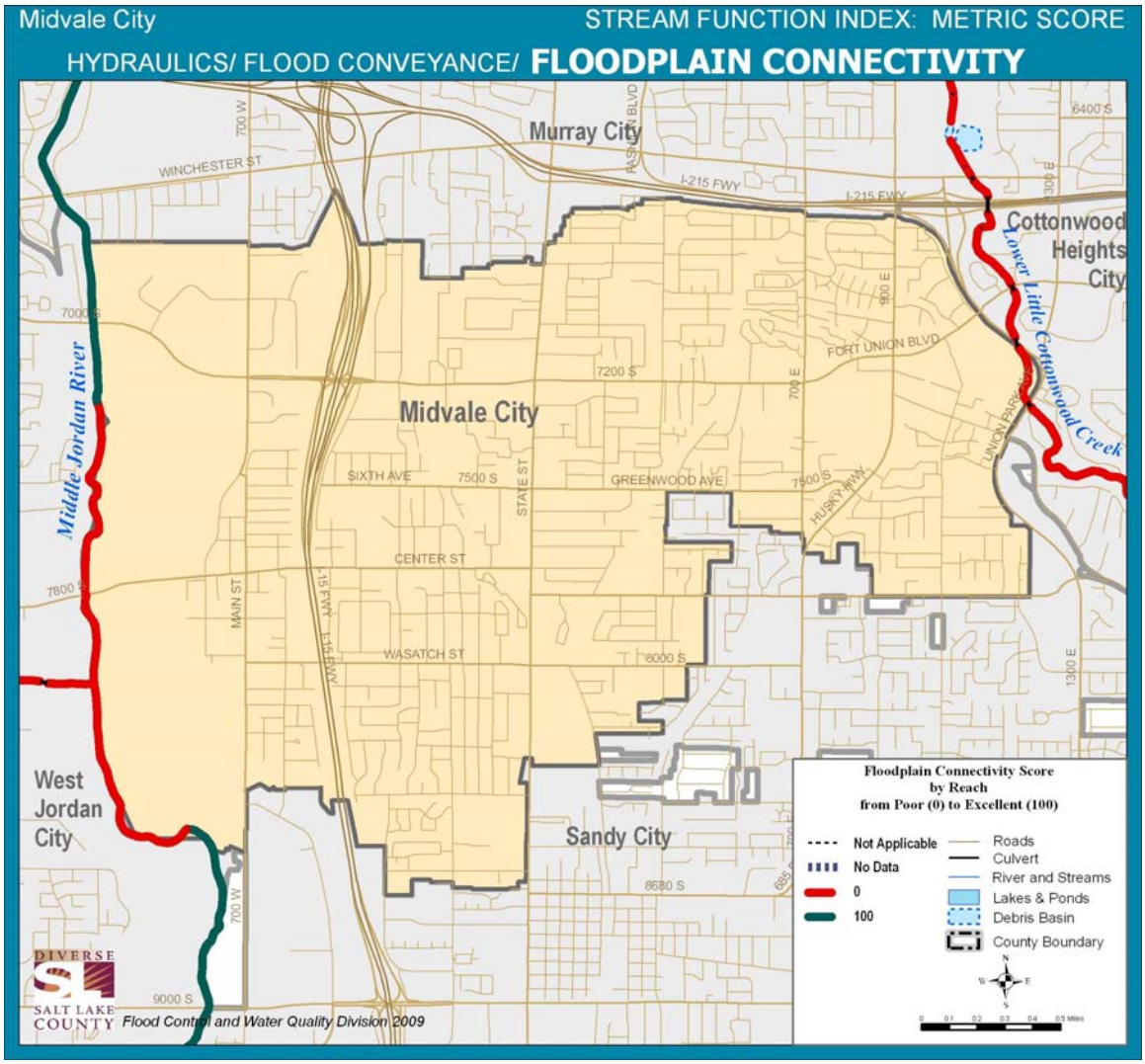

Figure 12. Hydraulics Function—Floodplain Connectivity in Midvale City

4.3.2 Floodplain Connectivity in Midvale City

The floodplain connectivity metric is essentially a measure of stream entrenchment (or eroded streambed). Entrenchment disconnects the stream from its historic floodplain, lowers the water table, and increases the intensity of flood events. For the purposes of the SFI, floodplain connectivity was measured and scored against targets established by stream type (see SFI Main Report.) Any score falling within the appropriate entrenchment range for a stream type was given a score of 100. If the entrenchment ratio was outside the appropriate range, the reach was given a score of 0.

As can be seen in Figure 12, a large section of the Jordan River adjacent to Midvale City scored extremely poorly for floodplain connectivity (0). A similar situation was observed in Little Cottonwood Creek.

An ecosystem restoration project using the emergent bench design (see Figure 18 on page 22) is currently part of bank stabilization plans from approximately 7500 S to 9000 S which includes the Midvale Slag Superfund Site. The project will provide a somewhat narrow but effective floodplain for normal high water. To address concerns observed in Little Cottonwood Creek, it is recommended that Midvale City partner with other authorities to conduct stream restoration efforts that may reconnect the stream with its floodplain. The emergent bench design used along the Jordan River may also be applicable for the section of Little Cottonwood Creek in Midvale.

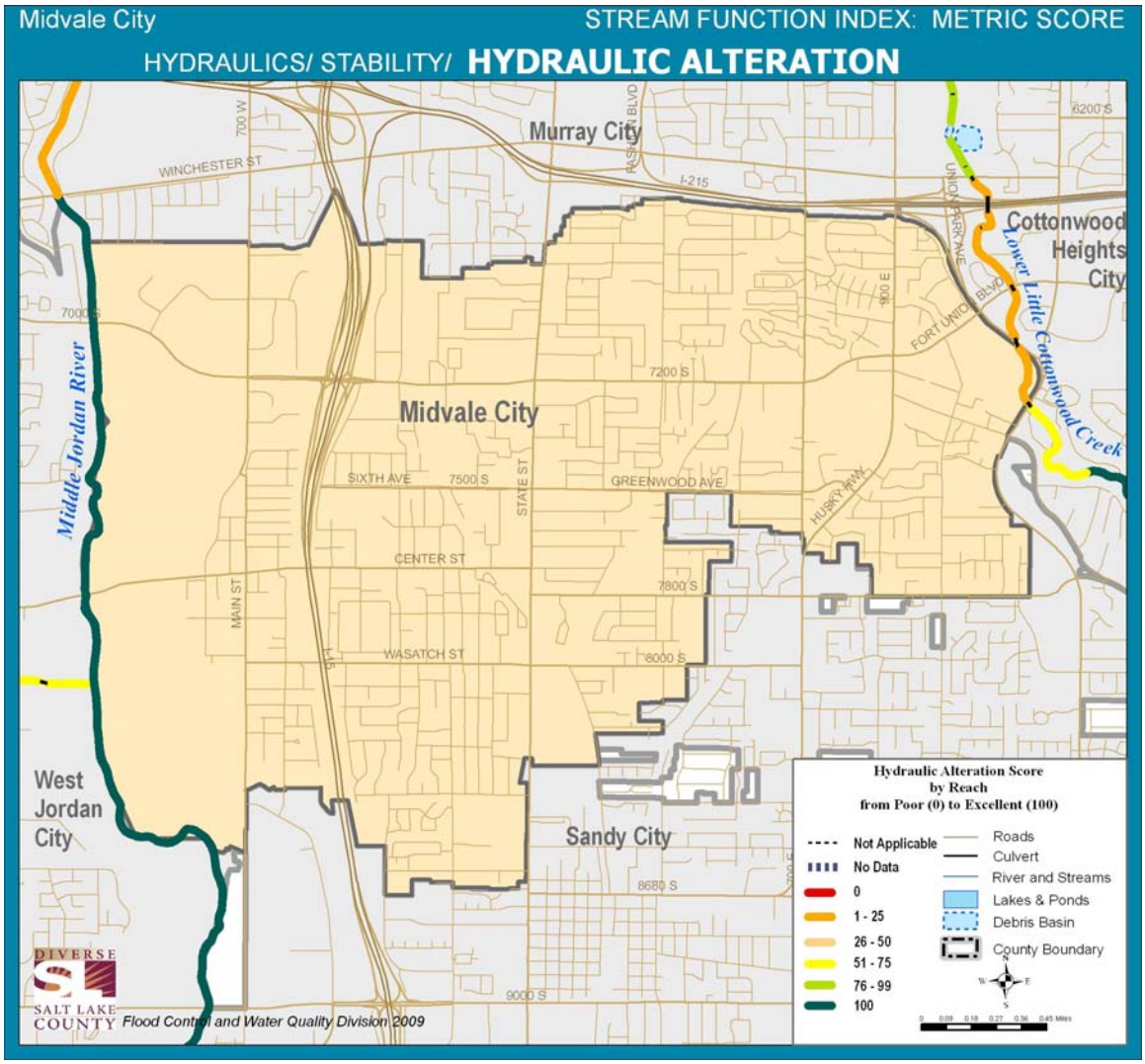

Figure 13. Hydraulics Function—Hydraulic Alteration in Midvale City

4.3.3 Hydraulic Alteration in Midvale City

Although bank stability is key to the hydraulics function of an urban stream, artificial bank configurations that reduce riparian and floodplain areas and the types of artificial materials used may cause stability and habitat problems. For the SFI, hydraulic alteration was evaluated as the percent of culverts and man-made bank stabilization structures and built with materials such as concrete riprap or gabion baskets within a reach. The percent was based on visual observation by field personnel and computer-aided mapping of culverts.

As can be seen in Figure 13, the section of the Jordan River that is adjacent to Midvale City scored well for hydraulic alteration (100); however, the section of Little Cottonwood Creek within Midvale City scored low (between 1 and 25).

No action is currently recommended for Midvale City's section of the Jordan River beyond the current ecosystem restoration projects currently in progress by EPA, Salt Lake County, and Midvale City between approximately 7500 S to 9000 S which includes the Midvale Slag Superfund Site. It is recommended that Midvale City work with Salt Lake County's Flood Control Division to identify opportunities for improvement of existing stability structures on Little Cottonwood Creek. Stability structures in poor condition may be updated with new methods and materials to function and appear more naturally.

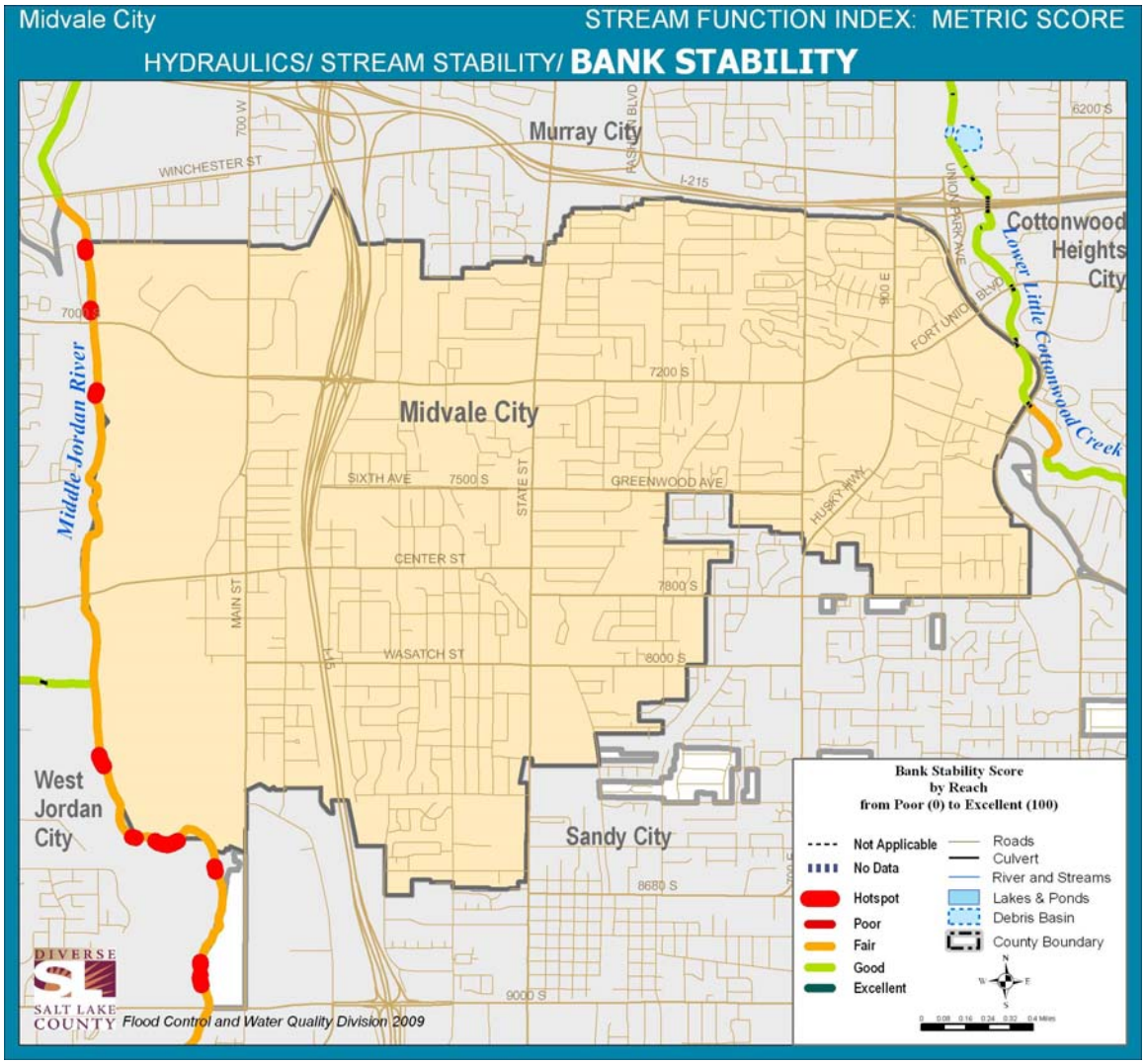

Figure 14. Hydraulics Function—Bank Stability in Midvale City

4.3.4 Bank Stability in Midvale City

In addition to measuring the condition and frequency of man-made stability structures in Salt Lake County's streams and river, an established bank stability method was also employed to characterize overall stream stability.

The Pfankuch Stream Stability Evaluation protocol—developed for the U.S. Forest Service—was slightly modified for use on the urban streams of Salt Lake County. Although the Pfankuch rating is only one of the metrics contained in the SFI, it, in itself, examines 18 stream characteristics. This metric therefore contains abundant information that may be used in stream restoration and enhancement projects. "Hot spots", or actively eroding sites, were also identified and mapped. Although the presence of a hot spot did not contribute directly to the score, they give an indication of where to perhaps prioritize bank stabilization projects.

As can be seen in Figure 14, the majority of the Jordan River adjacent to Midvale City had a "Fair" score for bank stability. However, numerous "Hotspots", or areas of extreme concern exist in this section of the Jordan River. Alternately, Little Cottonwood Creek scored "Good" within the Midvale City's boundaries.

Many of the hotspots indicated along the Midvale City side of the Jordan River are currently being addressed with the ecosystem restoration project related to the Midvale Slag Superfund Site. To address any stability concerns along the Jordan River not covered under the current projects, it is recommended that Midvale City partner with other municipalities and local agencies to conduct stream restoration/enhancement projects.

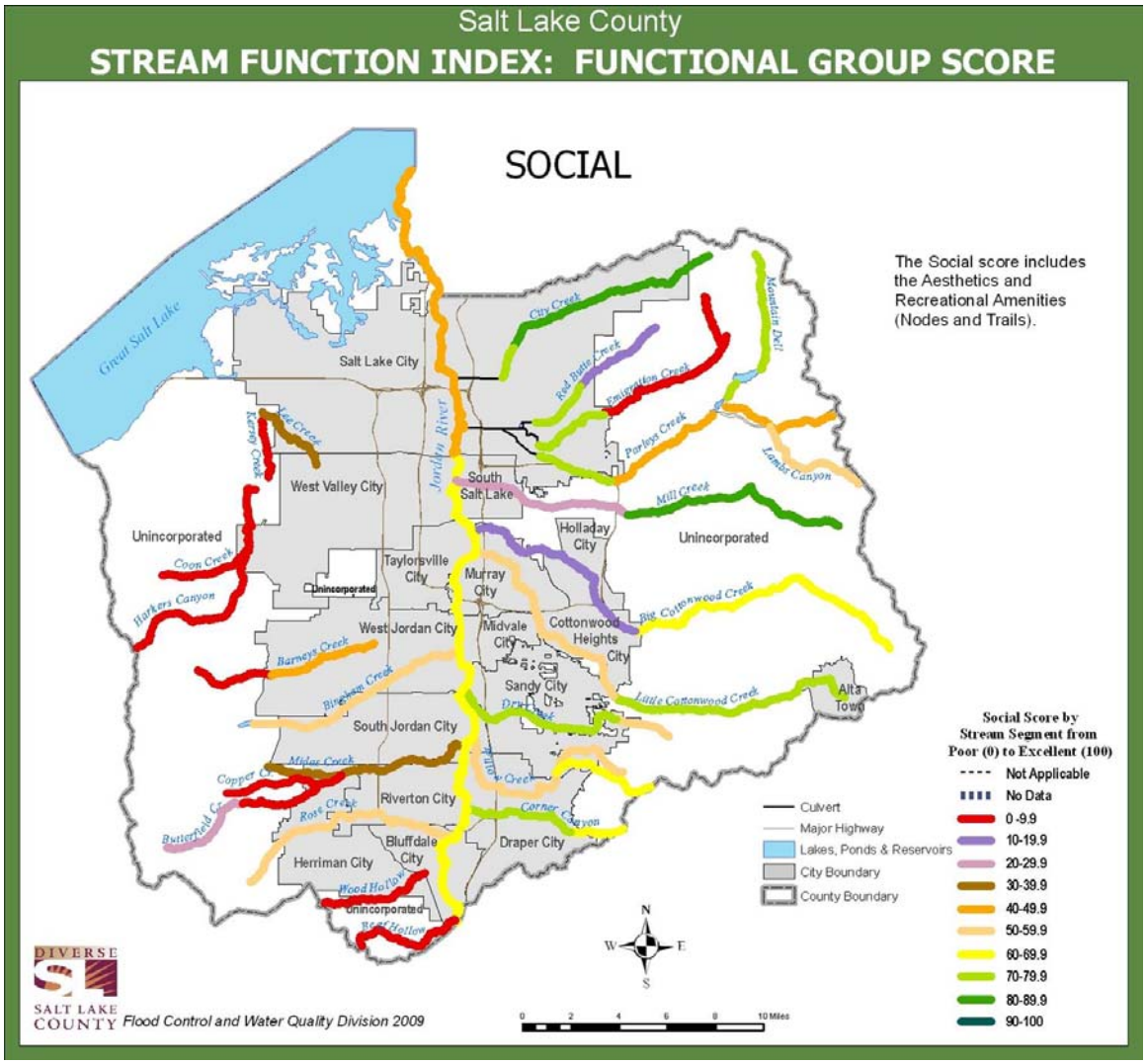

Figure 15. Social Functional Group Scores Countywide

4.4 SOCIAL FUNCTIONAL GROUP SCORE

Social watershed function was measured by examining recreational facilities: management, aesthetics, location, Americans with Disabilities Act (ADA) compatibility, restroom facilities, trail connectivity, and resource compatibility.

Social function is probably the most difficult function to measure because there is a broad range of preferences by recreationists for different types of facilities. Therefore, the SFI focused on assessing the availability of all types of recreation facilities along the waterways, the minimum requirements for a positive user experience, and impact that the use of those facilities may have on the stream ecosystem. Although recreation may have detrimental impacts on stream and river corridors, it is the opinion of Salt Lake County staff that the best way to promote stewardship of local resources is to provide appropriate facilities and access

As can be seen in Figure 15, the section of the Jordan River adjacent to Midvale City scored between 60 and 69.9 for social function. The segment of Little Cottonwood Creek that flows within Midvale City boundaries scored lower, between 50 and 59.9. To promote stewardship, Midvale City is encouraged to explore opportunities to enhance recreational facilities along their stream and river corridors that are compatible with the existing resource.

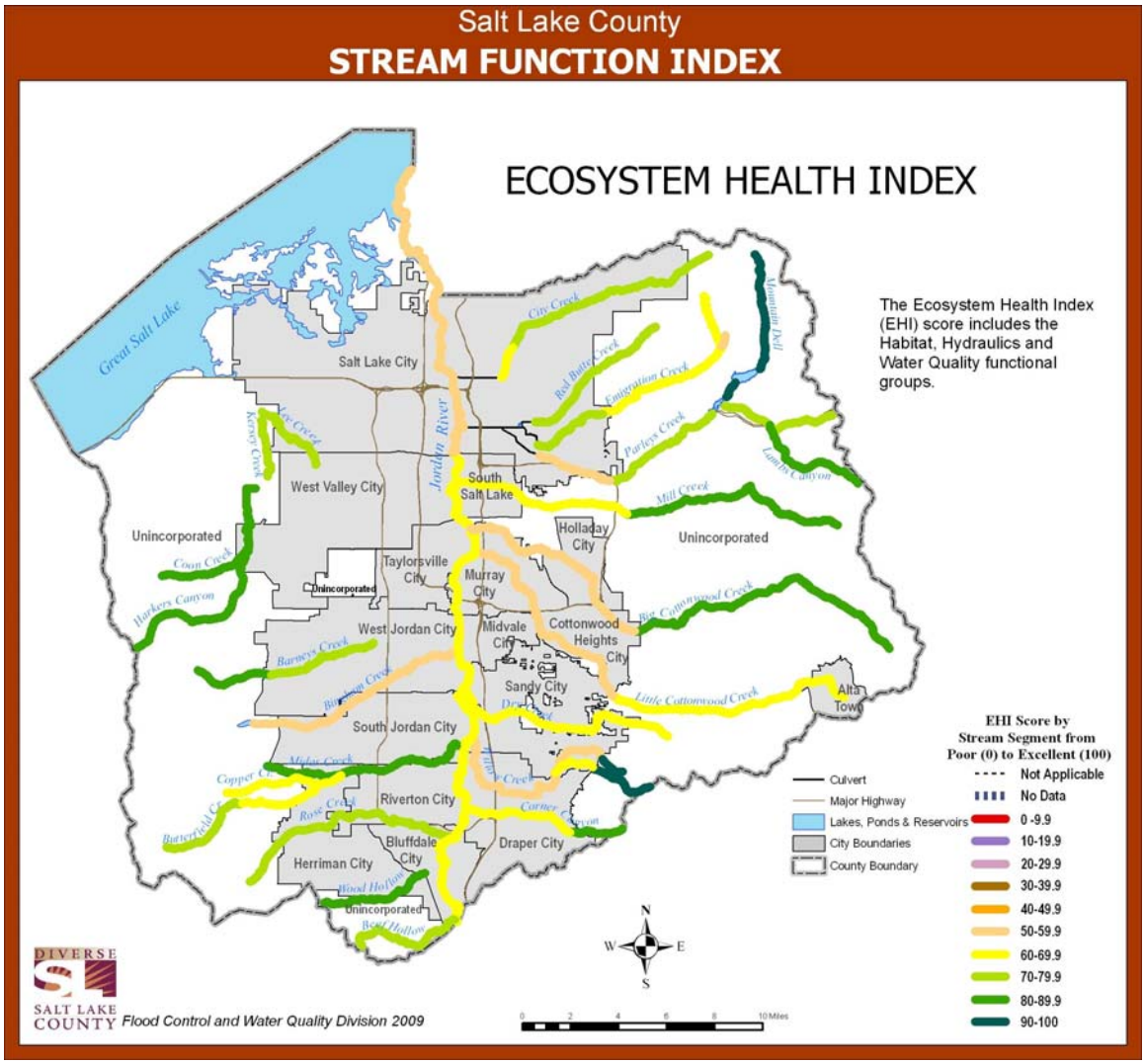

Figure 16. Ecosystem Health Index (EHI) Final Score 2009

5.0 ECOSYSTEM HEALTH INDEX (EHI) - MIDVALE CITY

In order to determine the physical, chemical, and biological health of streams in Salt Lake County, the County has developed an Ecosystem Health Index (EHI) score. This score is meant to reflect the ecological health of the stream. Although the County's position is to promote responsible and appropriate recreational access along the stream corridors, it is also understood that recreational activities may counteract ecological function. Therefore, it is important to examine the combined EHI score outside of the overall Stream Function Index (SFI) score which includes the Social Function.

As can be seen in Figure 16, the section of the Jordan River adjacent to Midvale City scored between 60 and 69.9. Little Cottonwood Creek scored slightly lower (between 50 and 59.9). In review of the EHI components, it appears that water quality, habitat, and hydraulics all had similar scores; therefore, no one component can be highlighted as the major concern. It is therefore recommended that that Midvale City seek to address multiple issues simultaneously by: 1) partnering with adjacent cities and other agencies to complete and implement the Jordan River TMDL, 2) seek partners and explore stream/river restoration efforts, and 3) work with local and state agencies to explore opportunities to enhance instream flows and reduce hydraulic alteration.

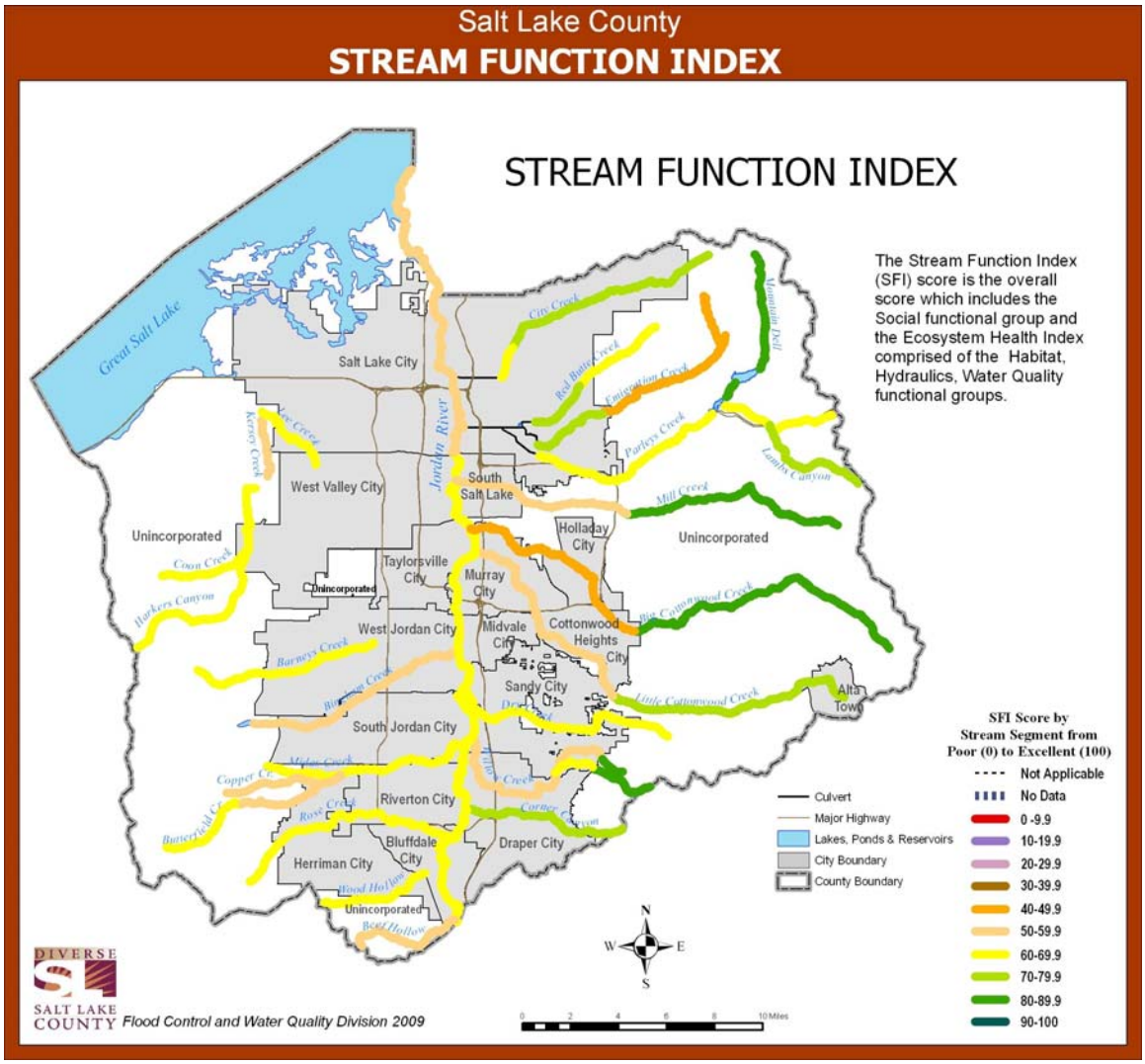

Figure 17. Stream Function Index (SFI) Final Score 2009

6.0 STREAM FUNCTION INDEX (SFI) - MIDVALE CITY

To include social/recreational functions in the overall SFI score, Salt Lake County combined the EHI with social scores.

As can be seen in Figure 17, the Jordan River had an SFI score between 60 and 69.9 along Midvale City's boundary. Little Cottonwood Creek scored slightly lower (between 50 and 59.9). In review of the SFI components, it appears that these scores are a compilation of all four watershed functional groups and may not be attributed to one group or metric. Therefore, it is recommended that Midvale City partner with adjacent cities and other agencies to implement the recommendations to increase the EHI score within Midvale City boundaries. Additionally, it is recommended that Midvale City work toward augmenting existing recreational facilities along Little Cottonwood Creek. These facilities may be constructed in conjunction with stream/river restoration efforts. Additionally, it is recommended that Midvale City establish zoning ordinances and/or regulations that will limit development within 100 feet of both Little Cottonwood Creek and the Jordan River.

7.0 IMPLEMENTATION

Because many of the recommendations included in this document suggest stream/river restoration efforts, this section is written to provide some general guidelines/suggestions with such projects.

7.1 SITE IDENTIFICATION

Salt Lake County encourages local cities to consult the data collected as part of the SFI effort to identify appropriate restoration sites. In addition to the GIS data that each city will be provided, Salt Lake County staff are available for consultation and assistance with grant application efforts.

7.2 PLAN DEVELOPMENT

Salt Lake County has used an "Emergent Bench" design for restoration projects along the Jordan River (Figure 18). This design is appropriate for reaches with large easements/access. If easements are not available, other designs may need to be developed. Currently, Salt Lake County is working to develop ideas for entrenched, urban reaches.

7.3 FUNDING

As with most municipal functions, a major hurdle to stream/river restoration projects is funding. Some municipalities have elected to use stormwater utility fees or bond efforts to fund such projects. However, the majority of projects that have been completed in Salt Lake County have relied heavily on Federal grants. Fortunately, numerous Federal grants are available to support stream restoration efforts. However, the cost of site identification and plan development usually fall to the sponsoring agency.

Although application deadlines and typical amounts awarded vary greatly, there are some common characteristics of successful grant applications:

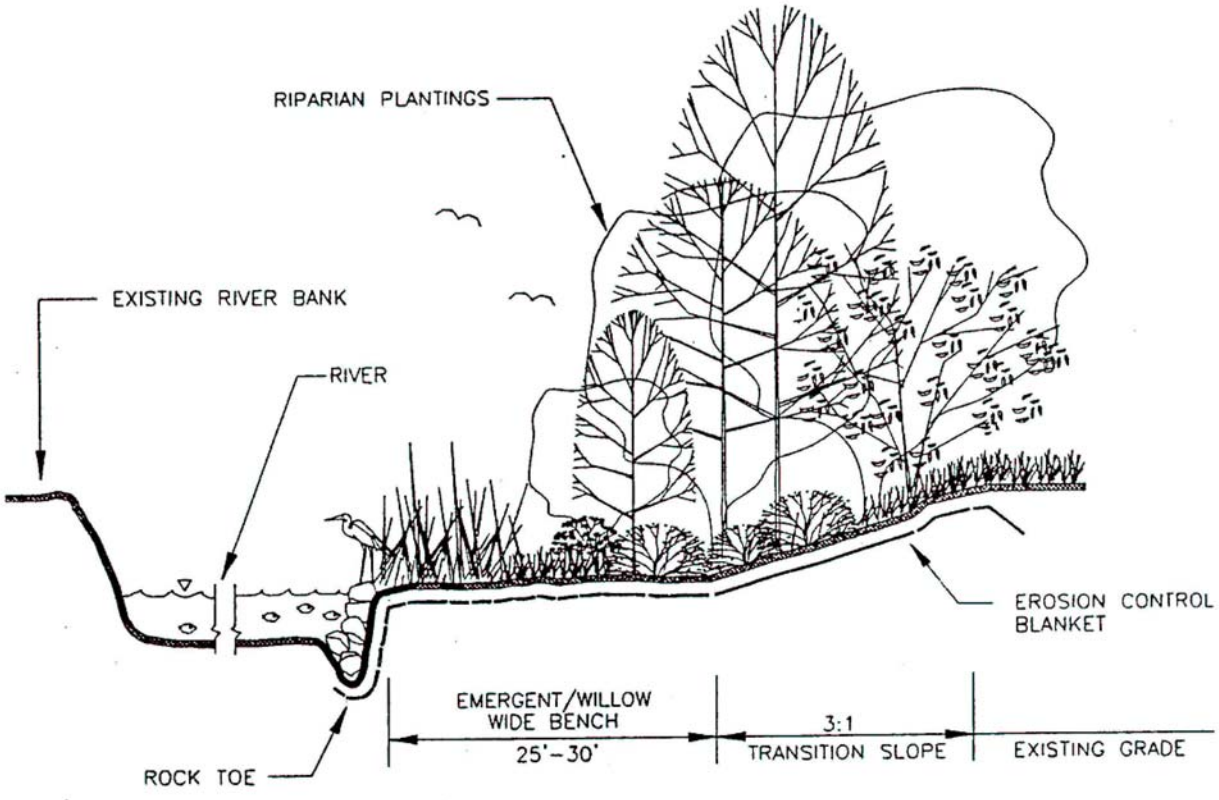

Figure 18. Diagram of Emergent Bench design used along the Jordan River

- A clear, precise work plan
- Demonstrated involvement of many partners
- Inclusion of a monitoring effort
- Strong financial match

A list of some grants that may be appropriate are provided in Table 3, Grants for Stream and River Restoration Projects.

7.4 PLAN IMPLEMENTATION

With robust planning, established partnerships, and sufficient funding, stream and river restoration efforts may be highly successful. However, some pitfalls do exist. Things to be aware of during a stream restoration effort:

- Flow diversions may occur unexpectedly. Please assure that all permits (namely stream alteration and flood control permits) have been acquired and appropriate entities notified to avoid the unexpected destruction of restoration work.

- Order your plant and rock material early as many of these materials are in high demand.

- Notify the public. Although stream and river restoration efforts are a great benefit to the local stream health, the process of restoration may at times appear destructive. Post notices explaining the project in order to prevent public misunderstanding.

- Allow enough time. As with most projects, stream and river restoration projects may take longer than expected. Be sure to plan for unexpected delays in your scheduling.

- We're not the only ones that love trees. In many of the restoration efforts that Salt Lake County has overseen, beaver activity has been highly destructive. Be sure to consult local experts to prevent the destruction of your newly planted trees.

7.5 POST-CONSTRUCTION

One of the most important components of a successful stream or river restoration project is the long-term maintenance of the restoration site. Especially in the arid Salt Lake Valley, be sure to plan for irrigation of planted vegetation, and weed control to assure that the monies spent on the restoration project are used to their fullest extent; budgeting for a two-year establishment period is ideal.

Example of before (above) and after (right) river restoration project completed in 2009 using Emergent Bench model along the Jordan River. This site in Riverton will be irrigated for 2 years to establish vegetation.

GRANT	SPONSOR	ELIGIBLE	TYPES OF PROJECTS	MATCH	$ RANGE	DEADLINE	MORE INFORMATION
Targeted Watershed Grant	Environmental Protection Agency (EPA)	States, local governments, public and private nonprofit institutions/ organizations, federally recognized Indian tribal governments, U.S. territories or possessions, and interstate agencies.	**Eligible Activities** Activities that will result in the protection, and restoration of a watershed that incorporates a watershed-based approach, and meets the prescribed criteria. **Ineligible** - Development of TMDLs - Phase II Stormwater Projects - Construction of buildings or major structures - Purchase of equipment of machinery NOTE: Watershed nominations must be submitted by either a Governor or a Tribal Leader.	25% Non-federal match	2005 Grants ranged from $600,000 to $850,00	Typically October through November	http://www.epa.gov/twg
Environmental Education Grants	Environmental Protection Agency (EPA)	Local education agency, state education or environmental agency, college, or university, not-for-profit organization as described in section 501(C)(3) of the Internal Revenue Code, noncommercial educational broadcasting entity, tribal education agency (which includes school and community colleges controlled by an Indian tribe, band, or nation)	Environmental education projects that enhance the public's awareness, knowledge, and skills to help people make informed decisions that affect environmental quality.	25% Non-federal match	Applications may be up to $50,000; however, typical awards are between $15,000 and $20,000	Typically in December	http://www.epa.gov/ enviroed/grants.html
Aquatic Ecosystem Restoration (Section 206 of WRDA)		Nonprofit Groups, Conservation District, Water and Wastewater Utilities, Local Government, State/ Territorial Agency		35% Non-federal match	Typical awards are ~$300,000	None - these allocations are through Section 206 of the WRDA	www.usace.army.mil/ cw/
Conservation Security Program	Note: Upper Weber has received this	The agricultural operation must be privately owned land or Tribal land, the majority of which must be located within a selected priority watershed. The applicant must be in compliance with highly erodible and wetland compliance provisions, have an active interest in the agricultural operation, and have control of the land for the life of the contract. The applicant must share in the risk of producing any crop or livestock and be entitled to a share in the crop or livestock marketed from the	Financial and technical assistance to promote the conservation and improvement of soil, water, air, energy, plant and animal life, and other conservation purposes on Tribal and private working lands.	None required	Not available; however, in FY 2007 this program was awarded $259 Million	1. The CSP sign-up will be offered in selected priority watersheds across the Nation. 2. Producers completed a self-assessment to determine eligibility. 3. Eligible producers within these watersheds submit an application. 4. Base on the application, description of conservation activities, and a follow up interview, the Natural Resources Conservation Service	www.nrcs.usda.gov/ programs/csp

Table 3. Grants for Stream and River Restoration Projects

GRANT	SPONSOR	ELIGIBLE	TYPES OF PROJECTS	MATCH	$ RANGE	DEADLINE	MORE INFORMATION
Conservation Security Program - Continued		operation. There are certain tier eligibility and contract requirements, as well: -For Tier I, the producer must have addressed soil quality and water quality for eligible land uses on part of the agricultural operation prior to application. -For Tier II, the producer must have addressed soil quality and water quality for eligible land uses on the entire agricultural operation prior to application and agree to address one additional resource concern by the end of the contract period. -For Tier III, the producer must have addressed all resource concerns to a resource management system level for all eligible land uses on the entire agricultural operation and adequately treat riparian zones before application into the program.				(NRCS) will determine which program tier and enrollment category are available for the applicant.	
Environmental Quality Incentives Program (EQIP)		Business, Community/Watershed Group, Nonprofit Groups, Educational Institution, Private Landowner, Water and Wastewater Utilities, State/ Territorial Agency, Tribal Agency, Agricultural producers who face serious threats to soil, water, and related natural resources, or who need assistance with complying with Federal and State environmental laws. A participant may be an owner, landlord, operator, or tenant of eligible agricultural lands. Limited resource producers, small-scale producers, producers of minority groups, Federally recognized Indian tribal governments, Alaska natives, and Pacific Islanders are encouraged to apply.	These contracts provide incentive payments and cost-shares to implement conservation practices. Persons who are engaged in livestock or agricultural production on eligible land may participate in the EQIP program.	Typically 25 to 50%	Limited to $10,000 per person per year and to $50,000 over the length of the contract. Not available in FY 2007 this program was awarded $739 Million		http:// www.nrcs.usda.gov/ programs/equip
Five-Star Restoration Program		Business, Community/Watershed Group, Nonprofit Groups, Educational Institution, Private Landowner, Conservation District, Water and Wastewater Utilities, Local Government, State/Territorial Agency, Tribal Agency		Typical projects include at least five diverse partners. Most partnerships contribute more than $40,000 for every $10,000 Five Star grant.	Typically range between $5,000 and $20,000	Typically in February or March	http://www.epa.gov/ owow/wetlands/ restore/5star/ index.html

Table 3. Grants for Stream and River Restoration Projects (continued)

GRANT	SPONSOR	ELIGIBLE	TYPES OF PROJECTS	MATCH	$ RANGE	DEADLINE	MORE INFORMATION
Land and Water Conservation Fund (Outdoor Recreation, Acquisition, Development and Planning Grants)	National Park Service (NPS)	Local Government, State/ Territorial Agency, Tribal Agency			Typically range between $1,000 and $3 million - median is $150,000		http://wwwnps.gov/nrc/programs/lwcf/
Natural Resources Conservation Service: Conservation on Private Lands	National Fish and Wildlife Foundation (NFWS)	Community/Watershed Group, Nonprofit Groups, Educational Institution, Conservation District, Local Government, State/ Territorial Agency, Tribal Agency, Federal Agency	Grants are awarded to projects that: (1) address priority actions promoting fish and wildlife conservation and the habitats on which they depend; (2) work proactively to involve other conservation and community interests; (3) leverage available funding; and (4) evaluate project outcomes.	NFWF funds must be matched on at least a 1:1 basis, although 2:1 is encouraged, and higher ratios are more competitive.	Typically range between $10,000 and 150,000 - median is $60,000	Varies each year.	http://www.nfwf.org/AM/Template.cfm?Section=Home
Nonpoint Source Implementation Grants (319 Programs)	Environmental Protection Agency (EPA) through the Utah Division of Water Quality	Business, Community/ Watershed Group, Nonprofit Groups, Educational Institution, Conservation District, Local Government, State/Territorial Agency, Tribal Agency, Federal Agency	Restoration, Information & Education, Planning, TMDL implementation	States required to provide 40% non-Federal match for whole grant. Recipients within state typically required to provide 40% match for each project, but this may be negotiable with a given state.	Varies		Mike Reichert; Utah Division of Water Quality (DWQ)
North American Wetlands Conservation Act Grants Program	United States Fish and Wildlife Service (USFWS)	Business, Nonprofit Groups, Private Landowner, Local Government, State/Territorial Agency, Federal Agency	Long-term protection, restoration, and/or enhancement of wetlands and associated uplands habitats.	Cost-share partners must match grant funds 1:1 with U.S. non-federal dollars	Funding amounts vary; however in 2007 this program was awarded 39.4 Million	Typically in early spring (March)	http://www.fws.gove/birdhabitat/Grants/NAWC/index.shtm
Not-for-Profit Acid Mine Drainage Reclamation	U.S. Department of the Interior Office of Surface Mining, Division of Reclamation Support	Community/Watershed Group, Nonprofit Groups, Conservation District	Support the efforts of local not-for-profit organizations, especially watershed groups, to complete construction projects designed to clean streams impacted by Acid Mine Drainage	Partners are encouraged to make monetary contributions or provide in-kind services; however, a specific match is not specified.	Typically range between $25,000 and $150,000 - median is $50,000	Applications will be accepted until all available funds have been awarded	http://www.osmre.gov/osmaml.htm

Table 3. Grants for Stream and River Restoration Projects (continued)

GRANT	SPONSOR	ELIGIBLE	TYPES OF PROJECTS	MATCH	$ RANGE	DEADLINE	MORE INFORMATION
Partners for Fish and Wildlife Program	U.S. Department of the Interior, U.S. Fish and Wildlife Service Branch of Habitat Restoration, Division of Fish and Wildlife Management and Habitat Restoration	Business, Community/ Watershed Group, Nonprofit Groups, Educational Institution, Private Landowner, Conservation District, Local Government, Tribal Agency	The partners for Fish and Wildlife Program provides technical and financial assistance to private landowners to restore fish and wildlife habitats on their lands.	Typically an applicant contributes 50% of the total project cost through matching funds or in-kind services but this amount is negotiable.	Typically range between $300 and $25,000 - median is $25,000	Funds available year -round	http://ecos.fws.gov/ partners/ viewContent.do? viewPage=home
Urban and Community Forestry Challenge Cost -Share Grants	USDA Forest Service	Business, Community/ Watershed Group, Nonprofit Groups, Educational Institution, Conservation District, Water and Wastewater Utilities, Local Government, State/Territorial Agency, Tribal Agency	The program works to achieve a number of goals, including (1) effectively communicating information about the social, economic, and ecological values of urban and community forests; (2) involving diverse resource professionals in urban and community forestry issues; and (3) supporting a holistic view of urban and community forestry. In particular, the program supports an ecosystem approach to managing urban forests for their benefits to air quality, stormwater runoff, wildlife and fish habitat, and other related ecosystem concerns.	All grant funds must be matched at least equally (dollar for dollar) with non-federal source funds.	Typically range between $3,000 and $250,000 - median is $125,000	The annual Request for Pre-Proposals is released the first week in September. Pre-proposals are due the second Tuesday of November	http://www.freelink.org/ nucfac
Water 2025 Challenge Grant Program	Bureau of Reclamation, Office of Program & Policy Services	Nonprofit Groups, Educational Institution, Conservation District, Water and Wastewater Utilities, Local Government, State/ Territorial Agency, Tribal Agency	The goal of Water 2025 is to prevent crises and conflict over water in the western United States. The Challenge Grant Program is administered by the Bureau of Reclamation and is designed to contribute to this goal by providing 50% funding for projects that will conserve water, increase water use efficiency, or enhance water management, using advanced technology, improvements to existing facilities, and water banks and markets.	A match is required, but the % is not specified.	Typically range between $19,000 and $300,000 median is $140,000	Visit the Department of the Interior Water 2025 website, www.doi.gov/ water2025/, for current information on any upcoming RFP dates and deadlines	http://www.doi.gov/ water2025
Water Resources Research National Competitive Grants Program	U.S. Geological Survey	Educational Institution	Proposals are sought in not only the physical dimensions of supply and demand, but also quality trends in raw water supplies, the role of economics and institutions in water supply and demand, institutional arrangements for tracking and reporting water supply and availability, and institutional arrangements for coping with extreme hydrologic conditions.	A match is required, but the % is not specified.	Typically range between $5,000 and $250,000 - median is $120,000	February 16, 2007 (for investigations); March 2, 2007 (for institutes)	http://water.usgs.gov/ wrri/institutes.html

Table 3. Grants for Stream and River Restoration Projects (continued)

GRANT	SPONSOR	ELIGIBLE	TYPES OF PROJECTS	MATCH	$ RANGE	DEADLINE	MORE INFORMATION
Watershed Protection and Flood Prevention Program	USDA	Conservation District, Local Government, State/Territorial Agency, Tribal Agency	Projects related to watershed protection, flood mitigation, water supply, water quality, erosion and sediment control, wetland creation and restoration, fish and wildlife habitat enhancement, agricultural water conservation, and public recreation are eligible for assistance. Technical and financial assistance is also available for planning new watershed surveys.	Approximately 75%	Typically range between $5,000 and $2.16 Million - median is $650,000	Eligible project sponsors may submit formal requests for assistance to the NRCS state conservationists in each state at any time.	http:// www.nrcs.usda.gov/ programs/watershed/
Wetlands Program Development Grants	EPA	Nonprofit Groups, Local Government, State/Territorial Agency, Tribal Agency	The EPA's Wetland Program Development Grants are intended to encourage comprehensive wetlands program development by promoting the coordination and acceleration of research, investigations, experiments, training, demonstrations, surveys, and studies relating to the causes, effects, extent, prevention, reduction, and elimination of water pollution. Projects build the capacity of states, tribes and local governments to effectively protect wetland and riparian resources. Projects funded under this program support the initial development of a wetlands protection, restoration or management program or support enhancement/refinement of an existing program.	25% Non-federal match	Typically range between $11,000 and $500,000 - median is $250,000	Deadlines are determined annually and vary from region to region.	http://www.epa.gov/ owow/wetlands/ grantguidelines/
Wetlands Reserve Program	USDA - NRCS	Business, Community/ Watershed Group, Nonprofit Groups, Educational Institution, private Landowner, Conservation District, Water and Wastewater Utilities, Local Government, State/Territorial Agency, Tribal Agency	Through this voluntary program, the USDA Natural Resources Conservation Service (NRCS) provides landowners with financial incentives to restore and protect wetlands in exchange for retiring marginal agricultural land.	For restoration cost-share agreements and 30 year easement participants, up to 25% of the cost of restoring the acreage must be provided.		Applications are accepted year-round.	http:// www.nrcs.usda.gov/
Wildlife Habitat Incentives Program	USDA - NRCS	Nonprofit Groups, Private Landowners	The Wildlife Habitat Incentive Program (WHIP) is a voluntary program for people who want to develop and improve wildlife habitat on private lands. It provides both technical assistance and cost sharing to help establish and improve fish and wildlife habitat. Participants work with USDA's Natural Resources Conservation Service to prepare a wildlife habitat development plan in consultation with a local conservation district. The plan describes the landowner's goals for improving wildlife habitat, includes a list of practices and a schedule for installing them, and details the steps necessary to maintain the habitat for the life of the agreement.	25% Non-federal match	Not available; however, in FY 2007 this program was awarded $259 Million	Continuous sign-up process	http:// www.nrcs.usda.gov/ programs/whip/

Table 3. Grants for Stream and River Restoration Projects (continued)