LITTLE COTTONWOOD CREEK
Stream Survey Report

United States Department of Agriculture
Wasatch-Cache National Forest
Salt Lake Ranger District

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INTRODUCTION

In the summer of 1999, a fish habitat inventory was conducted on Little Cottonwood Creek. The stream was divided into sections that are located in Little Cottonwood Canyon in Salt Lake County, Utah. Little Cottonwood Creek is a tributary of the Jordan River, and is located on the Wasatch-Cache National Forest. The R1/R4 (Northern/Intermountain Regions) Fish and Fish Habitat Standard Inventory (Overton et al. 1997) was performed July-September 1999 by Mark Muir, Bryan Stephens, and Dax Dugaw. The purpose of the survey was to assess fish habitat and abundance in Little Cottonwood Creek.

PROJECT AREA

Little Cottonwood Creek is mainly a 3rd order stream as it flows through the canyon. The creek flows from around 9850 feet at the headwaters to around 5600 feet at the mouth of the canyon. The stream flows in a northwest direction as it leaves the headwaters by Cecret Lake and then flows due west down the canyon. At the base of the canyon, the stream leaves the Wasatch-Cache National Forest and the water enters the Murray City Water Diversion (Wasatch Resort) to provide water for Salt Lake City, during late summer. During peak flow, the stream flows northwest until the confluence with the Jordan River around the Taylorsville-Murray area, however during most of the year the flow does not reach the Jordan River and is completely dry below the Murray City Diversion.

The source waters at the top of Little Cottonwood Canyon begin above the Alta Ski Area and flow from Cecret Lake and many small intermittent streams. Additionally precipitation and several tributaries along the canyon contribute water volume to Little Cottonwood Creek. Alta receives over 50 inches of precipitation annually, most in the form of snow (500 inches annually). The average daily peak flow at the canyon mouth is 460 cfs. and the average annual water yield is 46,149 acre-feet (USDA Forest Service 1996). This canyon is a protected watershed area under strict management controls since it is the second largest provider of water for Salt Lake City. No dogs or horses are allowed. Although the water quality is among the highest of the drainages used for water supply, the data indicates that several parameters exceed state water quality standards in Little Cottonwood Creek. In samples taken at the Murray City Water Diversion (start of reach 1) in 1977-78, 1985-86, and through 1994, maximum temperature, cadmium, and silver exceeded the state standards for cold water fisheries use. Additionally, Phosphorus, Zinc, and pH levels were exceeded for cold water fisheries use at several sites throughout Little Cottonwood Canyon. (USDA Forest Service 1996)

The Utah Department of Wildlife Resources has identified Little Cottonwood Creek as a cold water fishery that does not support a very extensive fish population (USDA Forest Service 1996). The main limitations to stream productivity are low water levels in the fall and winter months, and the water chemistry. For over 20 years, Salt Lake City has withdrawn about 6 vertical feet of water (approximately 8 million gallons) from Cecret Lake each fall and for over 10 years an additional 4-6 million gallons of water has been withdrawn annually for snowmaking purposes at Alta Ski Area. The past impacts of water withdrawals are not known since baseline monitoring was not performed before this activity began. The 1996 Utah Water Quality Assessment Report to Congress states that Little Cottonwood Creek above the Forest Boundary is considered water quality impaired, and therefore, not supporting its designated beneficial uses for fisheries due to zinc concentrations that exceed state standards for fisheries. (USDA Forest Service 1996)

Little Cottonwood Canyon and the surrounding Wasatch-Cache National Forest have a long history of resource use and development. As Salt Lake City grew through the mid 1800's to early 1900's tremendous demands were placed on natural resources through population growth, mining, railroading, and manufacturing. The canyon was stripped of timber, forage, and minerals by 1900. Primary impacts were from the timber and mining industry. Today the canyon continues to be impacted through recreational demands and urban pressure. (Peterson et al. 1980)

Outdoor activities in the canyon include fishing, hunting, camping, hiking, picnicking, sightseeing, biking, rock climbing, skiing, and snowboarding. The National Forest land in the canyon is intermixed with private land. The private land contains many homes, some of which are right alongside Little Cottonwood Creek. Two large ski resorts are also located in the canyon. All of these activities further influence this ecosystem.

Little Cottonwood Creek from the Murray City Water Diversion (Wasatch Resort) to Cecret Lake can be divided into 8 reaches. From July 28, 1999 to September 10, 1999 a complete survey was performed on reaches 1, 2, 3, 4, and 5. Additional stream sections were also surveyed in 1997.

METHODS

General Information

The 1999 Little Cottonwood Creek Fish Habitat Inventory was conducted using the R1/R4 (Northern/Intermountain Regions) Fish and Fish Habitat Standard Inventory Procedures Handbook. (Overton et al. 1997) This handbook was designed for fisheries biologists working for the Forest Service, U.S. Department of Agriculture in order to assess the effects of National Forest management activities on fish and fish habitat. This information can help identify factors limiting fish populations and future extinction risks.

There is a basic four-step process to this inventory procedure: preinventory, inventory, postinventory, and data entry and reporting. In the preinventory stage, survey reaches are delineated based on flow changes from: tributaries, channel type, and substantial gradient changes. These reach breaks are then recorded on 7.5 minute topographic maps. Header forms are completed to give an overall description of each reach. The inventory phase is where a two-person crew consisting of an Observer and a Recorder performs the field inventory. During this stage the stream habitat and sample fish population data is collected. The postinventory process involves proofreading, organizing, and labeling data and photos. Data entry and reporting are completed through a fish habitat input program called FBASE. This computer program takes raw data and calculates summary reports that can be used to analyze the data effectively. (Overton et al. 1997)

Survey Details

The five reaches (1, 2, 3, 4, and 5), where the complete R1/R4 survey was performed in 1999, were classified into different habitat classes based on discharge measurements and then further specified into habitat groups and habitat types. Fast water habitats have a velocity greater than 0.3 m per second, while slow water habitats generally have a velocity less the 0.3 m per second. Fast water habitats can be either turbulent or non-turbulent. Turbulent water types include: cascades (CAS), step runs (SRN), high grade riffles (HJR), and low grade riffles (LGR). Non-turbulent water types include runs (RUN) and glides (GLD). Slow water habitats or pools are broken into dammed and scour habitat groups and then further classified into various habitat types based on their positions and formative features. Dammed pools can either be in the main (M) or backwater (B) position in the stream and can have formative features such as: large woody debris (LWD), boulders (B), artificial (man caused)(A), beavers (V), landslides (L), and other (O). Scour pools can be in several positions in the stream

channel such as: lateral scour (L), mid-scour (M), plunge (P), or underscour (U). The formative features that characterize scours include: large woody debris (LWD), boulder (B), artificial (A), bedrock (R), tributary (T), culvert (C), meander (M), beaver (V), and other (O). One other habitat type is the step pool complex (STP); it is characterized by a series of three or more step-like mid-scour pools separated by short sections of turbulent water. For example a typical habitat unit labeled as DMV would be interpreted as a dammed pool formed by beavers in the main channel of the stream. (Overton et al. 1997)

Habitat unit variables were collected for each new habitat unit surveyed along the reaches. The data collected varied based on the reach type, channel unit, and the habitat type. Every habitat unit had several standard variables measured such as: length, width, average wetted width and depth, bank length, bank stability, bank undercut, channel shape, LWD counts, and riparian community types. In fast water habitats the number of pocket pools and the average maximum depth of the pocket pools was recorded. In slow water habitats the maximum depth and crest depth of the pools was measured as well as the number of pools over 1 m. Substrate composition was analyzed about every 15-30 habitat units (every page) in low grade riffles and scour pool tails in the main stream channel from bankfull stage to bankfull stage. The percentage of each substrate class (fines, small gravel, small cobble, cobble, small boulder, boulder, and bedrock) was visually estimated and recorded. Water and air temperatures and the time they were measured were also recorded every page, or at least 3 times daily, and above and below tributaries. All large woody debris that was in the bankfull channel was classified as either single ($\geq$ 3m. length or $\geq$ two-thirds the wetted width of the stream and $\geq$ 0.1 m. in diameter one-third of the way up the base), aggregates ($\geq$ two clumped pieces of LWD; all qualifying pieces are counted), brush piles, or rootwads. The riparian classes were used to identify the vegetative structures surrounding the stream bed and consisted of: grassland/forb (GF), shrub/seedling (SS), sapling/pole (SP), small trees (ST), large trees (LT), and mature trees (MT). (Overton et al. 1997)

Fish population sampling was performed by either one or two snorkelers depending on the width of the habitat unit. Larger habitat units were divided in half and the observers would move at the same speed adjacent to each other and only count the fish that passed between their shoulder outward to the bank. In narrower habitat units one snorkeler counted all the fish from bank to bank as they floated down the center of the stream or swam upstream. Fish were counted by species and size classes. Snorkeling surveys were conducted at every 10^{th} slow water habitat and at a few non-turbulent fast water habitats. (Overton et al. 1997)

RESULTS

Reach 1

Reach one started at the Murray City Water Diversion (Wasatch Resort), elevation 5,600 ft., and ended at the Coalpit Gulch Tributary. The total reach length was 1,857.0 m. (Table 5) and contained a total of 168 habitat units (68 fast and 100 slow) (Table 1). The slow water : fast water velocity by count was 1:0.68 (Table 1) and by surface area was 1:1.19 (Table 3). Reach 1 was a confined channel with reach type A and an average map gradient of 8.3% and an average observed gradient of 11.3%. The average flow was 2.61 m^3/s. The average habitat width was 8.5 m. (Table 7) and the average habitat depth was 0.44 m. (Table 8). The habitats were composed of 46% riffles, 0% runs/glides, and 48% pools (Table 11). The total number of pocket pools was 606 and there were 62 per 100 m. with an average depth of 0.56 m. Reach 1 contained 87 pools/mile. The stream banks were 97% stable overall with 7.9% undercut (Table 12). The dominant substrate was 21.5% small boulder and fines were 4.3% (Figure 1). The total number of pieces of LWD per mile was 255.9 with a total of 230 single pieces (12.4/100 m.), 50 aggregates (2.7/100m.), and 14 root wads (0.8/100 m.) (Table 13). Reach 1 had a dominant riparian class of Shrub/Seedling Condition (Table 13). Rainbow and cutthroat trout species were present in this reach (Figures 6, 8, and 9) and there was 48.9% overhead cover in snorkel areas.

Reach 2

Reach two started at the Coalpit Gulch Tributary, elevation 6,065 ft., and ended at the Hogum Fork Tributary. The total reach length was 1,794.6 m. (Table 5) and contained a total of 99 habitat units (51 fast and 48 slow) (Table 1). The slow water : fast water velocity by count was 1:1.06 (Table 1) and by surface area was 1:2.52 (Table 3). Reach 2 was a confined channel with reach type A and an average map gradient of 7.4% and an average observed gradient of 4.8%. The average flow was 2.32 m^3/s. The average habitat width was 7.5 m. (Table 7) and the average habitat depth was 0.36 m. (Table 8). The habitats were composed of 69% riffles, 0% runs/glides, and 30% pools (Table 11). The total number of pocket pools was 1,188 and there were 95 per 100 m. with an average depth of 0.50 m. Reach 2 contained 65 pools/mile. The stream banks were 84.6% stable overall with 7.4% undercut (Table 12). The dominant substrate was 28.8% cobble and fines were 3.8% (Figure 2). The total number of pieces of LWD per mile was 879.7 with a total of 199 single pieces (11.1/100 m.), 79 aggregates (4.4/100m.), and 21 root wads (1.2/100 m.) (Table 13). Reach 2 had a dominant riparian class of Shrub/Seedling Condition (Table 13). Rainbow, brook, and cutthroat trout species were present in this reach (Figures 6, 7, 8, and 10) and there was 39.6% overhead cover in snorkel areas.

Reach 3
Reach three started at the Hogum Fork Tributary, elevation 6,420 ft., and ended at the Maybird Gulch Tributary. The total reach length was 1360.0 m. (Table 5) and contained a total of 73 habitat units (38 fast and 35 slow) (Table 1). The slow water : fast water velocity by count was 1:1.09 (Table 1) and by surface area was 1:1.46 (Table 3). Reach 3 was a confined channel with reach type A and an average map gradient of 9.3% and an average observed gradient of 7.0%. The flow was not taken on this reach. The average habitat width was 7.5 m. (Table 7) and the average habitat depth was 0.39 m. (Table 8). The habitats were composed of 38% riffles, 0% runs/glides, and 44% pools (Table 11). The total number of pocket pools was 711 and there were 93 per 100 m. with an average depth of 0.49 m. Reach 3 contained 69 pools/mile. The stream banks were 85.0% stable overall with 7.2% undercut (Table 12). The dominant substrate was 27.5% small cobble and fines were 5.0% (Figure 3). The total number of pieces of LWD per mile was 700.9 with a total of 104 single pieces (7.7/100 m.), 38 aggregates (2.8/100m.), and 37 root wads (2.7/100 m.) (Table 13). Reach 3 had a dominant riparian class of Small Trees Condition (Table 13). Rainbow, brook, and cutthroat trout species were present in this reach (Figures 6, 7, 8, and 11) and there was 40.5% overhead cover in snorkel areas.

Reach 4
Reach four started at the Maybird Gulch Tributary, elevation 6,830 ft., and ended at the Red Pine Fork Tributary. The total reach length was 920.5 m. (Table 5) and contained a total of 69 habitat units (38 fast and 31 slow) (Table 1). The slow water : fast water velocity by count was 1:1.23 (Table 1) and by surface area was 1:2.13 (Table 3). Reach 4 was a confined channel with reach type A and an average map gradient of 10.9% and an average observed gradient of 10.0%. The average flow was 1.69 m^3/s. The average habitat width was 6.9 m. (Table 7) and the average habitat depth was 0.37 m. (Table 8). The habitats were composed of 39% riffles, 0% runs/glides, and 33% pools (Table 11). The total number of pocket pools was 556 and there were 91 per 100 m. with an average depth of 0.51 m. Reach 4 contained 77 pools/mile. The stream banks were 84.3% stable overall with 6.9% undercut (Table 12). The dominant substrate was 25.8% cobble and fines were 3.3% (Figure 4). The total number of pieces of LWD per mile was 573.6 with a total of 54 single pieces (5.9/100 m.), 38 aggregates (4.1/100m.), and 8 root wads (0.9/100 m.) (Table 13). Reach 4 had a dominant riparian class of Sapling/Pole Condition (Table 13). Rainbow and brook trout species were present in this reach (Figures 6, 7, and 12) and there was 46.9% overhead cover in snorkel areas.

Reach 5
Reach five started at the Red Pine Fork Tributary, elevation 7,135 ft., and ended at the White Pine Fork Tributary, elevation 7,400 ft. The total reach length was 1,065.6 m. (Table 5) and contained a total of 62 habitat units (32 fast and 30 slow) (Table 1). The slow water : fast water velocity by count was 1:1.07 (Table 1) and by surface area was 1:1.31 (Table 3). Reach 5 was a confined channel with reach type A and an average map gradient of 8.8% and the average observed gradient was not taken. The average flow was 0.96 m^3/s. The average habitat width was 7.3 m. (Table 7) and the average habitat depth was 0.35 m. (Table 8). The habitats were composed of 35% riffles, 0% runs/glides, and 45% pools (Table 11). The total number of pocket pools was 590 and there were 100 per 100 m. with an average depth of 0.48 m. Reach 5 contained 70 pools/mile. The stream banks were 88.3% stable overall with 5.9% undercut (Table 12). The dominant substrate was 27.5% small cobble and fines were 5.0% (Figure 5). The total number of pieces of LWD per mile was 445.9 with a total of 59 single pieces (5.5/100 m.), 26 aggregates (2.4/100m.), and 5 root wads (.5/100 m.) (Table 13). Reach 5 had a dominant riparian class of Sapling/Pole Condition (Table 13). Rainbow trout were the only fish present in this reach (Figures 6 and 13) and there was 42.8% overhead cover in snorkel areas.

Summary of Main Channel Physical Habitat Dimensions in Little Cottonwood Creek, 1999

Table 1. Count of Habitat Type by Reach

REACH	FAST	SLOW	TOTAL
1	68	100	168
2	51	48	99
3	38	35	73
4	38	31	69
5	32	30	62

Table 2. Percent of Habitat Type by Reach

REACH	FAST	SLOW	TOTAL
1	40%	60%	100%
2	52%	48%	100%
3	52%	48%	100%
4	55%	45%	100%
5	52%	48%	100%

Table 3. Count of Habitat Area (m^2) by Reach

REACH	FAST	SLOW	TOTAL
1	8,544.2	7,193.5	15,737.7
2	9,686.6	3,844.1	13,530.7
3	6,026.4	4,132.3	10,158.7
4	4,306.0	2,024.4	6,330.4
5	4415.9	3364.3	7,780.2

Table 4. Percent of Habitat Area (m^2) by Reach

REACH	FAST	SLOW	TOTAL
1	54%	46%	100%
2	72%	28%	100%
3	59%	41%	100%
4	68%	32%	100%
5	57%	43%	100%

Table 5. Total Length (m) of Habitat Type by Reach

REACH	FAST	SLOW	TOTAL
1	973.4	883.6	1,857.0
2	1,256.5	538.1	1,794.6
3	762.8	597.2	1,360.0
4	613.6	306.9	920.5
5	589.8	475.8	1,065.6

Table 6. Average Length (m) of Habitat Type by Reach

REACH	FAST	SLOW
1	14.3	8.8
2	24.6	11.2
3	20.1	17.1
4	16.1	9.9
5	18.4	15.9

Table 7. Average Width (m) of Habitat Type by Reach

REACH	FAST	SLOW
1	8.8	8.1
2	7.7	7.1
3	7.9	6.9
4	7.0	6.6
5	7.5	7.1

Table 8. Average Depth (m) of Habitat Type by Reach

REACH	FAST	SLOW
1	0.35	0.54
2	0.31	0.48
3	0.31	0.50
4	0.32	0.48
5	0.28	0.45

Table 9. Total Volume (m^3) of Habitat Type by Reach

REACH	FAST	SLOW	TOTAL
1	2,950.3	3,918.0	6,868.3
2	2,958.0	1,853.3	4,811.3
3	1,895.2	2,051.4	3,946.6
4	1,356.4	981.8	2,338.2
5	1224.4	1523.2	2,747.6

Table 10. Average Volume (m^3) of Habitat Type by Reach

REACH	FAST	SLOW
1	43.4	39.2
2	58.0	38.6
3	49.9	58.6
4	35.7	31.7
5	38.3	50.8

Table 11. Percent of Habitat by Area (m^2)

REACH	%Riffle	%Runs / Glides	%Pools	Total
1	46	0	48	93
2	69	0	30	99
3	38	0	44	82
4	39	0	33	72
5	35	0	45	80

Summary of Main Channel Bank Conditions, Woody Debris Counts, and Riparian Community Types in Little Cottonwood Creek, 1999

Table 12. Stream Habitat Bank Conditions by Reach

Reach #	1	2	3	4	5
Bank Length (m) (Left)	2,136.4	1,948.8	1,541.4	1,054.8	1208.6
Bank Length (m) (Right)	2,131.8	1,975.2	1,570.4	1,058.6	1206.1
% Stable Bank (Left)	97	84	84	86	87
% Stable Bank (Right)	97	85	86	83	90
% Unstable Bank (Left)	3	16	16	14	13
% Unstable Bank (Right)	3	15	14	17	10
% Undercut Bank (Left)	9	7	7	7	6
% Undercut Bank (Right)	6	8	8	6	6

Table 13. Woody Debris Counts and Dominant Riparian Types by Reach

Reach #	1	2	3	4	5
Total # of Single Pieces	230	199	104	54	59
Average # of Single Pieces	1.4	2	1.5	0.8	1
Single Pieces/100m	12.4	11.1	7.7	5.9	5.5
Total # of Aggregates	50	79	38	38	26
Average # of Aggregates	0.3	0.8	0.5	0.6	0.4
Aggregates/100m	2.7	4.4	2.8	4.1	2.4
Total # of Root Wads	14	21	37	8	5
Average # of Root Wads	0.1	0.2	0.5	0.1	0.1
Root Wads/100m	0.8	1.2	2.7	0.9	0.5
Dominant Riparian Community Type	SS	SS	ST	SP	SP

Substrate Composition in Little Cottonwood Creek, 1999 (values represent percent occurence)

Figure 1. Reach 1 Substrate Composition

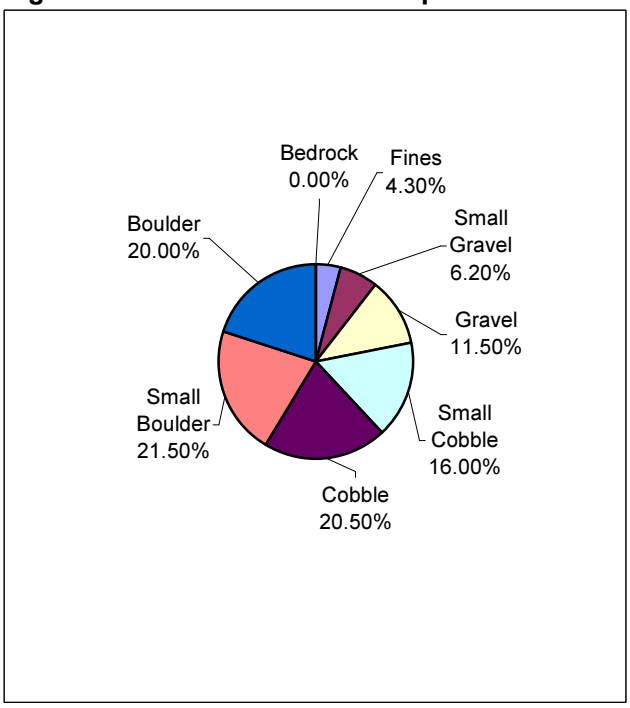


Figure 2. Reach 2 Substrate Composition

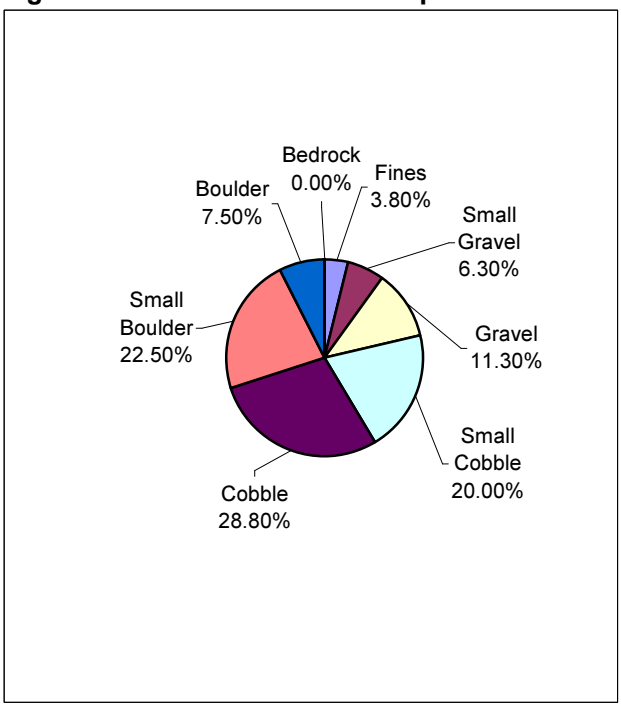


Figure 3. Reach 3 Substrate Composition

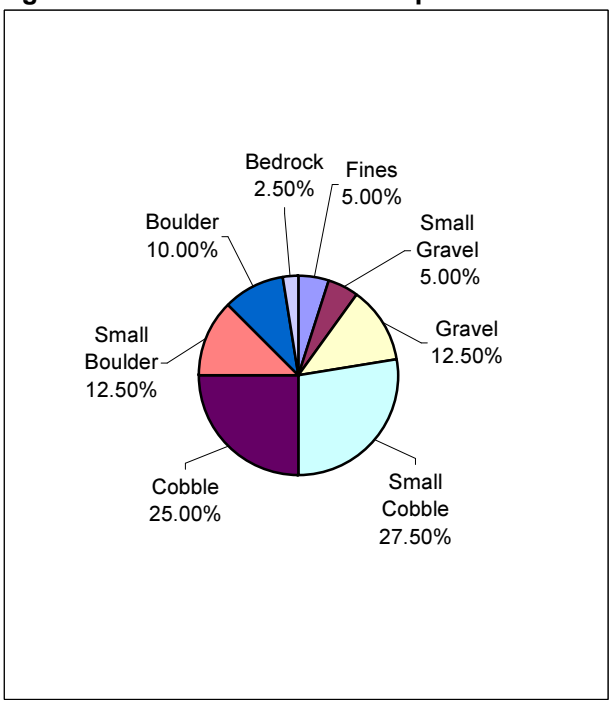
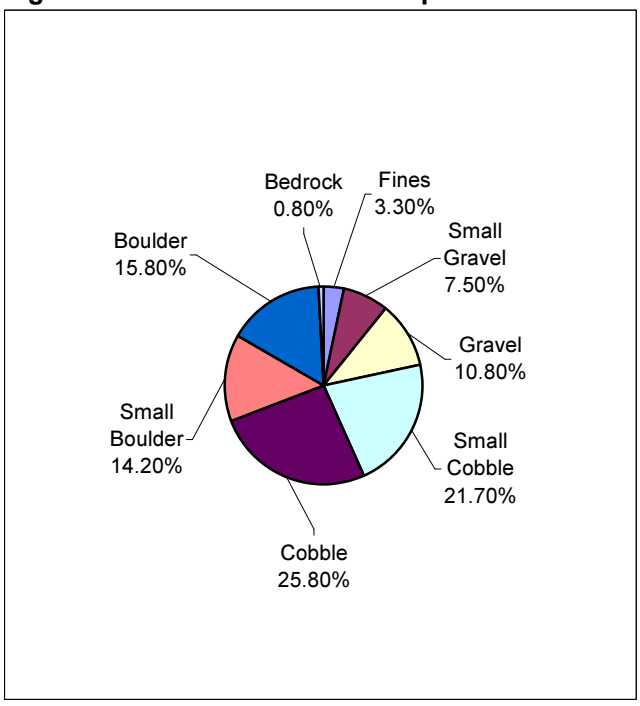


Figure 4. Reach 4 Substrate Composition



Substrate Composition in Little Cottonwood Creek, 1999 (values represent percent occurence)

Figure 5. Reach 5 Substrate Composition

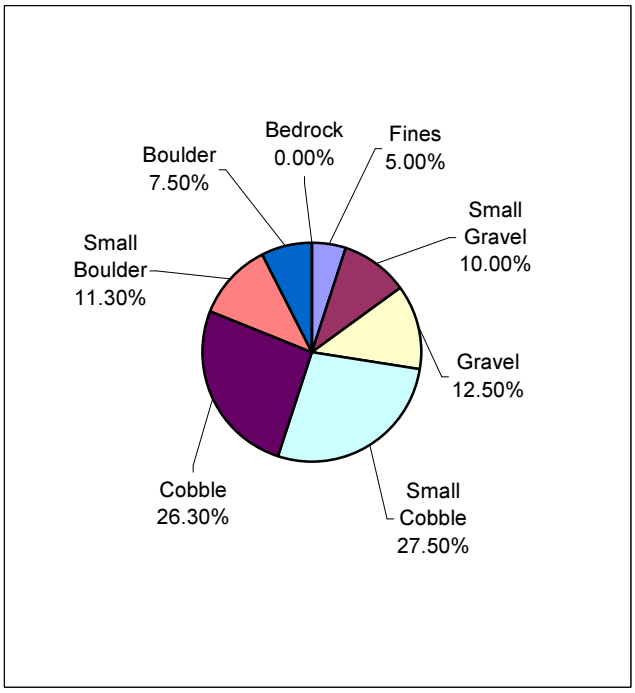


Figure 6. Length Frequency Distribution of Rainbow Trout in Little Cottonwood Creek, Salt Lake County, Utah, 1999

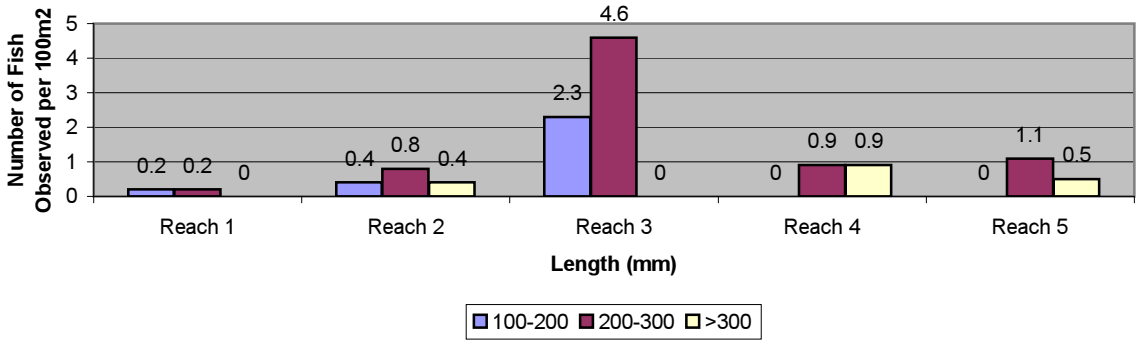


Figure 7. Length Frequency Distribution of Brook Trout in Little Cottonwood Creek, Salt Lake County, Utah, 1999

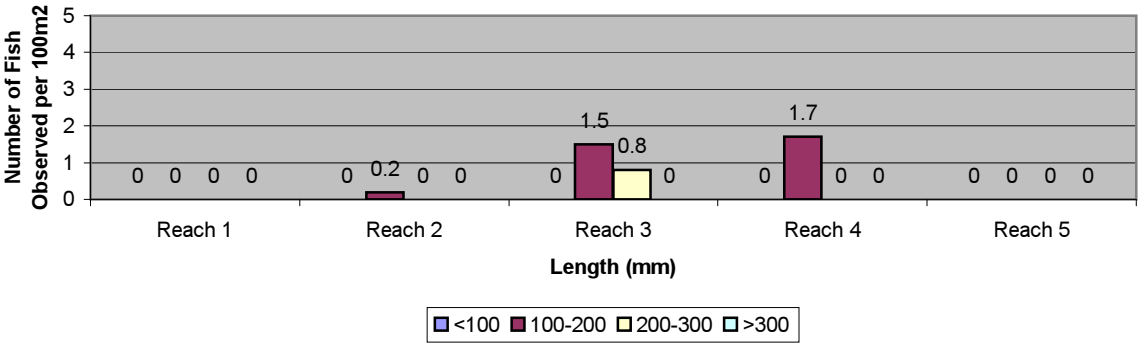
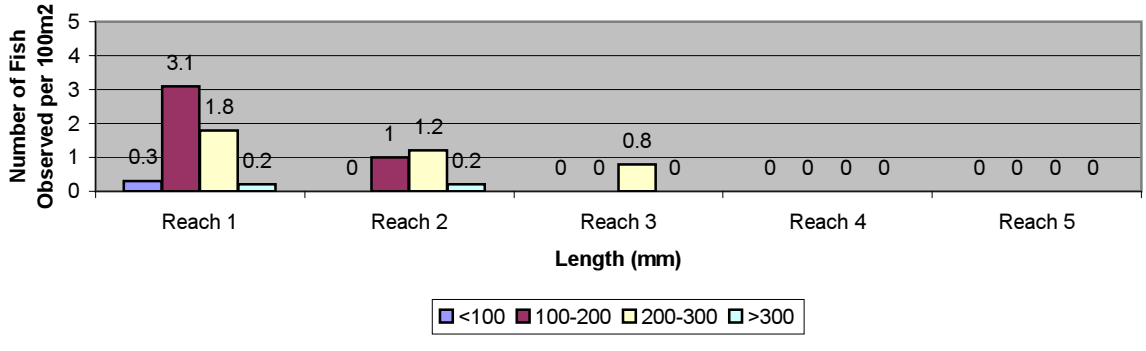


Figure 8. Length Frequency Distribution of Cutthroat Trout in Little Cottonwood Creek, Salt Lake County, Utah, 1999



Fish Composition in Little Cottonwood Creek, 1999 (values represent percent observed)

Figure 9. Reach 1 Fish Composition

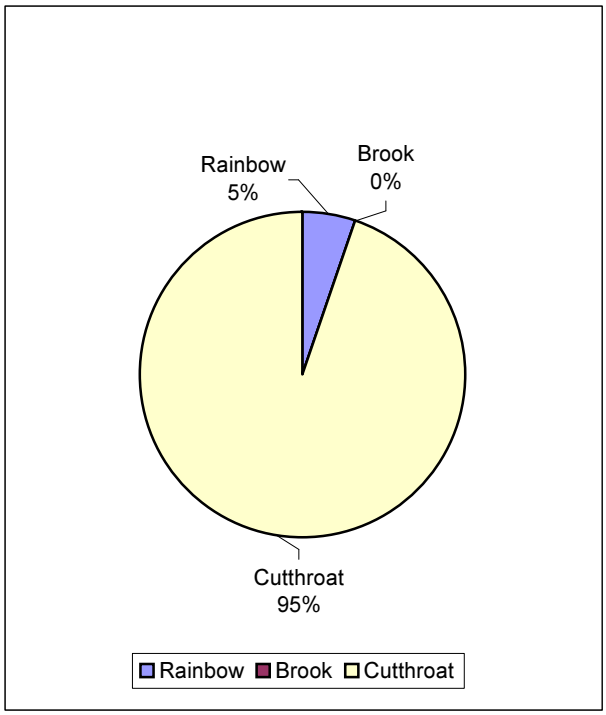


Figure 10. Reach 2 Fish Composition

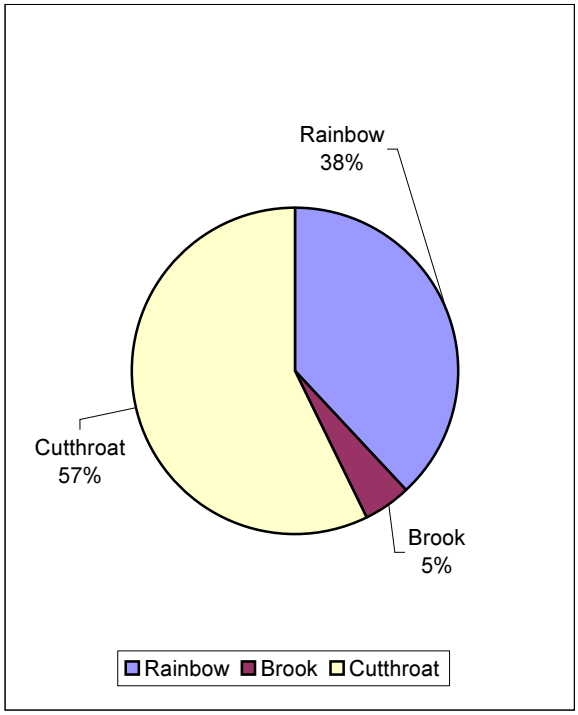


Figure 11. Reach 3 Fish Composition

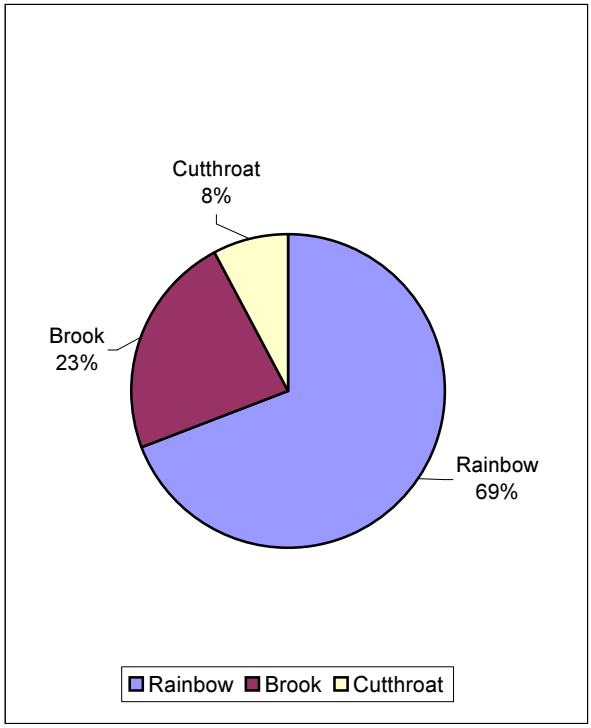
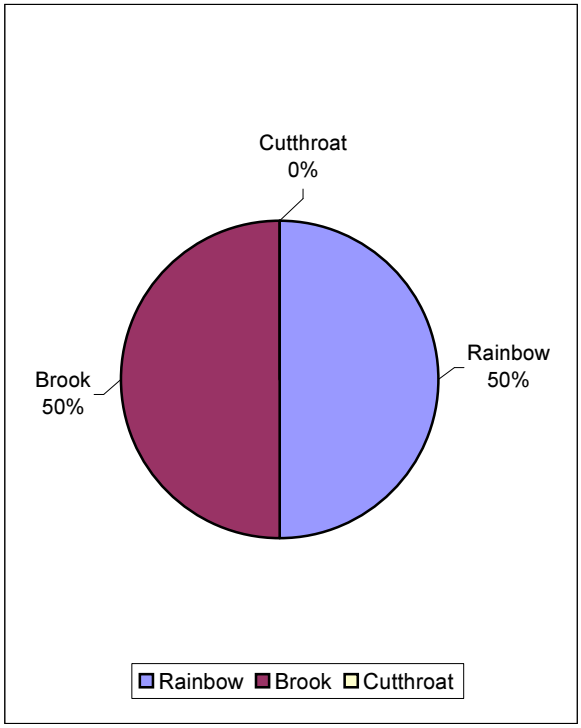
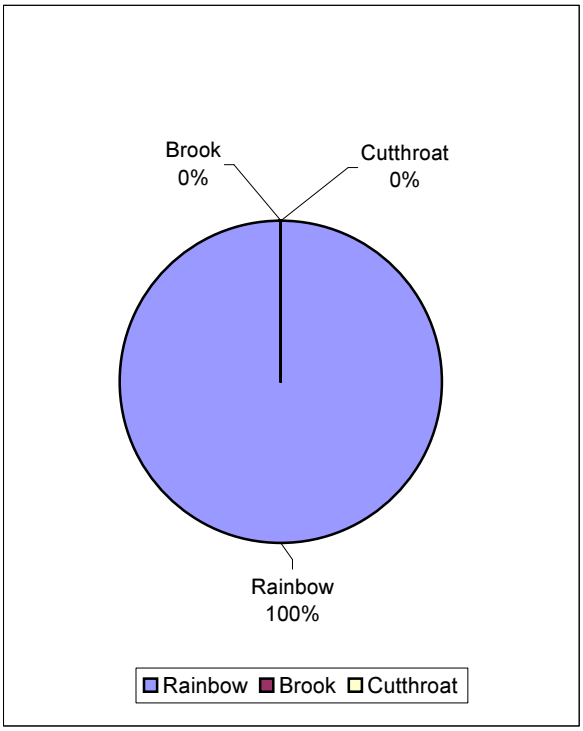


Figure 12. Reach 4 Fish Composition



Fish Composition in Little Cottonwood Creek, 1999 (values represent percent observed)

Figure 13. Reach 5 Fish Composition



DISCUSSION

Little Cottonwood Creek, as mentioned earlier in this paper, has been identified as a cold water fishery that does not support a very extensive fish population. The main limitations to stream productivity are low water levels in the fall and winter months, and the water chemistry which affects macro invertebrate communities. (USDA Forest Service 1996) Resource use and development have been impacting the canyon since the mid-1800's and continues today. If managed properly, however, Little Cottonwood Canyon and its waters may have the potential to support a productive riparian community in the Wasatch-Cache National Forest.

In the User's Guide to Fish Habitat: Descriptions that Represent Natural Conditions in the Salmon River Basin, Idaho (Overton et al. 1995), natural condition descriptors of stream channel characteristics are listed. These figures can be compared to the 1999 Little Cottonwood Creek data along with statistics taken from the Inland Native Fish Strategy Environmental Assessment (INFISH, USDA Forest Service 1995). INFISH lists quantitative summary features used to describe good habitat for western anadromous and non-anadromous streams. It is important to note a few main differences between Natural Condition Descriptors and INFISH. The Natural Condition Descriptors explain what is representative in the field currently, but not necessarily the most optimal conditions. INFISH, however, describes desired future conditions for riparian zones to be achieved over time. Another main difference between these two stream descriptors is that INFISH does not account for channel type and topography in its estimates.

Little Cottonwood Creek had much higher pools/mile than the natural condition descriptors. Reaches 1, 2, 3, 4, and 5 with average wetted widths of 28.3 ft. (8.5 m.), 25.0 ft. (7.5 m.), 25.0 ft. (7.5 m.), 23.0 ft. (6.9 m.), and 24.3 ft. (7.3 m.), respectively, were above the standard error range of pools per mile. All five reaches had 65-87 pools/mile as compared to 22.66-22.78 pools/mile in the natural condition descriptors. The increased pools/mile could be due to high amounts of large woody debris caused by log jams from avalanche slide paths. As for the INFISH statistics, reach 1 with a wetted width of 25-50 ft. should have had 47-26 pools/mile and reaches 2, 3, 4, and 5 with wetted widths of 20-25 ft. should have had 56-47 pools/mile. All five reaches were above the INFISH desirable characteristics for pools/mile as well. Another factor that may explain the high pools/mile in Little Cottonwood Creek, as compared to the INFISH statistics, is that INFISH does not account for channel type or topography in its estimates.

Habitat percentages by area (Table 11) are a supplementary way to analyze pool habitat through pool: riffle ratios. By using the percent of habitat area (m^2) found in Table 11, the following pool: riffle ratios were calculated for reaches 1, 2, 3, 4, and 5: 1:0.96, 1:2.30, 1:0.86, and 1:1.18, and 1:0.78 respectively. The Habitat Suitability Index Models suggest a pool: riffle ratio of 1:1 for optimal fish habitat conditions or at least 40-60% pool habitat. (Hickman and Raleigh 1982). Reaches 1, 3, and 5 were slightly below the 1:1 pool: riffle ratio, but had 44-48% pools. Conversely, reaches 2 and 4 had 30-33% pool habitat, but were above the 1:1 pool: riffle ratio.

Large Woody Debris (LWD) is another stream channel characteristic analyzed by the User's Guide to Fish Habitat (Overton et al. 1995) and INFISH (USDA Forest Service 1995). Reaches 1, 2, 3, 4, and 5 had 255.9 LWD/mile, 879.7 LWD/mile, 700.9 LWD/mile, 573.6 LWD/mile, and 445.9 LWD/mile, respectively. All five reaches were above the natural condition descriptor of 100.58-119.95 LWD/mile (Overton et al. 1995). The increased woody debris may be caused by high amounts of log jams from avalanche slide paths in this area. INFISH lists the desirable LWD in forested systems as >20 pieces/mile (>12 inch diameter; >35 foot length). It is difficult to compare this characteristic to the 1999 Little Cottonwood Creek data because the LWD

diameters and lengths were not recorded, however with the high amounts of LWD recorded in the reaches it seems that they would fall within the desirable characteristics. On a side note it is interesting to point out that reaches within Little Cottonwood Creek near the road had considerably less woody debris than those reaches that were more out of sight. It appears that those areas that are more easily accessible were heavily deforested in the 1800-1900's and continue to be effected by snow plowing today.

A stream bed's width per depth ratio references it's ability to be a stable ecosystem by maintaining optimal temperatures in the summer and winter, and providing deep pools and therefore better fish habitat. A low width per depth ratio is ideal in productive riparian areas. Little Cottonwood's width/depth ratio was calculated by dividing the reaches average wetted width by the average depth (Table 7 and Table 8). Reaches 1, 2, 3, 4, and 5 had width/depth ratios of: 19, 21, 19, 19 and 21, respectively. According to the classification key for natural rivers in Applied River Morphology (Rosgen 1996) all five Little Cottonwood reaches surveyed in 1999 would fall under stream type B and should therefore have a width/depth ratio of >12 which correlates with the field data found. The natural condition descriptor lists a width/depth between 4 and 22 as occurring most often. (Overton et al. 1995) However, in relation to the width/depth ratio of ≤10 in INFISH (USDA Forest Service 1995), all five reaches are about two times above the objective value. There are significant influences to the stream channel within Little Cottonwood Canyon that would cause this undesirable elevated width/depth ratio. The mine activity of the 1800-1900's forced large amounts of tailings and sediment into the stream. Additional manipulations to the stream bed were caused by the construction and development of the canyon road, saw mills and mines, picnic and campground areas, residential houses, and the 2 ski resorts. Present and future management concerns should address the further riparian damage of winter road maintenance and additional recreation and residential site expansion.

Other influences to the width per depth ratio are the percent surface fines and percent fines in the stream bed substrate composition and the percent stream bank stability. Reaches 1, 2, 3, 4, and 5 had surface fines percents of: 7.7%, 7.3%, 7.9%, 8.3%, and 8.4%, respectively. The natural condition descriptor (Overton et al. 1995) of 10-20% surface fines was slightly above the percentages for Little Cottonwood Creek. The Habitat Suitability Index Models (Hickman and Raleigh 1982) states the optimal spawning gravel for trout species is ≤5% fines, while ≥30% fines will cause low survival of embryos and emerging yolk-sac fry. Reaches 1, 2, 3, 4, and 5 had fines percents (figures 1-4) of: 4.3%, 3.8%, 5%, 3.3%, and 5%, respectively. All five reaches are within the optimal percent fines and are well below the amount to cause mortality. It is important to note, however, the distinction between percent surface fines and percent fines. Surface fines are estimated by only looking at the fines at the top of the substrate, while fines are estimated within a column of material. Therefore, surface fines estimates may be underestimated when comparing to fines estimates. Reaches 1, 2, 3, 4, and 5 had stable bank percentages (Table 12) as follows: 97.0%, 84.6%, 85.0, 84.3%, and 88.3%. This data was found by averaging the % stable bank left and the % stable bank right. The natural condition descriptor (Overton et al. 1995) was 93-100% bank stability, which suggests that the banks are somewhat unstable in reaches 2, 3, 4, and 5. INFISH (USDA Forest Service 1995) recommends >80% bank stability, which all reaches demonstrated. These figures may indicate that the stream bed has begun to recover from some of the land disturbing activities of the past and present.

In stream temperatures in Little Cottonwood Creek ranged from 4ºC to 14ºC (39ºF to 57ºF) during the survey. The most frequently observed natural condition descriptor temperature is 8ºC (46ºF) (Overton et al. 1995), while INFISH (USDA Forest Service 1995) lists a maximum temperature of <68ºF (20ºC) in compliance with state water quality standards. According to The

Habitat Suitability Index Models (Hickman and Raleigh et al. 1982, 1984, 1986) the optimal temperature range for trout species is as follows: 12-15ºC (54-59ºF) for cutthroat, 12-18ºC (54-64ºF) for rainbow, 11-16ºC (52-61ºF) for brook, and 12-19ºC (54-66ºF) for brown. The survey data indicates that the water temperatures were within the range for the natural condition descriptor and INFISH, while stream temperatures may have been on the low end for the HIS models.

Little Cottonwood Creek snorkeling surveys indicated trout species in all five reaches (Figures 6-13). Rainbow trout (*Salmo gairdneri*) (Figure 6) was found in reaches 1, 2, 3, 4, and 5. Brook trout (*Salvelinus fontinalis*) (Figure 7) was found in reaches 2, 3, and 4. Cutthroat trout (*Salmo clarki*), was found in reaches 1, 2, and 3. In the 1997 Little Cottonwood Creek Survey, only rainbow trout (natural and hatchery stocked), and one brook trout were found while electrofishing seven different sections. Some of the rainbow trout found, 1.5 miles downstream of the Tanner Flat Campground (section 2), had large side spotting and light yellow slashes under each branch under the jaw. This suggests that some of these fishes may be rainbow and cutthroat trout crosses. No fish were found at section 6 by the Wasatch Drain Tunnel or section 7 between the Sugarloaf Lift and Albion Lift at Alta. It is important to remember, however, that although cutthroat trout were found in the 1999 survey of Little Cottonwood Creek, this does not suggest that these fish are pure Bonneville cutthroat trout. These cutthroat trout could be a mix of other cutthroat trout varieties or rainbow trout. (Cowley 1997)

Historically the waters of Little Cottonwood Creek are thought to have supported a healthy fish population. This historic presence leads one to question why Little Cottonwood Creek is not supporting a healthy fish population today? It is difficult to pinpoint one distinct answer to this question for it is more likely a combination of factors. As explained earlier in this paper, there have been significant influences to this riparian ecosystem over the years such as: mining and timber harvesting, which have resulted in sediment inputs, water quality degradation, and habitat loss. Couple these impacts with the current issues of water withdrawal rates, road sediment, ski area and residential expansion, campground use, and potential over fishing. There is also the possibility of one single incident such as a chemical spill at the mines in the 1800-1900's that could have wiped out the entire fish population instantaneously. Another issue that further complicates matters is the stocking of fish species by Utah Department of Wildlife Resources. Currently, UDWR stocks 1000 rainbow trout each summer above Snowbird Ski Resort. According to Sigler and Sigler, 1996, the main limiting factors to cutthroat survival are: reduced flows, degradation of water quality, and inadequate overwintering habitat. Furthermore, in degraded habitat, cutthroat trout do not compete well with introduced species. In recent years, efforts have been made to understand the heavy metals contamination in Little Cottonwood Creek. Until a solution to the water chemistry issue is reached, Little Cottonwood Creek will continue to only support a limited fish population. Based on this information, once the water quality is improved, it would be beneficial to reintroduce the native Bonneville cutthroat trout and sterile rainbow trout to Little Cottonwood Creek; creating a more natural ecosystem.

PROJECT OPPPORTUNITIES

Throughout history rivers and watersheds have been impacted by man's watershed activities, causing environmental stress and degraded water resource values. There is currently a rising interest in fish habitat improvement projects throughout the western U.S. that are focused on the restoration of natural tendencies in river channel behavior. (Rosgen 1996) With today's growing population and watershed requirements, a balance needs to be created between consumptive uses of water resources and sustainable riparian systems.

Salt Lake City, Utah is a prime example of this theory. The population of Salt Lake Valley is growing at a tremendous rate and so are the demands placed on watersheds and riparian or stream systems such as Little Cottonwood Canyon. Salt Lake City is a unique metropolitan area with its close proximity to the Wasatch-Cache National Forest, therefore the management of the Little Cottonwood Creek watershed must be designed to minimize the pressures of the city and the surrounding area.

According to Rosgen's applications table for management interpretations of various stream types (Rosgen 1996), Little Cottonwood Creek has a low sensitivity to disturbance, sediment supply, and stream bank erosion potential. Additionally vegetation has a moderate influence to width to depth ratio stability and the system as a whole has an excellent recovery potential after causes of instabilities are corrected (Rosgen 1996). This is useful information when considering future riparian improvement project opportunities.

Overall the main impacts to fish habitat quality observed in 1999 survey of Little Cottonwood Creek were: sediment loading from the canyon road and areas of bank instability, bank slumping and erosion, and riparian vegetation degradation. Some of the most effected areas in the 5 surveyed reaches were the popular destination spots such as: Little Cottonwood Trail, areas along the reaches where the Little Cottonwood Canyon road is within 5-10m. of the stream, and Tanner's Flat Campground. Possible improvement projects could include: allowing fewer access points to the stream banks in affected areas, building of improved stream crossings, and riparian vegetation restoration. Additional management concerns are: fish stocking, low instream flows in late summer through winter and the amount of water uptake, the expansion of residential properties and ski area facilities, and the water quality issues associated with the past mining activity. We need to carefully analyze our stocking policies and shift to the stocking of native Bonneville cutthroat trout as well as increase our instream flow requirements, control canyon development, and improve water quality.

Rivers are the lifeblood of our civilization, we therefore need to carefully consider the consequences of our actions and attempt to maintain ecologically sound riparian and aquatic communities.

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APPENDIX

Information sheet for Little Cottonwood Creek, Wasatch-Cache National Forest.
Survey completed summer 1999.

Date Surveyed:	July 28, 1999-September 10, 1999
County:	Salt Lake, Utah
Survey Length:	6,997.7 m.
Reach 1:	1,857.0 m. (Murray City Water Diversion – Coalpit Gulch Tributary)
Reach 2:	1,794.6 m. (Coalpit Gulch Tributary – Hogum Fork Tributary)
Reach 3:	1,360.0 m. (Hogum Fork Tributary – Maybird Gulch Tributary)
Reach 4:	920.5 m. (Maybird Gulch Tributary – Red Pine Fork Tributary)
Reach 5:	1,065.6 m. (Red Pine Fork Tributary – White Pine Fork Tributary)
Climate:	Mountainous climate with wide ranging temperatures. During the 1999 summer survey, air temperatures ranged from 5ºC - 25ºC (41ºF – 77ºF).
	Mean annual precipitation is >50 inches and from this around 500 inches of total annual snowfall are measured. (USDA Forest Service 1996)
	Water temperatures ranged from 4ºC - 14ºC (39ºF – 57ºF) during the 1999 summer survey.
Elevation:	Headwaters by Cecret Lake 9850 feet Mouth of Little Cottonwood Canyon 5600 feet
Riparian Vegetation:	Riparian vegetation includes: grasslands/forbs, shrubs/seedlings, saplings/poles, small trees, large trees, and mature trees.
Fish Species:	Rainbow trout (*Salmo gairdneri*), Brook trout (*Salvelinus fontinalis*), and Bonneville cutthroat trout (*Salmo clarki utah*)
Distribution:	Reach 1: rainbow trout and cutthroat trout Reach 2: rainbow trout, brook trout, and cutthroat trout Reach 3: rainbow trout, brook trout, and cutthroat trout Reach 4: rainbow trout and brook trout Reach 5: rainbow trout
Management:	Summer recreation (sightseeing, hiking, picnicking, camping, rock climbing, biking, fishing, and seasonal hunting)
	Winter Recreation (skiing, and snowboarding)

Habitat Class	Number of Snorkel Sites	Habitat Area (m²)	Habitat Vol (m«)	Chinook Total	Chinook per 100m²	Steelhead Total	Steelhead per 100m²	Rainbow Total	Rainbow per 100m²	Cutthroat Trout Total	Cutthroat Trout 100m²	Bull Trout Total	Bull Trout per 100m²	Brook Trout Total	Brook Trout per 100m²
Survey Reach:1 Survey Reach Lower Boundary: MURRAY CITY WATER DIVERSION (WASATCH RESORT)															
Reach Type: A Survey Reach Upper Boundary: COALPIT GULCH TRIB															
SLOW	10	687.7	382.6	0	0.00	0	0.00	2	0.29	36	5.24	0	0.00	0	0.00
Subtotals	10	687.7	382.6	0		0		2		36		0		0	
Densities					0.00		0.00		0.29		5.24		0.00		0.00
Survey Reach:2 Survey Reach Lower Boundary: COALPIT GULCH TRIBUTARY															
Reach Type: A Survey Reach Upper Boundary: HOGUM FORK TRIBUTARY															
SLOW	5	506.0	285.1	0	0.00	0	0.00	8	1.58	12	2.37	0	0.00	1	0.20
Subtotals	5	506.0	285.1	0		0		8		12		0		1	
Densities					0.00		0.00		1.58		2.37		0.00		0.20
Survey Reach:3 Survey Reach Lower Boundary: HOGUM FORK TRIBUTARY (6420FT)															
Reach Type: A Survey Reach Upper Boundary: MAYBIRD GULCH (6830FT)															
SLOW	3	130.5	69.1	0	0.00	0	0.00	9	6.90	1	0.77	0	0.00	3	2.30
Subtotals	3	130.5	69.1	0		0		9		1		0		3	
Densities					0.00		0.00		6.90		0.77		0.00		2.30
Survey Reach:4 Survey Reach Lower Boundary: MAYBIRD GULCH TRIBUTARY															
Reach Type: A Survey Reach Upper Boundary: RED PINE FORK TRIBUTARY															
SLOW	3	116.2	66.3	0	0.00	0	0.00	2	1.72	0	0.00	0	0.00	2	1.72
Subtotals	3	116.2	66.3	0		0		2		0		0		2	
Densities					0.00		0.00		1.72		0.00		0.00		1.72
Survey Reach:5 Survey Reach Lower Boundary: RED PINE FORK TRIBUTARY															
Reach Type: A Survey Reach Upper Boundary: WHITE PINE FORK TRIBUTARY															

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

Habitat Class	Number of Snorkel Sites	Habitat Area (m²)	Habitat Vol (m«)	Chinook Total	Chinook per 100m²	Steelhead Total	Steelhead per 100m²	Rainbow Total	Rainbow per 100m²	Cutthroat Trout Total	Cutthroat Trout 100m²	Bull Trout Total	Bull Trout per 100m²	Brook Trout Total	Brook Trout per 100m²
SLOW	3	188.1	90.6	0	0.00	0	0.00	3	1.59	0	0.00	0	0.00	0	0.00
Subtotals	3	188.1	90.6	0		0		3		0		0		0	
Densities					0.00		0.00		1.59		0.00		0.00		0.00
Totals	24	1,628.4	893.6	0		0		24		49		0		6	
Densities					0.00		0.00		1.47		3.01		0.00		0.37

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

Habitat Class	No. of Snorkel Sites	Dive Length Total	Dive Width Mean(n)	Dive Depth Mean(n)	Dive Max Depth Mean(n)	Habitat Area Total(n)	Habitat Area Percent	Habitat Volume Total(n)	Habitat Volume Percent	% Underct Bank Mean(n)	% Overhd Cover Mean(n)	% Submrg Cover Mean(n)	% Large Substr Mean(n)
Survey Reach:1 Survey Reach Lower Boundary: MURRAY CITY WATER DIVERSION (WASATCH RESORT)													
Reach Type: A Survey Reach Upper Boundary: COALPIT GULCH TRIB													
SLOW	10	80.6	8.5(10)	0.56(10)	1.16(10)	687.7(10)	100.0	382.6(10)	100.0	24.8(10)	48.9(10)	22.8(10)	39.9(10)
Stotals	10	80.6				687.7(10)	42.2(10)	382.6(10)	42.8(10)				
Means			8.5(10)	0.56(10)	1.16(10)					24.8(10)	48.9(10)	22.8(10)	39.9(10)
Survey Reach:2 Survey Reach Lower Boundary: COALPIT GULCH TRIBUTARY													
Reach Type: A Survey Reach Upper Boundary: HOGUM FORK TRIBUTARY													
SLOW	5	76.4	6.6(5)	0.56(5)	1.16(5)	506.0(5)	100.0	285.1(5)	100.0	44.3(5)	39.6(5)	25.8(5)	55.5(5)
Stotals	5	76.4				506.0(5)	31.1(5)	285.1(5)	31.9(5)				
Means			6.6(5)	0.56(5)	1.16(5)					44.3(5)	39.6(5)	25.8(5)	55.5(5)
Survey Reach:3 Survey Reach Lower Boundary: HOGUM FORK TRIBUTARY (6420FT)													
Reach Type: A Survey Reach Upper Boundary: MAYBIRD GULCH (6830FT)													
SLOW	3	24.1	5.4(3)	0.53(3)	1.09(3)	130.5(3)	100.0	69.1(3)	100.0	31.0(3)	40.5(3)	27.6(3)	51.2(3)
Stotals	3	24.1				130.5(3)	8.0(3)	69.1(3)	7.7(3)				
Means			5.4(3)	0.53(3)	1.09(3)					31.0(3)	40.5(3)	27.6(3)	51.2(3)
Survey Reach:4 Survey Reach Lower Boundary: MAYBIRD GULCH TRIBUTARY													
Reach Type: A Survey Reach Upper Boundary: RED PINE FORK TRIBUTARY													
SLOW	3	17.0	6.8(3)	0.57(3)	1.19(3)	116.2(3)	100.0	66.3(3)	100.0	17.4(3)	46.9(3)	33.9(3)	40.0(3)
Stotals	3	17.0				116.2(3)	7.1(3)	66.3(3)	7.4(3)				
Means			6.8(3)	0.57(3)	1.19(3)					17.4(3)	46.9(3)	33.9(3)	40.0(3)
Survey Reach:5 Survey Reach Lower Boundary: RED PINE FORK TRIBUTARY													

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

Habitat Class	No. of Snorkel Sites	Dive Length Total	Dive Width Mean(n)	Dive Depth Mean(n)	Dive Max Depth Mean(n)	Habitat Area Total(n)	Habitat Area Percent	Habitat Volume Total(n)	Habitat Volume Percent	% Underct Bank Mean(n)	% Overhd Cover Mean(n)	% Submrg Cover Mean(n)	% Large Substr Mean(n)
Reach Type: A Survey Reach Upper Boundary: WHITE PINE FORK TRIBUTARY													
SLOW	3	25.6	7.3(3)	0.48(3)	1.15(3)	188.1(3)	100.0	90.6(3)	100.0	20.0(3)	27.8(3)	30.0(3)	42.2(3)
Stotals	3	25.6				188.1(3)	11.6(3)	90.6(3)	10.1(3)				
Means			7.3(3)	0.48(3)	1.15(3)					20.0(3)	27.8(3)	30.0(3)	42.2(3)
Totals	24	223.7				1,628.4(24)	100.00	893.6(24)	100.00				
Means			7.28(24)	0.55(24)	1.15(24)					31.0(24)	42.8(24)	25.7(24)	45.9(24)

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

Habitat Class	No. of Snorkel Sites	Chinook Counts								Steelhead Counts							
		Age 0	#per 100m²	Age 1	#per 100m²	Adult	#per 100m²	Total	#per 100m²	Age 1	#per 100m²	Age 2	#per 100m²	Age 3	#per 100m²	Total	#per 100m²
Survey Reach:1 Reach Type: A		Survey Reach Lower Boundary: MURRAY CITY WATER DIVERSION (WASATCH RESORT) Survey Reach Upper Boundary: COALPIT GULCH TRIB															
SLOW	10	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Subtotals	10	0		0		0		0		0		0		0		0	
Densities			0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Survey Reach:2 Reach Type: A		Survey Reach Lower Boundary: COALPIT GULCH TRIBUTARY Survey Reach Upper Boundary: HOGUM FORK TRIBUTARY															
SLOW	5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Subtotals	5	0		0		0		0		0		0		0		0	
Densities			0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Survey Reach:3 Reach Type: A		Survey Reach Lower Boundary: HOGUM FORK TRIBUTARY (6420FT) Survey Reach Upper Boundary: MAYBIRD GULCH (6830FT)															
SLOW	3	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Subtotals	3	0		0		0		0		0		0		0		0	
Densities			0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Survey Reach:4 Reach Type: A		Survey Reach Lower Boundary: MAYBIRD GULCH TRIBUTARY Survey Reach Upper Boundary: RED PINE FORK TRIBUTARY															
SLOW	3	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Subtotals	3	0		0		0		0		0		0		0		0	
Densities			0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Survey Reach:5 Reach Type: A		Survey Reach Lower Boundary: RED PINE FORK TRIBUTARY Survey Reach Upper Boundary: WHITE PINE FORK TRIBUTARY															

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

		Chinook Counts								Steelhead Counts							
Habitat Class	No. of Snorkel Sites	Age 0	#per 100m²	Age 1	#per 100m²	Adult	#per 100m²	Total	#per 100m²	Age 1	#per 100m²	Age 2	#per 100m²	Age 3	#per 100m²	Total	#per 100m²
SLOW	3	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Subtotals	3	0		0		0		0		0		0		0		0	
Densities			0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Totals	24	0		0		0		0		0		0		0		0	
Densities			0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

Habitat Class	No. of Snorkel Sites	Rainbow Counts Total	Rainbow Counts #per 100m²	Redband Counts <100mm	Redband Counts #per 100m²	Redband Counts 100-200mm	Redband Counts #per 100m²	Redband Counts >200mm	Redband Counts #per 100m²	Redband Counts Total	Redband Counts #per 100m²
Survey Reach:1 Survey Reach Lower Boundary: MURRAY CITY WATER DIVERSION (WASATCH RESORT)											
Reach Type: A Survey Reach Upper Boundary: COALPIT GULCH TRIB											
SLOW	10	2	0.29	0	0.00	0	0.00	0	0.00	0	0.00
Subtotals	10	2		0		0		0		0	
Densities			0.29		0.00		0.00		0.00		0.00
Survey Reach:2 Survey Reach Lower Boundary: COALPIT GULCH TRIBUTARY											
Reach Type: A Survey Reach Upper Boundary: HOGUM FORK TRIBUTARY											
SLOW	5	8	1.58	0	0.00	0	0.00	0	0.00	0	0.00
Subtotals	5	8		0		0		0		0	
Densities			1.58		0.00		0.00		0.00		0.00
Survey Reach:3 Survey Reach Lower Boundary: HOGUM FORK TRIBUTARY (6420FT)											
Reach Type: A Survey Reach Upper Boundary: MAYBIRD GULCH (6830FT)											
SLOW	3	9	6.90	0	0.00	0	0.00	0	0.00	0	0.00
Subtotals	3	9		0		0		0		0	
Densities			6.90		0.00		0.00		0.00		0.00
Survey Reach:4 Survey Reach Lower Boundary: MAYBIRD GULCH TRIBUTARY											
Reach Type: A Survey Reach Upper Boundary: RED PINE FORK TRIBUTARY											
SLOW	3	2	1.72	0	0.00	0	0.00	0	0.00	0	0.00
Subtotals	3	2		0		0		0		0	
Densities			1.72		0.00		0.00		0.00		0.00
Survey Reach:5 Survey Reach Lower Boundary: RED PINE FORK TRIBUTARY											
Reach Type: A Survey Reach Upper Boundary: WHITE PINE FORK TRIBUTARY											

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

Habitat Class	No. of Snorkel Sites	Rainbow Counts		Redband Counts							
		Total	#per 100m²	<100mm	#per 100m²	100-200mm	#per 100m²	>200mm	#per 100m²	Total	#per 100m²
SLOW	3	3	1.59	0	0.00	0	0.00	0	0.00	0	0.00
Subtotals	3	3		0		0		0		0	
Densities			1.59		0.00		0.00		0.00		0.00
Totals	24	24		0		0		0		0	
Densities			1.47		0.00		0.00		0.00		0.00

Bull Trout Counts

Habitat Class	No. of Snorkel Sites	<100mm	#per 100m²	100-200mm	#per 100m²	200-300mm	#per 100m²	300-400mm	#per 100m²	400-500mm	#per 100m²	>500mm	#per 100m²	Total	#per 100m²
Survey Reach:1 Survey Reach Lower Boundary: MURRAY CITY WATER DIVERSION (WASATCH RESORT)															
Reach Type: A Survey Reach Upper Boundary: COALPIT GULCH TRIB															
SLOW	10	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Subtotals	10	0		0		0		0		0		0		0	
Densities			0.00		0.00		0.00		0.00		0.00		0.00		0.00
Survey Reach:2 Survey Reach Lower Boundary: COALPIT GULCH TRIBUTARY															
Reach Type: A Survey Reach Upper Boundary: HOGUM FORK TRIBUTARY															
SLOW	5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Subtotals	5	0		0		0		0		0		0		0	
Densities			0.00		0.00		0.00		0.00		0.00		0.00		0.00
Survey Reach:3 Survey Reach Lower Boundary: HOGUM FORK TRIBUTARY (6420FT)															
Reach Type: A Survey Reach Upper Boundary: MAYBIRD GULCH (6830FT)															
SLOW	3	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Subtotals	3	0		0		0		0		0		0		0	
Densities			0.00		0.00		0.00		0.00		0.00		0.00		0.00
Survey Reach:4 Survey Reach Lower Boundary: MAYBIRD GULCH TRIBUTARY															
Reach Type: A Survey Reach Upper Boundary: RED PINE FORK TRIBUTARY															
SLOW	3	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Subtotals	3	0		0		0		0		0		0		0	
Densities			0.00		0.00		0.00		0.00		0.00		0.00		0.00
Survey Reach:5 Survey Reach Lower Boundary: RED PINE FORK TRIBUTARY															
Reach Type: A Survey Reach Upper Boundary: WHITE PINE FORK TRIBUTARY															

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

Bull Trout Counts

Habitat Class	No. of Snorkel Sites	<100mm	#per 100m²	100-200mm	#per 100m²	200-300mm	#per 100m²	300-400mm	#per 100m²	400-500mm	#per 100m²	>500mm	#per 100m²	Total	#per 100m²
SLOW	3	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Subtotals	3	0		0		0		0		0		0		0	
Densities			0.00		0.00		0.00		0.00		0.00		0.00		0.00
Totals	24	0		0		0		0		0		0		0	
Densities			0.00		0.00		0.00		0.00		0.00		0.00		0.00

Habitat Class	No. of Snorkel Sites	Brook Trout Counts <100mm	100-200mm	200-300mm	>300mm	Total	#per 100m²	Brown Trout Counts <100mm	100-200mm	200-300mm	300-400mm	>400mm	Total	#per 100m²
Survey Reach:1 Survey Reach Lower Boundary: MURRAY CITY WATER DIVERSION (WASATCH RESORT)														
Reach Type: A Survey Reach Upper Boundary: COALPIT GULCH TRIB														
SLOW	10	0	0	0	0	0	0.00	0	0	0	0	0	0	0.00
Subtotals	10	0	0	0	0	0		0	0	0	0	0	0	
Densities							0.00							0.00
Survey Reach:2 Survey Reach Lower Boundary: COALPIT GULCH TRIBUTARY														
Reach Type: A Survey Reach Upper Boundary: HOGUM FORK TRIBUTARY														
SLOW	5	0	1	0	0	1	0.20	0	0	0	0	0	0	0.00
Subtotals	5	0	1	0	0	1		0	0	0	0	0	0	
Densities							0.20							0.00
Survey Reach:3 Survey Reach Lower Boundary: HOGUM FORK TRIBUTARY (6420FT)														
Reach Type: A Survey Reach Upper Boundary: MAYBIRD GULCH (6830FT)														
SLOW	3	0	2	1	0	3	2.30	0	0	0	0	0	0	0.00
Subtotals	3	0	2	1	0	3		0	0	0	0	0	0	
Densities							2.30							0.00
Survey Reach:4 Survey Reach Lower Boundary: MAYBIRD GULCH TRIBUTARY														
Reach Type: A Survey Reach Upper Boundary: RED PINE FORK TRIBUTARY														
SLOW	3	0	2	0	0	2	1.72	0	0	0	0	0	0	0.00
Subtotals	3	0	2	0	0	2		0	0	0	0	0	0	
Densities							1.72							0.00
Survey Reach:5 Survey Reach Lower Boundary: RED PINE FORK TRIBUTARY														
Reach Type: A Survey Reach Upper Boundary: WHITE PINE FORK TRIBUTARY														

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

Habitat Class	No. of Snorkel Sites	Brook Trout Counts						Brown Trout Counts						
		<100mm	100-200mm	200-300mm	>300mm	Total	#per 100m²	<100mm	100-200mm	200-300mm	300-400mm	>400mm	Total	#per 100m²
SLOW	3	0	0	0	0	0	0.00	0	0	0	0	0	0	0.00
Subtotals	3	0	0	0	0	0		0	0	0	0	0	0	
Densities							0.00							0.00
Totals	24	0	5	1	0	6		0	0	0	0	0	0	
Densities							0.37							0.00

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

Cutthroat Counts

Habitat Class	No. of Snorkel Sites	<100mm	#per 100m²	100-200mm	#per 100m²	200-300mm	#per 100m²	>300mm	#per 100m²	Total	#per 100m²
Survey Reach:1 Survey Reach Lower Boundary: MURRAY CITY WATER DIVERSION (WASATCH RESORT)											
Reach Type: A Survey Reach Upper Boundary: COALPIT GULCH TRIB											
SLOW	10	2	0.29	21	3.05	12	1.75	1	0.15	36	5.24
Subtotals	10	2		21		12		1		36	
Densities			0.29		3.05		1.75		0.15		5.24
Survey Reach:2 Survey Reach Lower Boundary: COALPIT GULCH TRIBUTARY											
Reach Type: A Survey Reach Upper Boundary: HOGUM FORK TRIBUTARY											
SLOW	5	0	0.00	5	0.99	6	1.19	1	0.20	12	2.37
Subtotals	5	0		5		6		1		12	
Densities			0.00		0.99		1.19		0.20		2.37
Survey Reach:3 Survey Reach Lower Boundary: HOGUM FORK TRIBUTARY (6420FT)											
Reach Type: A Survey Reach Upper Boundary: MAYBIRD GULCH (6830FT)											
SLOW	3	0	0.00	0	0.00	1	0.77	0	0.00	1	0.77
Subtotals	3	0		0		1		0		1	
Densities			0.00		0.00		0.77		0.00		0.77
Survey Reach:4 Survey Reach Lower Boundary: MAYBIRD GULCH TRIBUTARY											
Reach Type: A Survey Reach Upper Boundary: RED PINE FORK TRIBUTARY											
SLOW	3	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Subtotals	3	0		0		0		0		0	
Densities			0.00		0.00		0.00		0.00		0.00
Survey Reach:5 Survey Reach Lower Boundary: RED PINE FORK TRIBUTARY											
Reach Type: A Survey Reach Upper Boundary: WHITE PINE FORK TRIBUTARY											

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

Cutthroat Counts

Habitat Class	No. of Snorkel Sites	<100mm	#per 100m²	100-200mm	#per 100m²	200-300mm	#per 100m²	>300mm	#per 100m²	Total	#per 100m²
SLOW	3	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Subtotals	3	0		0		0		0		0	
Densities			0.00		0.00		0.00		0.00		0.00
Totals	24	2		26		19		2		49	
Densities			0.12		1.60		1.17		0.12		3.01

FB_PO7R1 v98.03b — R1/R4 FISH HABITAT INVENTORY SYSTEM — Run date: 11/24/2000

Summary of Main Channel Fish Counts and Densities — Page 1

Listing by Habitat Class and by Habitat Group

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK — Forest: WASATCH-CACHE NF — District: SALT LAKE RD — Study: I99

Habitat Group	Number of Snorkel Sites	Habitat Area (m²)	Habitat Vol (m«)	Chinook Total	Chinook per 100m²	Steelhead Total	Steelhead per 100m²	Rainbow Total	Rainbow per 100m²	Cutthroat Trout Total	Cutthroat Trout 100m²	Bull Trout Total	Bull Trout per 100m²	Brook Trout Total	Brook Trout per 100m²
Habitat Class: SLOW															
SLA	4	274.9	132.0	0	0.00	0	0.00	2	0.73	10	3.64	0	0.00	0	0.00
SMD	17	1,106.7	579.9	0	0.00	0	0.00	17	1.54	31	2.80	0	0.00	3	0.27
SPL	3	246.8	181.8	0	0.00	0	0.00	5	2.03	8	3.24	0	0.00	3	1.22
Subtotals	24	1,628.4	893.6	0		0		24		49		0		6	
Densities					0.00		0.00		1.47		3.01		0.00		0.37
Totals	24	1,628.4	893.6	0		0		24		49		0		6	
Densities					0.00		0.00		1.47		3.01		0.00		0.37

FB_PO7A v98.03b — R1/R4 FISH HABITAT INVENTORY SYSTEM — Run date: 11/24/2000

Summary of Main Channel Snorkeled Habitat Dimensions and Cover — Page 1

Listing by Habitat Class and by Habitat Group

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK — Forest: WASATCH-CACHE NF — District: SALT LAKE RD — Study: I99

Habitat Group	No. of Snorkel Sites	Dive Length Total	Dive Width Mean(n)	Dive Depth Mean(n)	Dive Max Depth Mean(n)	Habitat Area Total(n)	Habitat Area Percent	Habitat Volume Total(n)	Habitat Volume Percent	% Underct Bank Mean(n)	% Overhd Cover Mean(n)	% Submrg Cover Mean(n)	% Large Substr Mean(n)
Habitat Class: SLOW													
SLA	4	38.2	7.2(4)	0.48(4)	1.10(4)	274.9(4)	16.9	132.0(4)	14.8	24.9(4)	43.6(4)	23.2(4)	48.1(4)
SMD	17	165.5	6.7(17)	0.52(17)	1.08(17)	1,106.7(17)	68.0	579.9(17)	64.9	30.1(17)	42.8(17)	25.0(17)	45.8(17)
SPL	3	20.0	12.3(3)	0.74(3)	1.61(3)	246.8(3)	15.2	181.8(3)	20.3	49.8(3)	41.9(3)	32.0(3)	44.0(3)
Stotals	24	223.7				1,628.4(24)	100.0(24)	893.6(24)	100.0(24)				
Means			7.3(24)	0.55(24)	1.15(24)					31.0(24)	42.8(24)	25.7(24)	45.9(24)
Totals	24	223.7				1,628.4(24)	100.00	893.6(24)	100.00				
Means			7.28(24)	0.55(24)	1.15(24)					31.0(24)	42.8(24)	25.7(24)	45.9(24)

FB_PO7C v98.03b

R1/R4 FISH HABITAT INVENTORY SYSTEM
Summary of Main Channel Fish Counts and Densities-Rainbow & Redband
Listing by Habitat Class and by Habitat Group

Run date: 11/24/2000

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK
Forest: WASATCH-CACHE NF
District: SALT LAKE RD
Study: I99

Habitat Group	No. of Snorkel Sites	Rainbow Counts Total	Rainbow Counts #per 100m²	Redband Counts <100mm	Redband Counts #per 100m²	Redband Counts 100-200mm	Redband Counts #per 100m²	Redband Counts >200mm	Redband Counts #per 100m²	Redband Counts Total	Redband Counts #per 100m²
Habitat Class: SLOW											
SLA	4	2	0.73	0	0.00	0	0.00	0	0.00	0	0.00
SMD	17	17	1.54	0	0.00	0	0.00	0	0.00	0	0.00
SPL	3	5	2.03	0	0.00	0	0.00	0	0.00	0	0.00
Subtotals	24	24		0		0		0		0	
Densities			1.47		0.00		0.00		0.00		0.00
Totals	24	24		0		0		0		0	
Densities			1.47		0.00		0.00		0.00		0.00

FB_PO7E v98.03b

R1/R4 FISH HABITAT INVENTORY SYSTEM
Summary of Main Channel Fish Counts and Densities-Brook & Brown Trout
Listing by Habitat Class and by Habitat Group

Run date: 11/24/2000

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK
Forest: WASATCH-CACHE NF
District: SALT LAKE RD
Study: I99

Habitat Group	No. of Snorkel Sites	Brook Trout Counts <100mm	Brook Trout Counts 100-200mm	Brook Trout Counts 200-300mm	Brook Trout Counts >300mm	Brook Trout Counts Total	Brook Trout Counts #per 100m²	Brown Trout Counts <100mm	Brown Trout Counts 100-200mm	Brown Trout Counts 200-300mm	Brown Trout Counts 300-400mm	Brown Trout Counts >400mm	Brown Trout Counts Total	Brown Trout Counts #per 100m²
Habitat Class: SLOW														
SLA	4	0	0	0	0	0	0.00	0	0	0	0	0	0	0.00
SMD	17	0	3	0	0	3	0.27	0	0	0	0	0	0	0.00
SPL	3	0	2	1	0	3	1.22	0	0	0	0	0	0	0.00
Subtotals	24	0	5	1	0	6		0	0	0	0	0	0	
Densities							0.37							0.00
Totals	24	0	5	1	0	6		0	0	0	0	0	0	
Densities							0.37							0.00

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

Cutthroat Counts

Habitat Group	No. of Snorkel Sites	<100mm	#per 100m²	100-200mm	#per 100m²	200-300mm	#per 100m²	>300mm	#per 100m²	Total	#per 100m²
Habitat Class: SLOW											
SLA	4	0	0.00	3	1.09	6	2.18	1	0.36	10	3.64
SMD	17	2	0.18	17	1.54	11	0.99	1	0.09	31	2.80
SPL	3	0	0.00	6	2.43	2	0.81	0	0.00	8	3.24
Subtotals	24	2		26		19		2		49	
Densities			0.12		1.60		1.17		0.12		3.01
Totals	24	2		26		19		2		49	
Densities			0.12		1.60		1.17		0.12		3.01

FB_PO7R1 v98.03b — R1/R4 FISH HABITAT INVENTORY SYSTEM — Run date: 11/24/2000

Summary of Side Channel Fish Counts and Densities — Page 1

Listing by Habitat Class and by Habitat Group

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK — Forest: WASATCH-CACHE NF — District: SALT LAKE RD — Study: I99

Habitat Group	Number of Snorkel Sites	Habitat Area (m²)	Habitat Vol (m«)	Chinook Total	Chinook per 100m²	Steelhead Total	Steelhead per 100m²	Rainbow Total	Rainbow per 100m²	Cutthroat Trout Total	Cutthroat Trout 100m²	Bull Trout Total	Bull Trout per 100m²	Brook Trout Total	Brook Trout per 100m²
Habitat Class: SLOW															
SMD	1	53.2	13.8	0	0.00	0	0.00	1	1.88	0	0.00	0	0.00	0	0.00
Subtotals	1	53.2	13.8	0		0		1		0		0		0	
Densities					0.00		0.00		1.88		0.00		0.00		0.00
Totals	1	53.2	13.8	0		0		1		0		0		0	
Densities					0.00		0.00		1.88		0.00		0.00		0.00

FB_PO7A v98.03b — R1/R4 FISH HABITAT INVENTORY SYSTEM — Run date: 11/24/2000

Summary of Side Channel Snorkeled Habitat Dimensions and Cover — Page 1

Listing by Habitat Class and by Habitat Group

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK — Forest: WASATCH-CACHE NF — District: SALT LAKE RD — Study: I99

Habitat Group	No. of Snorkel Sites	Dive Length Total	Dive Width Mean(n)	Dive Depth Mean(n)	Dive Max Depth Mean(n)	Habitat Area Total(n)	Habitat Area Percent	Habitat Volume Total(n)	Habitat Volume Percent	% Underct Bank Mean(n)	% Overhd Cover Mean(n)	% Submrg Cover Mean(n)	% Large Substr Mean(n)
Habitat Class: SLOW													
SMD	1	12.1	4.4(1)	0.26(1)	0.59(1)	53.2(1)	100.0	13.8(1)	100.0	10.0(1)	10.0(1)	30.0(1)	20.0(1)
Stotals	1	12.1				53.2(1)	100.0(1)	13.8(1)	100.0(1)				
Means			4.4(1)	0.26(1)	0.59(1)					10.0(1)	10.0(1)	30.0(1)	20.0(1)
Totals	1	12.1				53.2(1)	100.00	13.8(1)	100.00				
Means			4.40(1)	0.26(1)	0.59(1)					10.0(1)	10.0(1)	30.0(1)	20.0(1)

FB_PO7C v98.03b — R1/R4 FISH HABITAT INVENTORY SYSTEM — Run date: 11/24/2000

Summary of Side Channel Fish Counts and Densities-Rainbow & Redband — Page 1

Listing by Habitat Class and by Habitat Group

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK — Forest: WASATCH-CACHE NF — District: SALT LAKE RD — Study: I99

Habitat Group	No. of Snorkel Sites	Rainbow Counts Total	Rainbow Counts #per 100m²	Redband Counts <100mm	Redband Counts #per 100m²	Redband Counts 100-200mm	Redband Counts #per 100m²	Redband Counts >200mm	Redband Counts #per 100m²	Redband Counts Total	Redband Counts #per 100m²
Habitat Class: SLOW											
SMD	1	1	1.88	0	0.00	0	0.00	0	0.00	0	0.00
Subtotals	1	1		0		0		0		0	
Densities			1.88		0.00		0.00		0.00		0.00
Totals	1	1		0		0		0		0	
Densities			1.88		0.00		0.00		0.00		0.00

FB_PO7E v98.03b — R1/R4 FISH HABITAT INVENTORY SYSTEM — Run date: 11/24/2000

Summary of Side Channel Fish Counts and Densities-Brook & Brown Trout — Page 1

Listing by Habitat Class and by Habitat Group

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK — Forest: WASATCH-CACHE NF — District: SALT LAKE RD — Study: I99

Habitat Group	No. of Snorkel Sites	Brook Trout Counts <100mm	Brook Trout Counts 100-200mm	Brook Trout Counts 200-300mm	Brook Trout Counts >300mm	Brook Trout Counts Total	Brook Trout Counts #per 100m²	Brown Trout Counts <100mm	Brown Trout Counts 100-200mm	Brown Trout Counts 200-300mm	Brown Trout Counts 300-400mm	Brown Trout Counts >400mm	Brown Trout Counts Total	Brown Trout Counts #per 100m²
Habitat Class: SLOW														
SMD	1	0	0	0	0	0	0.00	0	0	0	0	0	0	0.00
Subtotals	1	0	0	0	0	0		0	0	0	0	0	0	
Densities							0.00							0.00
Totals	1	0	0	0	0	0		0	0	0	0	0	0	
Densities							0.00							0.00

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

Habitat Group	No. of Snorkel Sites	Cutthroat Counts									
		<100mm	#per 100m²	100-200mm	#per 100m²	200-300mm	#per 100m²	>300mm	#per 100m²	Total	#per 100m²
Habitat Class: SLOW											
SMD	1	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Subtotals	1	0		0		0		0		0	
Densities			0.00		0.00		0.00		0.00		0.00
Totals	1	0		0		0		0		0	
Densities			0.00		0.00		0.00		0.00		0.00

Habitat Class	Total Number of Units	Single Pieces Tot#	Single Pieces Mean#	Single Pieces #/100m	Single Pieces Mean Diam.	Single Pieces Mean Length	Single Pieces Vol (m«)	Single Pieces %Sub.Vol	Aggregates Tot#	Aggregates Mean#	Aggregates #/100m	Aggregates # Pieces	Root Wads Tot#	Root Wads Mean#	Root Wads #/100m
Survey Reach:1 Survey Reach Lower Boundary: MURRAY CITY WATER DIVERSION (WASATCH RESORT)															
Reach Type: A Survey Reach Upper Boundary: COALPIT GULCH TRIB															
FAST	68	117	1.7	12.0	-	-	-	0.00	23	0.3	2.4	-	10	0.1	1.0
SLOW	100	113	1.1	12.9	-	-	-	0.00	27	0.3	3.1	-	4	0.0	0.5
Subtotals	168	230					-	0.00	50			-	14		
Means			1.4	12.4	-	-				0.3	2.7			0.1	0.8
Survey Reach:2 Survey Reach Lower Boundary: COALPIT GULCH TRIBUTARY															
Reach Type: A Survey Reach Upper Boundary: HOGUM FORK TRIBUTARY															
FAST	51	143	2.8	11.4	-	-	-	0.00	47	0.9	3.7	-	12	0.2	1.0
SLOW	48	56	1.2	10.4	-	-	-	0.00	32	0.7	5.9	-	9	0.2	1.7
Subtotals	99	199					-	0.00	79			-	21		
Means			2.0	11.1	-	-				0.8	4.4			0.2	1.2
Survey Reach:3 Survey Reach Lower Boundary: HOGUM FORK TRIBUTARY (6420FT)															
Reach Type: A Survey Reach Upper Boundary: MAYBIRD GULCH (6830FT)															
FAST	38	67	1.8	8.8	-	-	-	0.00	23	0.6	3.0	-	26	0.7	3.4
SLOW	35	37	1.1	6.3	-	-	-	0.00	15	0.5	2.6	-	11	0.3	1.9
Subtotals	73	104					-	0.00	38			-	37		
Means			1.5	7.7	-	-				0.5	2.8			0.5	2.7
Survey Reach:4 Survey Reach Lower Boundary: MAYBIRD GULCH TRIBUTARY															
Reach Type: A Survey Reach Upper Boundary: RED PINE FORK TRIBUTARY															
FAST	38	44	1.2	7.2	-	-	-	0.00	25	0.7	4.1	-	5	0.1	0.8
SLOW	31	10	0.3	3.3	-	-	-	0.00	13	0.4	4.2	-	3	0.1	1.0

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

Habitat Class	Total Number of Units	Single Pieces Tot#	Mean#	#/100m	Mean Diam.	Mean Length	Vol (m³)	%Sub.Vol	Aggregates Tot#	Mean#	#/100m	# Pieces	Root Wads Tot#	Mean#	#/100m
Subtotals	69	54					-	0.00	38			-	8		
Means			0.8	5.9	-	-				0.6	4.1			0.1	0.9
Survey Reach:5		Survey Reach Lower Boundary: RED PINE FORK TRIBUTARY													
Reach Type: A		Survey Reach Upper Boundary: WHITE PINE FORK TRIBUTARY													
FAST	32	35	1.1	5.9	-	-	-	0.00	12	0.4	2.0	-	3	0.1	0.5
SLOW	30	24	0.8	5.0	-	-	-	0.00	14	0.5	2.9	-	2	0.1	0.4
Subtotals	62	59					-	0.00	26			-	5		
Means			1.0	5.5	-	-				0.4	2.4			0.1	0.5
Totals	471	646					-	0.00	231			-	85		
Means			1.4	9.3	-	-				0.5	3.3			0.2	1.2

Habitat Class	Total Number of Units	Single Pieces Tot#	Mean#	#/100m	Mean Diam.	Mean Length	Vol (m«)	%Sub.Vol	Aggregates Tot#	Mean#	#/100m	# Pieces	Root Wads Tot#	Mean#	#/100m
Survey Reach:1		Survey Reach Lower Boundary: MURRAY CITY WATER DIVERSION (WASATCH RESORT)													
Reach Type: A		Survey Reach Upper Boundary: COALPIT GULCH TRIB													
FAST	1	1	1.0	33.3	-	-	-	0.00	0	0.0	0.0	-	0	0.0	0.0
SLOW	3	3	1.0	10.8	-	-	-	0.00	1	0.3	3.6	-	0	0.0	0.0
Subtotals	4	4					-	0.00	1			-	0		
Means			1.0	13.0	-	-				0.3	3.2			0.0	0.0
Survey Reach:2		Survey Reach Lower Boundary: COALPIT GULCH TRIBUTARY													
Reach Type: A		Survey Reach Upper Boundary: HOGUM FORK TRIBUTARY													
FAST	17	30	2.0	11.5	-	-	-	0.00	29	1.9	11.1	-	0	0.0	0.0
SLOW	14	19	1.6	14.8	-	-	-	0.00	9	0.8	7.0	-	2	0.2	1.6
Subtotals	31	49					-	0.00	38			-	2		
Means			1.8	12.6	-	-				1.4	9.7			0.1	0.5
Survey Reach:3		Survey Reach Lower Boundary: HOGUM FORK TRIBUTARY (6420FT)													
Reach Type: A		Survey Reach Upper Boundary: MAYBIRD GULCH (6830FT)													
FAST	2	1	0.5	4.7	-	-	-	0.00	1	0.5	4.7	-	0	0.0	0.0
SLOW	4	7	2.3	12.2	-	-	-	0.00	4	1.3	7.0	-	2	0.7	3.5
Subtotals	6	8					-	0.00	5			-	2		
Means			1.6	10.1	-	-				1.0	6.3			0.5	3.0
Survey Reach:4		Survey Reach Lower Boundary: MAYBIRD GULCH TRIBUTARY													
Reach Type: A		Survey Reach Upper Boundary: RED PINE FORK TRIBUTARY													
FAST	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SLOW	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

Habitat Class	Total Number of Units	Single Pieces							Aggregates				Root Wads		
		Tot#	Mean#	#/100m	Mean Diam.	Mean Length	Vol (m«)	%Sub.Vol	Tot#	Mean#	#/100m	# Pieces	Tot#	Mean#	#/100m
Subtotals	3	-					-	-	-			-	-		
Means			-	-	-	-				-	-			-	-
Totals	44	61					-	0.00	44			-	4		
Means			1.7	12.2	-	-				1.2	8.8			0.1	0.9

Habitat Class	Total Number of Units	Habitat Length (m) Total(n)	Mean(n)	Percent(n)	Mean Width (m)(n)	Habitat Depth (m) Mean(n)	Mean-Max(n)	Mean Width/ Depth(n)	Habitat Area (m²) Total(n)	Mean(n)	Percent(n)	Habitat Volume (m«) Total(n)	Mean(n)	Percent(n)
Survey Reach: 1		Survey Reach Lower Boundary: MURRAY CITY WATER DIVERSION (WASATCH RESORT)												
Reach Type: A		Survey Reach Upper Boundary: COALPIT GULCH TRIB												
FAST	68	973.4(68)	14.3(68)	52.4(68)	8.8(68)	0.35(68)	-	26.60(68)	8,544.2(68)	125.7(68)	54.3(68)	2,950.3(68)	43.4(68)	43.0(68)
SLOW	100	883.6(100)	8.8(100)	47.6(100)	8.1(100)	0.54(100)	1.07(95)	15.86(100)	7,193.5(100)	71.9(100)	45.7(100)	3,918.0(100)	39.2(100)	57.0(100)
Subtotals	168	1,857.0(168)		26.5(168)					15,737.8(168)		29.4(168)	6,868.3(168)		33.2(168)
Means			11.1(168)		8.5(168)	0.44(168)	1.07(95)	21.49(168)		93.7(168)			40.9(168)	
Survey Reach: 2		Survey Reach Lower Boundary: COALPIT GULCH TRIBUTARY												
Reach Type: A		Survey Reach Upper Boundary: HOGUM FORK TRIBUTARY												
FAST	51	1,256.5(51)	24.6(51)	70.0(51)	7.7(51)	0.31(51)	-	25.59(51)	9,686.6(51)	189.9(51)	71.6(51)	2,958.0(51)	58.0(51)	61.5(51)
SLOW	48	538.1(48)	11.2(48)	30.0(48)	7.1(48)	0.48(48)	0.99(48)	15.14(48)	3,844.1(48)	80.1(48)	28.4(48)	1,853.3(48)	38.6(48)	38.5(48)
Subtotals	99	1,794.6(99)		25.6(99)					13,530.8(99)		25.3(99)	4,811.3(99)		23.2(99)
Means			18.1(99)		7.5(99)	0.36(99)	0.99(48)	22.45(99)		136.7(99)			48.6(99)	
Survey Reach: 3		Survey Reach Lower Boundary: HOGUM FORK TRIBUTARY (6420FT)												
Reach Type: A		Survey Reach Upper Boundary: MAYBIRD GULCH (6830FT)												
FAST	38	762.8(38)	20.1(38)	56.1(38)	7.9(38)	0.31(38)	-	25.33(38)	6,026.4(38)	158.6(38)	59.3(38)	1,895.2(38)	49.9(38)	48.0(38)
SLOW	35	597.2(35)	17.1(35)	43.9(35)	6.9(35)	0.50(35)	1.06(35)	14.31(35)	4,132.3(35)	118.1(35)	40.7(35)	2,051.4(35)	58.6(35)	52.0(35)
Subtotals	73	1,360.0(73)		19.4(73)					10,158.8(73)		19.0(73)	3,946.7(73)		19.1(73)
Means			18.6(73)		7.5(73)	0.39(73)	1.06(35)	20.49(73)		139.2(73)			54.1(73)	
Survey Reach: 4		Survey Reach Lower Boundary: MAYBIRD GULCH TRIBUTARY												
Reach Type: A		Survey Reach Upper Boundary: RED PINE FORK TRIBUTARY												
FAST	38	613.6(38)	16.1(38)	66.7(38)	7.0(38)	0.32(38)	-	22.43(38)	4,306.0(38)	113.3(38)	68.0(38)	1,356.4(38)	35.7(38)	58.0(38)
SLOW	31	306.9(31)	9.9(31)	33.3(31)	6.6(31)	0.48(31)	1.09(31)	13.87(31)	2,024.4(31)	65.3(31)	32.0(31)	981.8(31)	31.7(31)	42.0(31)

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

Habitat Class	Total Number of Units	Habitat Length (m) Total(n)	Mean(n)	Percent(n)	Mean Width (m)(n)	Habitat Depth (m) Mean(n)	Mean-Max(n)	Mean Width/ Depth(n)	Habitat Area (m²) Total(n)	Mean(n)	Percent(n)	Habitat Volume (m«) Total(n)	Mean(n)	Percent(n)
Subtotals	69	920.5(69)		13.2(69)					6,330.4(69)		11.8(69)	2,338.2(69)		11.3(69)
Means			13.3(69)		6.9(69)	0.37(69)	1.09(31)	19.58(69)		91.7(69)			33.9(69)	
Survey Reach: 5		Survey Reach Lower Boundary: RED PINE FORK TRIBUTARY												
Reach Type: A		Survey Reach Upper Boundary: WHITE PINE FORK TRIBUTARY												
FAST	32	589.8(32)	18.4(32)	55.3(32)	7.5(32)	0.28(32)	-	27.37(32)	4,415.9(32)					
										138.0(32)	56.8(32)	1,224.4(32)		
													38.3(32)	44.6(32)
SLOW	30	475.8(30)	15.9(30)	44.7(30)	7.1(30)	0.45(30)	1.04(30)	16.04(30)	3,364.3(30)					
										112.1(30)	43.2(30)	1,523.2(30)		
													50.8(30)	55.4(30)
Subtotals	62	1,065.6(62)		15.2(62)					7,780.2(62)		14.5(62)	2,747.5(62)		13.3(62)
Means			17.2(62)		7.3(62)	0.35(62)	1.04(30)	22.31(62)		125.5(62)			44.3(62)	
Totals	471	6,997.7(471)		99.9(471)					53,537.8(471)		100.0(471)	20,712.0(471)		100.1(471)
Means			14.9(471)		7.7(471)	0.39(471)	1.05(239)	21.42(471)		113.7(471)			44.0(471)	

Habitat Class	Total Number of Units	Number of Pocket Pools: Total(n)	Mean(n)	per 100 m(n)	Pkt Pool Mean Depth (m)(n)	Total Pools in STPs(n)	Average Max Depth STP Cmplx(n)	Mean Crest Depth (m)(n)	Mean Resid. Max Depth (m)(n)	Residual Volume (m«): Total(n)	Mean(n)	LWD: Total(n)	n/100m(n)
Survey Reach: 1	Survey Reach Lower Boundary: MURRAY CITY WATER DIVERSION (WASATCH RESORT)												
Reach Type: A	Survey Reach Upper Boundary: COALPIT GULCH TRIB												
FAST	68	606(68)	8.9(68)	62.3(68)	0.56(67)	-	-	-	-	-	-	150(68)	15.4(68)
SLOW	100	-	-	-	-	26(5)	0.98(5)	0.45(95)	0.61(95)	4,207.5(95)	44.3(95)	144(99)	16.5(99)
Subtotals	168	606(68)				26(5)				4,207.5(95)		294(167)	
Means			8.9(68)	62.3(68)	0.56(67)		0.98(5)	0.45(95)	0.61(95)		44.3(95)		15.9(167)
Survey Reach: 2	Survey Reach Lower Boundary: COALPIT GULCH TRIBUTARY												
Reach Type: A	Survey Reach Upper Boundary: HOGUM FORK TRIBUTARY												
FAST	51	1,188(51)	23.3(51)	94.5(51)	0.50(51)	-	-	-	-	-	-	202(51)	16.1(51)
SLOW	48	-	-	-	-	43(12)	0.92(12)	0.46(36)	0.49(36)	983.4(36)	27.3(36)	97(48)	18.0(48)
Subtotals	99	1,188(51)				43(12)				983.4(36)		299(99)	
Means			23.3(51)	94.5(51)	0.50(51)		0.92(12)	0.46(36)	0.49(36)		27.3(36)		16.7(99)
Survey Reach: 3	Survey Reach Lower Boundary: HOGUM FORK TRIBUTARY (6420FT)												
Reach Type: A	Survey Reach Upper Boundary: MAYBIRD GULCH (6830FT)												
FAST	38	711(38)	18.7(38)	93.2(38)	0.49(38)	-	-	-	-	-	-	116(38)	15.2(38)
SLOW	35	-	-	-	-	80(16)	0.89(16)	0.43(18)	0.59(18)	518.3(18)	28.8(18)	63(33)	10.8(33)
Subtotals	73	711(38)				80(16)				518.3(18)		179(71)	
Means			18.7(38)	93.2(38)	0.49(38)		0.89(16)	0.43(18)	0.59(18)		28.8(18)		13.3(71)
Survey Reach: 4	Survey Reach Lower Boundary: MAYBIRD GULCH TRIBUTARY												
Reach Type: A	Survey Reach Upper Boundary: RED PINE FORK TRIBUTARY												
FAST	38	556(38)	14.6(38)	90.6(38)	0.51(38)	-	-	-	-	-	-	74(38)	12.1(38)
SLOW	31	-	-	-	-	28(8)	0.94(8)	0.41(23)	0.64(23)	590.1(23)	25.7(23)	26(31)	8.5(31)

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

Habitat Class	Total Number of Units	Number of Pocket Pools: Total(n)	Mean(n)	per 100 m(n)	Pkt Pool Mean Depth (m)(n)	Total Pools in STPs(n)	Average Max Depth STP Cmplx(n)	Mean Crest Depth (m)(n)	Mean Resid. Max Depth (m)(n)	Residual Volume (m«): Total(n)	Mean(n)	LWD: Total(n)	n/100m(n)
Subtotals	69	556(38)				28(8)				590.1(23)		100(69)	
Means			14.6(38)	90.6(38)	0.51(38)		0.94(8)	0.41(23)	0.64(23)		25.7(23)		10.9(69)
Survey Reach: 5		Survey Reach Lower Boundary: RED PINE FORK TRIBUTARY											
Reach Type: A		Survey Reach Upper Boundary: WHITE PINE FORK TRIBUTARY											
FAST	32	590(32)	18.4(32)	100.0(32)	0.48(32)	-	-	-	-	-	-	50(32)	8.5(32)
SLOW	30	-	-	-	-	55(13)	0.83(13)	0.37(17)	0.68(17)	669.9(17)	39.4(17)	40(30)	8.4(30)
Subtotals	62	590(32)				55(13)				669.9(17)		90(62)	
Means			18.4(32)	100.0(32)	0.48(32)		0.83(13)	0.37(17)	0.68(17)		39.4(17)		8.4(62)
Totals	471	3,651(227)				232(54)				6,969.1(189)		962(468)	
Means			16.1(227)	87.0(227)	0.50(226)		0.90(54)	0.44(189)	0.60(189)		36.9(189)		13.8(468)

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

Habitat Class	Total Number of Units	Bank Length (m) Left(n)	Bank Length (m) Right(n)	% Stable Bank Left(n)	% Stable Bank Right(n)	% Stable Bank Mean(n)	% Unstable Bank Left(n)	% Unstable Bank Right(n)	% Unstable Bank Mean(n)	% Undercut Bank Left(n)	% Undercut Bank Right(n)	% Undercut Bank Mean(n)
Survey Reach: 1 Survey Reach Lower Boundary: MURRAY CITY WATER DIVERSION (WASATCH RESORT)												
Reach Type: A Survey Reach Upper Boundary: COALPIT GULCH TRIB												
FAST	68	1,118.7(68)	1,117.9(68)	96.66(68)	96.70(68)	96.68(68)	3.34(68)	3.30(68)	3.32(68)	5.37(68)	3.96(67)	4.67(67)
SLOW	100	1,017.7(98)	1,013.9(98)	97.95(98)	96.70(98)	97.32(98)	2.05(98)	3.30(98)	2.68(98)	13.75(98)	8.79(97)	11.35(97)
Subtotals	168	2,136.4(166)	2,131.8(166)									
Means				97.27(166)	96.70(166)	96.99(166)	2.73(166)	3.30(166)	3.01(166)	9.36(166)	6.26(164)	7.86(164)
Survey Reach: 2 Survey Reach Lower Boundary: COALPIT GULCH TRIBUTARY												
Reach Type: A Survey Reach Upper Boundary: HOGUM FORK TRIBUTARY												
FAST	51	1,391.1(51)	1,391.0(51)	83.43(51)	85.77(51)	84.60(51)	16.57(51)	14.23(51)	15.40(51)	5.05(51)	7.16(51)	6.10(51)
SLOW	48	557.3(48)	584.2(48)	84.83(48)	84.52(48)	84.67(48)	15.17(48)	15.48(48)	15.33(48)	11.41(48)	9.76(48)	10.57(48)
Subtotals	99	1,948.4(99)	1,975.2(99)									
Means				83.83(99)	85.40(99)	84.62(99)	16.17(99)	14.60(99)	15.38(99)	6.87(99)	7.93(99)	7.40(99)
Survey Reach: 3 Survey Reach Lower Boundary: HOGUM FORK TRIBUTARY (6420FT)												
Reach Type: A Survey Reach Upper Boundary: MAYBIRD GULCH (6830FT)												
FAST	38	842.5(38)	870.8(38)	83.87(38)	86.10(38)	85.00(38)	16.13(38)	13.90(38)	15.00(38)	5.60(37)	7.15(37)	6.39(37)
SLOW	35	698.9(34)	699.6(34)	84.92(34)	84.91(34)	84.92(34)	15.08(34)	15.09(34)	15.08(34)	8.28(34)	8.14(34)	8.21(34)
Subtotals	73	1,541.4(72)	1,570.4(72)									
Means				84.35(72)	85.57(72)	84.96(72)	15.65(72)	14.43(72)	15.04(72)	6.82(71)	7.59(71)	7.21(71)
Survey Reach: 4 Survey Reach Lower Boundary: MAYBIRD GULCH TRIBUTARY												
Reach Type: A Survey Reach Upper Boundary: RED PINE FORK TRIBUTARY												
FAST	38	701.1(38)	711.6(38)	85.87(38)	84.33(38)	85.09(38)	14.13(38)	15.67(38)	14.91(38)	6.09(38)	5.66(38)	5.87(38)
SLOW	31	353.7(31)	347.0(31)	85.73(31)	79.82(31)	82.81(31)	14.27(31)	20.18(31)	17.19(31)	10.20(31)	7.55(31)	8.89(31)

Stream ID: IV080
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Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

Habitat Class	Total Number of Units	Bank Length (m) Left(n)	Bank Length (m) Right(n)	% Stable Bank Left(n)	% Stable Bank Right(n)	% Stable Bank Mean(n)	% Unstable Bank Left(n)	% Unstable Bank Right(n)	% Unstable Bank Mean(n)	% Undercut Bank Left(n)	% Undercut Bank Right(n)	% Undercut Bank Mean(n)
Subtotals	69	1,054.8(69)	1,058.6(69)									
Means				85.82(69)	82.85(69)	84.33(69)	14.18(69)	17.15(69)	15.67(69)	7.47(69)	6.28(69)	6.87(69)
Survey Reach: 5 Survey Reach Lower Boundary: RED PINE FORK TRIBUTARY												
Reach Type: A Survey Reach Upper Boundary: WHITE PINE FORK TRIBUTARY												
FAST	32	629.1(31)	635.1(31)	86.14(31)	90.08(31)	88.12(31)	13.86(31)	9.92(31)	11.88(31)	4.31(31)	5.94(31)	5.13(31)
SLOW	30	579.5(30)	571.0(30)	86.94(30)	90.21(30)	88.56(30)	13.06(30)	9.79(30)	11.44(30)	7.60(30)	5.96(30)	6.79(30)
Subtotals	62	1,208.6(61)	1,206.1(61)									
Means				86.53(61)	90.14(61)	88.33(61)	13.47(61)	9.86(61)	11.67(61)	5.89(61)	5.95(61)	5.92(61)
Totals	471	7,889.6(467)	7,942.1(467)									
Means				88.25(467)	88.85(467)	88.55(467)	11.75(467)	11.15(467)	11.45(467)	7.47(466)	6.90(464)	7.19(464)

Habitat Class	Total Number of Units	Number of Meas. Units	Number of Est. Units	Mean Percent Substrate Coverage: Fines	Small Gravel	Gravel	Small Cobble	Cobble	Small Boulder	Boulder	Bedrock	Mean % Surface Fines
Survey Reach:1 Survey Reach Lower Boundary: MURRAY CITY WATER DIVERSION (WASATCH RESORT)												
Reach Type: A Survey Reach Upper Boundary: COALPIT GULCH TRIB												
FAST	68	-	10	4.3	6.2	11.5	16.0	20.5	21.5	20.0	0.0	6.5
SLOW	100	-	-	-	-	-	-	-	-	-	-	7.9
Subtotals	168	-										
Means			10	4.3	6.2	11.5	16.0	20.5	21.5	20.0	0.0	7.7
Survey Reach:2 Survey Reach Lower Boundary: COALPIT GULCH TRIBUTARY												
Reach Type: A Survey Reach Upper Boundary: HOGUM FORK TRIBUTARY												
FAST	51	-	4	3.8	6.3	11.3	20.0	28.8	22.5	7.5	0.0	6.5
SLOW	48	-	-	-	-	-	-	-	-	-	-	7.6
Subtotals	99	-										
Means			4	3.8	6.3	11.3	20.0	28.8	22.5	7.5	0.0	7.3
Survey Reach:3 Survey Reach Lower Boundary: HOGUM FORK TRIBUTARY (6420FT)												
Reach Type: A Survey Reach Upper Boundary: MAYBIRD GULCH (6830FT)												
FAST	38	-	1	5.0	5.0	15.0	30.0	25.0	15.0	5.0	0.0	5.0
SLOW	35	-	1	5.0	5.0	10.0	25.0	25.0	10.0	15.0	5.0	8.1
Subtotals	73	-										
Means			2	5.0	5.0	12.5	27.5	25.0	12.5	10.0	2.5	7.9
Survey Reach:4 Survey Reach Lower Boundary: MAYBIRD GULCH TRIBUTARY												
Reach Type: A Survey Reach Upper Boundary: RED PINE FORK TRIBUTARY												
FAST	38	-	4	5.0	8.8	11.3	22.5	26.3	12.5	12.5	1.3	13.0
SLOW	31	-	2	0.0	5.0	10.0	20.0	25.0	17.5	22.5	0.0	7.3

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Habitat Class	Total Number of Units	Number of Meas. Units	Number of Est. Units	Mean Percent Substrate Coverage: Fines	Small Gravel	Gravel	Small Cobble	Cobble	Small Boulder	Boulder	Bedrock	Mean % Surface Fines
Subtotals	69	-										
Means			6	3.3	7.5	10.8	21.7	25.8	14.2	15.8	0.8	8.3
Survey Reach:5 Survey Reach Lower Boundary: RED PINE FORK TRIBUTARY												
Reach Type: A Survey Reach Upper Boundary: WHITE PINE FORK TRIBUTARY												
FAST	32	-	3	5.0	10.0	13.3	26.7	25.0	11.7	8.3	0.0	13.8
SLOW	30	-	1	5.0	10.0	10.0	30.0	30.0	10.0	5.0	0.0	7.0
Subtotals	62	-										
Means			4	5.0	10.0	12.5	27.5	26.3	11.3	7.5	0.0	8.4
Totals	471	-										
Means			26	4.2	7.0	11.5	20.6	24.2	17.7	14.4	0.4	7.8

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

Habitat Class	Total Number of Units	Habitat Length (m) Total(n)	Mean(n)	Percent(n)	Mean Width (m)(n)	Habitat Depth (m) Mean(n)	Mean-Max(n)	Mean Width/ Depth(n)	Habitat Area (m²) Total(n)	Mean(n)	Percent(n)	Habitat Volume (m«) Total(n)	Mean(n)	Percent(n)
Survey Reach: 1		Survey Reach Lower Boundary: MURRAY CITY WATER DIVERSION (WASATCH RESORT)												
Reach Type: A		Survey Reach Upper Boundary: COALPIT GULCH TRIB												
FAST	1	3.0(1)	3.0(1)	9.7(1)	2.7(1)	0.12(1)	-	22.50(1)	8.1(1)	8.1(1)	8.5(1)	1.0(1)	1.0(1)	3.0(1)
SLOW	3	27.8(3)	9.3(3)	90.3(3)	3.2(3)	0.35(3)	0.84(1)	9.19(3)	87.7(3)	29.2(3)	91.5(3)	30.9(3)	10.3(3)	97.0(3)
Subtotals	4	30.8(4)		5.2(4)					95.8(4)		4.1(4)	31.9(4)		6.3(4)
Means			7.7(4)		3.1(4)	0.33(4)	0.84(1)	10.49(4)		24.0(4)			8.0(4)	
Survey Reach: 2		Survey Reach Lower Boundary: COALPIT GULCH TRIBUTARY												
Reach Type: A		Survey Reach Upper Boundary: HOGUM FORK TRIBUTARY												
FAST	17	282.4(17)	16.6(17)	66.2(17)	4.1(17)	0.17(17)	-	25.17(17)	1,148.8(17)	67.6(17)	66.1(17)	196.4(17)	11.6(17)	57.4(17)
SLOW	14	144.4(14)	10.3(14)	33.8(14)	4.1(14)	0.25(14)	0.59(14)	17.26(14)	589.7(14)	42.1(14)	33.9(14)	145.6(14)	10.4(14)	42.6(14)
Subtotals	31	426.8(31)		72.0(31)					1,738.4(31)		74.7(31)	342.0(31)		67.3(31)
Means			13.8(31)		4.1(31)	0.20(31)	0.59(14)	22.49(31)		56.1(31)			11.0(31)	
Survey Reach: 3		Survey Reach Lower Boundary: HOGUM FORK TRIBUTARY (6420FT)												
Reach Type: A		Survey Reach Upper Boundary: MAYBIRD GULCH (6830FT)												
FAST	2	21.4(2)	10.7(2)	22.4(2)	5.4(2)	0.23(2)	-	23.84(2)	115.2(2)	57.6(2)	34.7(2)	26.1(2)	13.0(2)	34.3(2)
SLOW	4	74.2(4)	18.6(4)	77.6(4)	2.9(4)	0.23(4)	0.60(4)	13.37(4)	217.1(4)	54.3(4)	65.3(4)	49.8(4)	12.5(4)	65.7(4)
Subtotals	6	95.6(6)		16.1(6)					332.3(6)		14.3(6)	75.9(6)		14.9(6)
Means			15.9(6)		3.5(6)	0.23(6)	0.60(4)	15.71(6)		55.4(6)			12.6(6)	
Survey Reach: 4		Survey Reach Lower Boundary: MAYBIRD GULCH TRIBUTARY												
Reach Type: A		Survey Reach Upper Boundary: RED PINE FORK TRIBUTARY												
FAST	1	8.2(1)	8.2(1)	20.8(1)	4.1(1)	0.21(1)	-	19.52(1)	33.6(1)	33.6(1)	20.9(1)	7.1(1)	7.1(1)	12.2(1)
SLOW	2	31.3(2)	15.7(2)	79.2(2)	4.1(2)	0.40(2)	0.71(2)	10.21(2)	127.4(2)	63.7(2)	79.1(2)	51.0(2)	25.5(2)	87.8(2)

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Habitat Class	Total Number of Units	Habitat Length (m) Total(n)	Mean(n)	Percent(n)	Mean Width (m)(n)	Habitat Depth (m) Mean(n)	Mean-Max(n)	Mean Width/ Depth(n)	Habitat Area (m²) Total(n)	Mean(n)	Percent(n)	Habitat Volume (m«) Total(n)	Mean(n)	Percent(n)
Subtotals	3	39.5(3)		6.7(3)					161.1(3)		6.9(3)	58.1(3)		11.4(3)
Means			13.2(3)		4.1(3)	0.36(3)	0.71(2)	12.14(3)		53.7(3)			19.4(3)	
Totals	44	592.7(44)		100.0(44)					2,327.6(44)		100.0(44)	507.8(44)		99.9(44)
Means			13.5(44)		3.9(44)	0.22(44)	0.62(21)	20.09(44)		52.9(44)			11.5(44)	

Habitat Class	Total Number of Units	Number of Pocket Pools: Total(n)	Mean(n)	per 100 m(n)	Pkt Pool Mean Depth (m)(n)	Total Pools in STPs(n)	Average Max Depth STP Cmplx(n)	Mean Crest Depth (m)(n)	Mean Resid. Max Depth (m)(n)	Residual Volume (m«): Total(n)	Mean(n)	LWD: Total(n)	n/100m(n)
Survey Reach: 1	Survey Reach Lower Boundary: MURRAY CITY WATER DIVERSION (WASATCH RESORT)												
Reach Type: A	Survey Reach Upper Boundary: COALPIT GULCH TRIB												
FAST	1	1(1)	1.0(1)	33.3(1)	-	-	-	-	-	-	-	1(1)	33.3(1)
SLOW	3	-	-	-	-	8(2)	0.48(2)	0.21(1)	0.63(1)	7.7(1)	7.7(1)	4(3)	14.4(3)
Subtotals	4	1(1)				8(2)				7.7(1)		5(4)	
Means			1.0(1)	33.3(1)	-		0.48(2)	0.21(1)	0.63(1)		7.7(1)		16.2(4)
Survey Reach: 2	Survey Reach Lower Boundary: COALPIT GULCH TRIBUTARY												
Reach Type: A	Survey Reach Upper Boundary: HOGUM FORK TRIBUTARY												
FAST	17	173(17)	10.2(17)	61.3(17)	0.34(17)	-	-	-	-	-	-	59(15)	22.5(15)
SLOW	14	-	-	-	-	21(6)	0.47(6)	0.28(8)	0.30(8)	67.9(8)	8.5(8)	30(12)	23.3(12)
Subtotals	31	173(17)				21(6)				67.9(8)		89(27)	
Means			10.2(17)	61.3(17)	0.34(17)		0.47(6)	0.28(8)	0.30(8)		8.5(8)		22.8(27)
Survey Reach: 3	Survey Reach Lower Boundary: HOGUM FORK TRIBUTARY (6420FT)												
Reach Type: A	Survey Reach Upper Boundary: MAYBIRD GULCH (6830FT)												
FAST	2	20(2)	10.0(2)	93.5(2)	0.42(2)	-	-	-	-	-	-	2(2)	9.3(2)
SLOW	4	-	-	-	-	17(2)	0.36(2)	0.28(2)	0.37(2)	10.3(2)	5.2(2)	13(3)	22.6(3)
Subtotals	6	20(2)				17(2)				10.3(2)		15(5)	
Means			10.0(2)	93.5(2)	0.42(2)		0.36(2)	0.28(2)	0.37(2)		5.2(2)		19.0(5)
Survey Reach: 4	Survey Reach Lower Boundary: MAYBIRD GULCH TRIBUTARY												
Reach Type: A	Survey Reach Upper Boundary: RED PINE FORK TRIBUTARY												
FAST	1	6(1)	6.0(1)	73.2(1)	0.40(1)	-	-	-	-	-	-	-	-
SLOW	2	-	-	-	-	6(1)	0.61(1)	0.18(1)	0.43(1)	7.6(1)	7.6(1)	-	-

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Habitat Class	Total Number of Units	Number of Pocket Pools: Total(n)	Mean(n)	per 100 m(n)	Pkt Pool Mean Depth (m)(n)	Total Pools in STPs(n)	Average Max Depth STP Cmplx(n)	Mean Crest Depth (m)(n)	Mean Resid. Max Depth (m)(n)	Residual Volume (m«): Total(n)	Mean(n)	LWD: Total(n)	n/100m(n)
Subtotals	3	6(1)				6(1)				7.6(1)		-	
Means			6.0(1)	73.2(1)	0.40(1)		0.61(1)	0.18(1)	0.43(1)		7.6(1)		-
Totals	44	200(21)				52(11)				93.4(12)		109(36)	
Means			9.5(21)	63.5(21)	0.35(20)		0.47(11)	0.27(12)	0.35(12)		7.8(12)		21.8(36)

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Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

Habitat Class	Total Number of Units	Bank Length (m) Left(n)	Bank Length (m) Right(n)	% Stable Bank Left(n)	% Stable Bank Right(n)	% Stable Bank Mean(n)	% Unstable Bank Left(n)	% Unstable Bank Right(n)	% Unstable Bank Mean(n)	% Undercut Bank Left(n)	% Undercut Bank Right(n)	% Undercut Bank Mean(n)
Survey Reach: 1 Survey Reach Lower Boundary: MURRAY CITY WATER DIVERSION (WASATCH RESORT)												
Reach Type: A Survey Reach Upper Boundary: COALPIT GULCH TRIB												
FAST	1	3.2(1)	4.0(1)	95.00(1)	100.00(1)	97.78(1)	5.00(1)	0.00(1)	2.22(1)	0.00(1)	0.00(1)	0.00(1)
SLOW	3	33.3(3)	34.1(3)	100.00(3)	100.00(3)	100.00(3)	0.00(3)	0.00(3)	0.00(3)	19.37(3)	6.23(3)	12.72(3)
Subtotals	4	36.5(4)	38.1(4)									
Means				99.56(4)	100.00(4)	99.79(4)	0.44(4)	0.00(4)	0.21(4)	17.67(4)	5.58(4)	11.49(4)
Survey Reach: 2 Survey Reach Lower Boundary: COALPIT GULCH TRIBUTARY												
Reach Type: A Survey Reach Upper Boundary: HOGUM FORK TRIBUTARY												
FAST	17	-	-	-	-	-	-	-	-	-	-	-
SLOW	14	-	-	-	-	-	-	-	-	-	-	-
Subtotals	31	-	-									
Means				-	-	-	-	-	-	-	-	-
Survey Reach: 3 Survey Reach Lower Boundary: HOGUM FORK TRIBUTARY (6420FT)												
Reach Type: A Survey Reach Upper Boundary: MAYBIRD GULCH (6830FT)												
FAST	2	-	-	-	-	-	-	-	-	-	-	-
SLOW	4	-	-	-	-	-	-	-	-	-	-	-
Subtotals	6	-	-									
Means				-	-	-	-	-	-	-	-	-
Survey Reach: 4 Survey Reach Lower Boundary: MAYBIRD GULCH TRIBUTARY												
Reach Type: A Survey Reach Upper Boundary: RED PINE FORK TRIBUTARY												
FAST	1	-	-	-	-	-	-	-	-	-	-	-
SLOW	2	-	-	-	-	-	-	-	-	-	-	-

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Habitat Class	Total Number of Units	Bank Length (m)		% Stable Bank			% Unstable Bank			% Undercut Bank		
		Left(n)	Right(n)	Left(n)	Right(n)	Mean(n)	Left(n)	Right(n)	Mean(n)	Left(n)	Right(n)	Mean(n)
Subtotals	3	-	-									
Means				-	-	-	-	-	-	-	-	-
Totals	44	36.5(4)	38.1(4)									
Means				99.56(4)	100.00(4)	99.79(4)	0.44(4)	0.00(4)	0.21(4)	17.67(4)	5.58(4)	11.49(4)

Habitat Class	Total Number of Units	Number of Meas. Units	Number of Est. Units	Mean Percent Substrate Coverage: Fines	Small Gravel	Gravel	Small Cobble	Cobble	Small Boulder	Boulder	Bedrock	Mean % Surface Fines
Survey Reach:1	Survey Reach Lower Boundary: MURRAY CITY WATER DIVERSION (WASATCH RESORT)											
Reach Type: A	Survey Reach Upper Boundary: COALPIT GULCH TRIB											
FAST	1	-	-	-	-	-	-	-	-	-	-	-
SLOW	3	-	-	-	-	-	-	-	-	-	-	5.0
Subtotals	4	-										
Means			-	-	-	-	-	-	-	-	-	5.0
Survey Reach:2	Survey Reach Lower Boundary: COALPIT GULCH TRIBUTARY											
Reach Type: A	Survey Reach Upper Boundary: HOGUM FORK TRIBUTARY											
FAST	17	-	-	-	-	-	-	-	-	-	-	8.6
SLOW	14	-	-	-	-	-	-	-	-	-	-	14.3
Subtotals	31	-										
Means			-	-	-	-	-	-	-	-	-	11.4
Survey Reach:3	Survey Reach Lower Boundary: HOGUM FORK TRIBUTARY (6420FT)											
Reach Type: A	Survey Reach Upper Boundary: MAYBIRD GULCH (6830FT)											
FAST	2	-	-	-	-	-	-	-	-	-	-	-
SLOW	4	-	-	-	-	-	-	-	-	-	-	7.5
Subtotals	6	-										
Means			-	-	-	-	-	-	-	-	-	7.5
Survey Reach:4	Survey Reach Lower Boundary: MAYBIRD GULCH TRIBUTARY											
Reach Type: A	Survey Reach Upper Boundary: RED PINE FORK TRIBUTARY											
FAST	1	-	-	-	-	-	-	-	-	-	-	-
SLOW	2	-	-	-	-	-	-	-	-	-	-	20.0

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Habitat Class	Total Number of Units	Number of Meas. Units	Number of Est. Units	Mean Percent Substrate Coverage: Fines	Small Gravel	Gravel	Small Cobble	Cobble	Small Boulder	Boulder	Bedrock	Mean % Surface Fines
Subtotals	3	-										
Means			-	-	-	-	-	-	-	-	-	20.0
Totals	44	-										
Means			-	-	-	-	-	-	-	-	-	11.1

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EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

Total Number of Units	Gradient MAP	Gradient OBS	Habitat Length(m) Total	Width(m) Mean	% Pools	Max Depth(m) Mean	Width/ Depth Mean	Resid. Vol.(m«) Mean	LWD No. per 100(m)	% Stbl Bank Mean	% Undrct Bank Mean	% Srfce Fines Mean	Dom. Ripar. Type	From:	Mid:	To:
Survey Reach:1 Reach Type: A			Survey Reach Lower Boundary: MURRAY CITY WATER DIVERSION (WASATCH RESORT) Survey Reach Upper Boundary: COALPIT GULCH TRIB													
168	8.3	11.3	1,857.0	8.5	47.6	1.07	21.5	44.3	15.9	97.0	7.9	7.7	SS	0.0	928.5	1,857.0
Survey Reach:2 Reach Type: A			Survey Reach Lower Boundary: COALPIT GULCH TRIBUTARY Survey Reach Upper Boundary: HOGUM FORK TRIBUTARY													
99	7.4	4.8	1,794.6	7.5	30.0	0.99	22.5	27.3	16.7	84.6	7.4	7.3	SS	1,857.0	2,754.3	3,651.6
Survey Reach:3 Reach Type: A			Survey Reach Lower Boundary: HOGUM FORK TRIBUTARY (6420FT) Survey Reach Upper Boundary: MAYBIRD GULCH (6830FT)													
73	9.3	7.0	1,360.0	7.5	43.9	1.06	20.5	28.8	13.3	85.0	7.2	7.9	ST	3,651.6	4,331.6	5,011.6
Survey Reach:4 Reach Type: A			Survey Reach Lower Boundary: MAYBIRD GULCH TRIBUTARY Survey Reach Upper Boundary: RED PINE FORK TRIBUTARY													
69	10.9	10.0	920.5	6.9	33.3	1.09	19.6	25.7	10.9	84.3	6.9	8.3	SP	5,011.6	5,471.9	5,932.1
Survey Reach:5 Reach Type: A			Survey Reach Lower Boundary: RED PINE FORK TRIBUTARY Survey Reach Upper Boundary: WHITE PINE FORK TRIBUTARY													
62	8.8	-	1,065.6	7.3	44.7	1.04	22.3	39.4	8.4	88.3	5.9	8.4	SP	5,932.1	6,464.9	6,997.7

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

Total Number of Units	Gradient MAP	Gradient OBS	Habitat Length(m) Total	Width(m) Mean	Depth(m) Mean	Width/ Depth Mean	Width/Mx Depth Mean	LWD No. per Mile	%Stbl Bank Mean	%Undrct Bank Mean	% Pools	#Pools per mi.	#Deep Pools per mi.	#Lrg. Pools per mi.	Resid. Max Dep. Mean	% Riffle	% Runs/ Glds	%Srfce Fines Mean	%Sm. Grav. Mean	% Grav. Mean
Survey Reach:1 Survey Reach Lower Boundary: INTERSECTION OF BABY THUNDER CHAIRLIFT & LCC Reach Type: A Survey Reach Upper Boundary: INTERSECTION OF ALBION CHAIRLIFT & LCC Channel Type:A2																				
168	7.0	6.5	1,857.0	8.5	0.44	21.5	7.72	255.9	97.0	7.9	47.6	86.6	6.1	72.8	0.61	45.8	0.0	7.7	6.2	11.5
Survey Reach:2 Channel Type:																				
99	0.0	0.0	1,794.6	7.5	0.36	22.5	7.01	879.7	84.6	7.4	30.0	0.0	0.0	0.0	0.49	69.4	0.0	7.3	6.3	11.3
Survey Reach:3 Channel Type:																				
73	0.0	0.0	1,360.0	7.5	0.39	20.5	6.44	700.9	85.0	7.2	43.9	0.0	0.0	0.0	0.59	38.1	0.0	7.9	5.0	12.5
Survey Reach:4 Channel Type:																				
69	0.0	0.0	920.5	6.9	0.37	19.6	6.06	573.6	84.3	6.9	33.3	0.0	0.0	0.0	0.64	39.1	0.0	8.3	7.5	10.8
Survey Reach:5 Channel Type:																				
62	0.0	0.0	1,065.6	7.3	0.35	22.3	7.12	445.9	88.3	5.9	44.7	0.0	0.0	0.0	0.68	35.0	0.0	8.4	10.0	12.5
Grand total.....			6,997.7																	

Stream ID: IV080
EPA Reach: 160202040109
Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

Riparian Community Type	Left Bank Occur	Left Bank % Occur	Left Bank % Strm Length	Right Bank Occur	Right Bank % Occur	Right Bank % Strm Length	Bank Total Occur	Bank Total % Occur	Bank Total % Strm Length
Survey Reach:1 Survey Reach Lower Boundary: MURRAY CITY WATER DIVERSION (WASATCH RESORT)									
Reach Type: A Survey Reach Upper Boundary: COALPIT GULCH TRIB									
	1	0.6	0.2	0	0.0	0.0	1	0.6	0.1
	0	0.0	0.0	3	1.8	1.9	3	1.8	0.9
	0	0.0	0.0	2	1.2	0.9	2	1.2	0.4
	1	0.6	0.6	0	0.0	0.0	1	0.6	0.3
	4	2.4	1.7	0	0.0	0.0	4	2.4	0.9
	12	7.2	7.7	5	3.0	2.5	16	9.6	5.1
	3	1.8	0.9	4	2.4	2.8	7	4.2	1.8
	50	29.9	30.3	57	34.1	35.8	90	53.9	33.0
	88	52.7	51.2	74	44.3	40.3	114	68.3	45.8
	9	5.4	7.3	22	13.2	15.9	29	17.4	11.6
Survey Reach:2 Survey Reach Lower Boundary: COALPIT GULCH TRIBUTARY									
Reach Type: A Survey Reach Upper Boundary: HOGUM FORK TRIBUTARY									
	1	1.0	1.3	4	4.1	1.6	5	5.1	1.4
	4	4.1	3.0	2	2.0	1.8	6	6.1	2.4
	29	29.6	33.6	28	28.6	29.7	46	46.9	31.7
	47	48.0	43.9	53	54.1	52.7	62	63.3	48.3
	17	17.3	18.2	11	11.2	14.2	25	25.5	16.2
Survey Reach:3 Survey Reach Lower Boundary: HOGUM FORK TRIBUTARY (6420FT)									
Reach Type: A Survey Reach Upper Boundary: MAYBIRD GULCH (6830FT)									
	5	7.0	4.1	1	1.4	0.9	6	8.5	2.5
	5	7.0	10.4	5	7.0	5.3	10	14.1	7.8
	17	23.9	23.2	25	35.2	37.4	37	52.1	30.3
	23	32.4	22.8	26	36.6	32.6	40	56.3	27.7
	21	29.6	39.5	14	19.7	23.8	29	40.8	31.6

Stream ID: IV080
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Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

Riparian Community Type	Left Bank Occur	Left Bank % Occur	Left Bank % Strm Length	Right Bank Occur	Right Bank % Occur	Right Bank % Strm Length	Bank Total Occur	Bank Total % Occur	Bank Total % Strm Length
Survey Reach:4 Survey Reach Lower Boundary: MAYBIRD GULCH TRIBUTARY Reach Type: A Survey Reach Upper Boundary: RED PINE FORK TRIBUTARY									
	0	0.0	0.0	8	12.1	9.0	8	12.1	4.5
	5	7.6	9.1	1	1.5	1.7	6	9.1	5.4
	22	33.3	38.1	19	28.8	37.2	31	47.0	37.7
	21	31.8	28.1	28	42.4	38.9	34	51.5	33.5
	18	27.3	24.7	10	15.2	13.2	25	37.9	18.9
Survey Reach:5 Survey Reach Lower Boundary: RED PINE FORK TRIBUTARY Reach Type: A Survey Reach Upper Boundary: WHITE PINE FORK TRIBUTARY									
	0	0.0	0.0	1	1.6	1.3	1	1.6	0.7
	4	6.6	3.0	1	1.6	1.5	5	8.2	2.3
	21	34.4	38.3	22	36.1	40.2	31	50.8	39.3
	20	32.8	36.8	19	31.1	33.5	30	49.2	35.1
	16	26.2	22.0	18	29.5	23.5	25	41.0	22.7

Stream ID: IV080
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Stream Name: LITTLE COTTONWOOD CREEK Forest: WASATCH-CACHE NF District: SALT LAKE RD Study: I99

Riparian Community Type	Left Bank Occur	Left Bank % Occur	Left Bank % Strm Length	Right Bank Occur	Right Bank % Occur	Right Bank % Strm Length	Bank Total Occur	Bank Total % Occur	Bank Total % Strm Length
Survey Reach:1 Survey Reach Lower Boundary: MURRAY CITY WATER DIVERSION (WASATCH RESORT)									
Reach Type: A Survey Reach Upper Boundary: COALPIT GULCH TRIB									
	2	50.0	54.9	0	0.0	0.0	2	50.0	27.4
	2	50.0	45.1	0	0.0	0.0	2	50.0	22.6
	0	0.0	0.0	4	100.0	100.0	4	100.0	50.0