Upper Snake Rock TMDL Modification

Upper Snake Rock Watershed Management Plan – Modification
A Modification of the Mid-Snake TMDL & Upper Snake Rock TMDL
To Account for the Billingsley Creek Wasteload Allocation
Part 3

Prepared for
U. S. Environmental Protection Agency – Region 10
U. E. EPA Idaho Operations Office – Boise, Idaho
Idaho Department of Environmental Quality – State Office
Middle Snake River Watershed Advisory Group

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1.0 INTRODUCTION

This public comment document describes Part 3 in the modification of three total maximum daily loads (TMDLs) – the *Middle Snake River Watershed Management Plan* (or Mid-Snake TMDL), the *Upper Snake Rock Watershed Management Plan* (or Upper Snake Rock TMDL), and the *Billingsley Creek Watershed Management Plan* (or Billingsley Creek TMDL). Part 3 in this TMDL modification process involves the twelve (12) fish hatcheries that discharge into the Billingsley Creek drainage. As such and as described in the Part 1 document, the Billingsley Creek TMDL is compartmentalized under Segment 5 of the Middle Snake River, which is considered a receiving stream segment. The twelve (12) fish hatcheries to consider include the following:

FACILITY	SOURCE WATER	RECEIVING WATER
1. Rangens (GAP-015)	Curren Springs	Billingsley Creek
2. Lee Ponds (GAP-050)	Spring Creek	Spring Creek
3. Johnson Ponds (GAP-130)	Spring Creek	Spring Creek/Billingsley Creek
4. Jones FH (GAP-005)	Weatherby Springs	Billingsley Creek
5. McFadden (GAP-066)	Springs	Billingsley Creek
6. Tupper (GAP-131)	Tupper Springs	Billingsley Creek
7. U of I (GAP-001)	Tupper Springs	Billingsley Creek
8. Hidden Springs (GAP-048)	Hidden Springs	Billingsley Creek
9. Fisheries Development (GAP-017)	Springs/Billingsley Ck	Billingsley Creek
10. Boyer FH (GAP-049)	Billingsley Creek	Billingsley Creek
11. Talbot FH (GAP-083)	Billingsley Creek	Billingsley Creek
12. Emerald Valley Ranch (GAP-132)	Billingsley Creek	Billingsley Creek/Snake River

The pollutants of concern are total phosphorus (TP) and total suspended solids (TSS). Bacteria are not considered because aquaculture fish hatcheries are not known to discharge *Escherichia coli* (or *E. coli*) from their facilities since the pollutant-generating species are cold-blooded fish.

After reviewing the public comments, DEQ intends to publish notice of its final decision in the Idaho Administrative Bulletin and provide written notice to members of the applicable Watershed Advisory Groups. Then the document will be submitted to the U. S. Environmental Protection Agency (EPA) for review and approval.

2.0 HISTORICAL PERSPECTIVE

Relative to the Billingsley Creek facilities in the Middle Snake River subbasin, the following is a historical perspective. Part of that historical perspective is the understanding that the Billingsley Creek facilities have always been considered "outside of the 970.2 lb/day TP load", much like the fish processors. Therefore, their wasteload allocation will be "in addition to" the 970.2 lb/day TP load, which has been considered for the overall industry. Note also that a public comment period has previously been

conducted for review of the *Billingsley Creek Total Maximum Daily Load and Localized Impacts Assessment*.

1981 – James E. Winner, IDWR, publishes *Billingsley Creek Water Quality* report. The objectives of the report are to: (1) determine the quality of the water, (2) determine the effects of water use on water quality, and (3) estimate the impacts of future development on water quality.

1986 – *Water Quality Status Report, #64, Billingsley Creek, Gooding County, Idaho* published by IDEQ defining status of the beneficial uses as described in the 1988 publication.

1988 – Idaho Water Quality Status Report and Nonpoint Source Assessment by IDEQ reports that Billingsley Creek is water quality limited and does not fully support beneficial uses. Partially supported uses include cold water aquatic life, salmonid spawning, and primary contact recreation. Threatened beneficial uses include domestic water supply and secondary contact recreation. Additionally, the stream is listed as special resource water and this is threatened as well.

1989 – Task force was formed by IDEQ to recommend actions that would improve water quality in Billingsley Creek by implementing practices to control sediments and incorporate actions to stabilize the creek degraded riparian areas.

1990 – Task force developed the completions report *Recommendations for Water Quality Improvement to the Billingsley Creek Agricultural Land Users*. The individual operators could choose the recommendations to be implemented. Recommendations were developed for 13 individual land owners/operators and only two implemented positive actions related to improving water quality. Other operators took little or no action.

December 1990 – A problem assessment and proposed TMDL completed by IDEQ and EPA-Region 10.

December 10, 1991 – USFWS-Boise has reviewed the NPDES permit applications for the seven fish culture facilities along Billingsley Creek and has no objections to issuance of the permits with the following comments: (1) the TMDL process should assist in addressing the cumulative effects of fish hatchery discharges with other existing and future sources of nonpoint source pollution on water quality.

October 19, 1992 – Billingsley Creek TMDL submitted by IDEQ to EPA for TP, TSS, and Settleable Solids as *Problem Assessment – Billingsley Creek* (October 14, 1992).

August 23, 1993 – Billingsley Creek TMDL approved by EPA as a gross concentration based limit with no wasteload allocations.

August 10, 1994 – EPA Fact Sheets and Permits for seven (7) Billingsley Creek facilities: Idaho Springs, Jones Hatchery, Rangen, Inc., Hidden Springs, Spring Creek, Fisheries Development, and Dale Boyer Farms.

August 30, 1994 – EPA-Region 10 finalizes the *Biological Evaluation for Reissuance of NPDES Permits for Billingsley Creek, Idaho Aquaculture Facilities*. The aquaculture facilities were estimated at being responsible for 75% of the Billingsley Creek's water quality impairment.

September 13, 1994 – USFWS-Boise responds to *Biological Evaluation for Reissuance of NPDES Permits for Billingsley Creek, Idaho Aquaculture Facilities* by stating that the BE failed to consider all potential effects, direct and indirect, to the listed species. Relative to the T & E mollusks: (1) The analysis of the effects of the action on the mollusk species and habitat did not include consideration of cumulative effects; and (2) to our knowledge, tests using hatchery effluent to determine effects to native mollusks have not been conducted. Relative to the T & E eagles: (1) extensive information from the literature about eagles was cited, but little site-specific information was presented; and (2) the BE only addressed threats to eagles in the Snake River Recovery Area, which were identified by the Recovery Plan. Other threats may exist relative to the eagle's primary food stocks and foraging areas in all areas influenced by the proposed activity.

March 25, 1997 – *The Middle Snake River Watershed Management Plan* (or Mid-Snake TMDL) is submitted to EPA. Public comment occurred from October 23, 1996 to November 22, 1996.

April 25, 1997 – The Mid-Snake TMDL is approved by EPA.

December 20, 1999 – *The Upper Snake Rock Watershed Management Plan* (or Upper Snake Rock TMDL) is submitted to EPA. The Mid-Snake TMDL timeline is modified in conjunction with the Upper Snake Rock TMDL and the general aquaculture permit to commence in year 2000. Public comment occurred twice: (1) June 17, 1998 – September 17, 1998, and (2) November 1, 1999 – December 1, 1999.

August 25, 2000 - The Upper Snake Rock TMDL is approved by EPA.

November 20, 2001 – 1st Meeting in Hagerman Research Station (University of Idaho) with Billingsley Creek Committee (fish facilities) to discuss the Billingsley Creek TMDL.

April 12, 2002 – Billingsley Creek Committee submits a wasteload allocation proposal for their fish facilities.

June 27, 2002 – Meeting by IDWR on the Minimum Stream Flow Applications on Billingsley Creek.

July 15, 2002 – IDWR sends out *Amended Applications for Permit – 36-08596 and 36-08793 in the names of the Idaho Water Resource Board* on Billingsley Creek.

August 23, 2002 – 2nd Meeting in Hagerman Research Station (University of Idaho) with Billingsley Creek fish facilities to discuss the TMDL on Billingsley Creek and its incorporation into the Upper Snake Rock TMDL.

October 1, 2002 – Memo on IDEQ's *Billingsley Creek Wasteload Allocation Proposal* sent to the Billingsley Creek Committee.

October 14, 2002 – Billingsley Creek Committee not satisfied with the memo of October 1, 2002 on the wasteload allocation. They feel that the proposal of April 12, 2002 was not given due consideration and that the wasteload allocation proposed by IDEQ is neither adequate nor workable.

July 30, 2003 – *Billingsley Creek Wasteload Allocations Logic Process Based on Billingsley Creek Q Model (version 2003)* finalized by Buhidar and Sharpnack to describe the low flow conditions of Billingsley Creek and its impacts on water quality.

August 4 – September 1, 2003 – Public comment period for *Billingsley Creek Total Maximum Daily Load and Localized Impacts Assessment (Draft – Public Comment Document)*. The document was prepared by IDEQ.

September 8, 2003 – Representatives of the Billingsley Creek Committee met with IDEQ to discuss the TMDL process on Billingsley Creek and EPA's lack of desire for a concentration-based wasteload allocation.

September 22, 2003 – Representatives of the Billingsley Creek Committee met with IDEQ to discuss the Localized Impact Analysis document that had been out for public comment.

September 1-October 1, 2003 – Public comment period extended for an additional 30 days for review of *Billingsley Creek Total Maximum Daily Load and Localized Impacts Assessment (Draft – Public Comment Document)*.

October 3, 2003 – IDEQ Memo on *Total Phosphorus on Billingsley Creek, 1972-2001* sent to the Billingsley Creek Committee.

3.0 VERSION 13 DATABASE AND TECHNICAL CALCULATIONS

In order to maintain consistency within the aquaculture industry, the Version 13 Database of the Billingsley Creek fish hatcheries was utilized to develop various wasteload allocation scenarios. The database was provided to the operators for their use in developing their own proposal with the stipulation that there could be no phosphorus speculation.

Finally, one technical aspect of the tables that are in this Part 1 document deals with the Microsoft program, Excel. This program was used for all calculations. Truncation of repeating or ratio values was selected at the centidecimal place (0.01 or two-decimal places to the right of the zero) and incorporated the Rule of Rounding before truncation. Therefore, although mathematically a rounded or truncated value may actually represent a range of numbers (such as 12.235-12.239 ≈ 12.24); the values found in the tables are the exact values at the second decimal place (i.e., 12.24) without any "hanging" rounding or truncation residual. This was done to eliminate any rounding errors or mis-calculations within the tables. However, despite the incorporation of the Rule of Rounding before truncation, a global rounding error is still expressed between what is considered the exact real number and the nearest floating-point representation. These rounding "precision" errors are accumulative where multiple calculations are involved. In effect, the value 4.0 (as an example) is really a range of values from 3.95 to 4.04, which yields a classic approach as an absolute bound or a probabilistic estimate of the first-order approximate of the final rounding error with respect to the elementary rounding errors introduced by the computation of intermediate variables (Langlois 2000). This is demonstrated in the following example for Milner Dam and Pillar Falls relative to TP and TSS. The lower bound value is the lowest value that is equivalent (based on rounding) to the expected value as the instream concentration. Likewise, the upper bound value is the highest value that is equivalent (based on rounding) to the expected value as the instream concentration. The % Range equates to the percentage value of the actual range (Upper Bound – Lower Bound) against the expected value.

Compliance	Expected Value	Lower Bound	Upper Bound	% Range
Total Phosphorus: 0.075 mg/L TP				
Milner Dam	1,560.41 lb/day	1,550.01	1,570.80	1.33%
Pillar Falls	1,914.93 lb/day	1,902.17	1,927.69	1.33%

Total Suspended Solids: 52.0 mg/L TSS

Milner Dam	197,443.25 ton/year	197,254.00	197,633.00	0.19%
Pillar Falls	196,172.04 ton/year	195,939.06	196,405.02	0.24%

Consequently, in this document the true or expected value is indeed a range of values that have lower and upper bound limits, but which round to the expected value. No correcting term was applied for this characteristic global rounding error (or linearization error) since it is characteristic of all data. Thus, the incorporation of standard mathematical operations from final accumulative solutions cannot be applied with the anticipation of obtaining the expected value. Therefore, a process was set by DEQ to minimize this potential error. That process followed the following procedure for determination of wasteload allocations within all of the TMDLs:

STEP 1. Calculate the Load Capacity for TP and TSS for each natural tributary using the following formulas:

TP, lb/day = cfs x 0.100-mg/L TP x 5.39 (tributaries)
TP, lb/day = cfs x 0.075-mg/L TP x 5.39 (Snake River)

TSS, ton/year = cfs x 52.0 mg/L TSS x 5.39 x 0.1825 (tributaries and Snake River)
TSS, ton/year = cfs x 25.0 mg/L TSS x 5.39 x 0.1825 (special resource waters)

STEP 2. Subtract the MOS from the Loading Capacity.

STEP 3. Subtract the Loss/Attenuation value where appropriate from the remaining Loading Capacity.

STEP 4. Subtract the Point Sources from the remaining Loading Capacity.

STEP 5. The remaining Loading Capacity is attributed to the Nonpoint Sources. Of this remaining Loading Capacity, 2% is temporarily attributed to Stormwater – Construction Activities. See §5.0 of this document on Stormwater. Therefore,

TP, lb/day = Loading Capacity, lb/day x 0.02
TSS, ton/year = Loading Capacity, ton/year x 0.02

For the Nonpoint Sources attributed to FERC facilities, Land Application sites, or Confined Feeding Operations (all sizes), these will carry a load of zero. The remaining Nonpoint Source component, once the 2% Stormwater – Construction Activities is subtracted, is attributed to a combined Nonpoint Source load of agricultural activities, grazing lands, private ground, and within the 2-mile corridor of the stream.

4.0 EXCEPTIONS TO THE WASTELOAD ALLOCATION

As previously noted in the Part 1 document, two additional portions to the aquaculture wasteload allocation are not incorporated in the 970.2 lb/day TP target. The first are the fish processors who are defined in Part 2 of the wasteload allocation. The second are the Billingsley Creek facilities and these comprise Part 3 of the wasteload allocation. The intent of DEQ is to bring all of the fish hatcheries in the Upper Snake Rock subbasin under the jurisdiction of the Upper Snake Rock Watershed Management Plan or Upper Snake Rock TMDL. This allows for uniformity in the process instead of dealing with separate TMDLs. Only TP, TSS, and *E. coli* are being considered. And *E. coli* is not considered a pollutant from fish hatcheries.

5.0 BENEFICIAL USE ATTAINMENT

Relative to compliance with water quality standards, the Upper Snake Rock TMDL (Buhidar 1999) defined tributaries as natural or manmade waterbodies that discharged into larger waterbodies. Water quality standard limitations are set on tributaries and may be set throughout the entire length of the natural waterbody. Water quality standard limitations on canalways, however, are set at the point where the canalway discharges into a natural waterbody and not throughout the entire length of the canalway.

Relative to meeting beneficial uses, the Upper Snake Rock TMDL identified nuisance aquatic plant growths as impairments to the beneficial uses of Billingsley Creek. In addition, sediment is known to impair several segments of the creek and aid in the production of these macrophytes. Instream water quality targets similar the Upper Snake Rock has been set in Billingsley Creek. These targets include the following:

	TP Target	TSS Target
Tributary	< 0.100 mg/L	< 25.0 mg/L
Springs	< 0.020 mg/L	< 1.3 mg/L

The 25.0 mg/L TSS target is due to the special resource water and drinking water supply designations that have been given to Billingsley Creek.

Stormwater Runoff and Construction Activities

Relative to nonpoint source stormwater runoff and construction activities that may potentially impact natural systems within the stream corridor, 2% of the nonpoint source load allocation was defined as a "reserve" for TSS and TP. As a reserve, it will revert to the nonpoint source category when stormwater runoff and construction activities are not occurring. These activities must comply with the limitations imposed by the TSS and TP reserve.

Future Growth Potential

Nonpoint source future growth potential such as subdivision development or similar ventures within the stream corridors must provide sufficient protection of nutrient (TP and nitrogen), sediment (TSS), and bacteria pollutants so that TMDL targets and goals are maintained. Subdivisions, although defined as a nonpoint source, have the tendency with septic systems to produce more TP than what would be allocated to straight agricultural lands. This assumes that the septic discharge enters the associated waterbody. Consequently, the TP loading limit for subsurface sewage disposal (IDAPA §58.01.03) or wastewater land application (IDAPA §58.01.17) is contained in the TMDL as part of the nonpoint source load allocation. Point source wasteload allocations are enforceable under NPDES permits. Nonpoint source load allocations are implemented by designated agencies under Idaho Code §39-3612 and IDAPA §58.01.02.350. In addition, DEQ policy relative to subdivision development within stream corridors should be reviewed in consultation with local planning and zoning restrictions for appropriate conside7ration.

6.0 TOTAL PHOSPHORUS POLLUTANT TRADING

Total phosphorus pollutant trading is presently described under a trading guidance that was developed by EPA and DEQ. Pollutant trading is a contractual agreement to exchange pollutant reductions between two partners. It is a voluntary way to help meet TMDLs. Trading is allowed on the Middle Snake River as described in the guidance. Trading into the tributaries will be allowed once DEQ

establishes equivalency ratios. Any seasonal or non-seasonal facility is eligible to participate in pollutant trading.

Pollutant trading is a tool that can be used to help a point source meet its NPDES phosphorus limits. Typically, a discharger facing relatively high pollutant reduction costs compensates another party to achieve an equivalent, though less costly, pollutant reduction. Trading is voluntary, takes place through private contracts, and is regulated through compliance with NPDES permit requirements.

A point source may voluntarily reduce its phosphorus discharge below its NPDES permit limit by a particular amount for a particular time-period. This creates a credit that may be sold to another point source. The transfer of credits reduces the seller's permit limit by the amount of the credits. The buyer may in crease its discharge limit by the amount of credits it purchases. Credits are characterized by an amount of a pollutant per unit of time. Each point source is responsible for meeting its individual permit limit for phosphorus, adjusted by traded credits. Credits must be generated and purchased during the same time-period. In other words, if a discharger exceeds a permit limit in January it must purchase credits generated in January.

As an example, if facility X has an NPDES permit allowing for the discharge of 100 lb/day of phosphorus and is able, through technology, to reduce its discharge to 75 lb/day, it has 25 credits to sell. If facility Y has an NPDES permit allowing for the discharge of 100 lb/day phosphorus, but is currently discharging 125 lb/day, it is exceeding its permit limit by 25 lb/day phosphorus. Facility Y may either find a way to reduce an additional 25 lb/day of phosphorus in order to meet its permit limit or it may purchase 25 lb/day of phosphorus credits from facility X. At this point, the same amount of phosphorus is discharged into the river, 200 lb/day, but through a different distribution between facilities X and Y. Each point source must reflect the actual discharge amount of phosphorus in their Discharge Monitoring Reports and also show the purchase of credits in a Trade Summary report in accordance with DEQ's trading guidance.

7.0 ALLOCATIONS BY CREEK SEGMENT & TRIBUTARY

Within the Billingsley Creek drainage in Hagerman Valley, Idaho, there are fifteen (15) fish hatcheries that discharge either to the Snake River, Billingsley Creek, or to quantifiable springs. The wasteload allocations presented in Part 3 of the Upper Snake Rock TMDL Modification pertain specifically to those fish hatcheries that discharge to Billingsley Creek or to quantifiable springs. Those that discharge to the Snake River were presented in the Part 1 document. The Part 3 document includes the twelve (12) facilities previously listed in §1.0 and thus incorporates 12 segments of Billingsley Creek. The creek throughout its 7 mile stretch is seriously depressed in flow due to a number of water management decisions. There is no evidence to indicate that this low flow condition will improve over the next 5-10 years, although an effort has been launched to pipe irrigation water to the creek so as to establish a minimum flow of sorts.

As previously stated, Billingsley Creek is subdivided into 12 segments that incorporate the 12 fish hatcheries of concern or those that discharge into Billingsley Creek or to a quantifiable spring. This section (§7.0) defines the wasteload allocations for each of the 12 segments. This approach of subdividing Billingsley Creek into 12 segments was done to compensate for the loss in flow throughout the stream. As previously noted in the *Billingsley Creek Total Maximum Daily Load and Localized Impacts Assessment* (2004) and in *Billingsley Creek Wasteload Allocations Logic Process* (2003), Billingsley Creek is suffering from severe water losses, which have impacted the production capabilities of the fish hatcheries substantially. Curren Springs lies at the headwaters of Billingsley Creek and serves as the "primer" for water intake into the creek.

For purposes of these wasteload allocations, Curren Springs flows that are less than 25.00 cfs will be considered as a low flow scenario. IDEQ expects that EPA will accept this low flow scenario for

wasteload allocations as protective of the resource. IDEQ also expects that should water flows increase significantly in the Curren Springs above 25.00 cfs, that EPA would adjust the wasteload allocations according to the increased level of flow. IDEQ expects that the adjustment in the wasteload allocations will occur at the most opportune time that matches with the timeframe for reissuance of the NPDES permit. In addition, IDEQ proposes to provide a wasteload allocation to each fish facility on the Billingsley Creek drainage by taking into account the influent and effluent nature of the phosphorus in question. This will insure that the water quality of Billingsley Creek will not be degraded beyond the 0.100 mg/L TP under the worst case scenario of low flow conditions. For total suspended solids (TSS), the 5.0 mg/L NPDES permit limit will be used for the fish facilities. The instream load capacity will be based on 25.0 mg/L TSS to allow protection of the special resource water designation and drinking water supply.

An implicit Margin of Safety is assumed as described in the Upper Snake Rock TMDL in that it is incorporated through conservative assumptions in the analysis. Section 3.4 (pages 195-197) of the Upper Snake Rock TMDL describes these conservative assumptions.

7.1 CURREN SPRINGS TO SPRING CREEK

Average flow conditions in this stretch of Billingsley Creek were 20.50 cfs or more in recent history. But since 1993, the flows have dropped below 20.50 cfs. In 2002 the flows were at 6.35 cfs. Only one point source exists on this segment of Billingsley Creek – Rangens, Inc. Fish Hatchery. Based on consumptive diversions the average availability of water from the stream channel to the facility under low flow conditions is 88.3%. Table 7.1 provides the point source (Rangens, Inc. GAP-015) and nonpoint source components for the headwaters of Billingsley Creek (from Curren Springs to Spring Creek) as part of the loading capacity for the stream segment. No other point sources exist. Nonpoint sources are defined as in Part 1 and Part 2 – agriculture, grazing, private land ownership, and in-stream corridor erosion factors.

Table 7.1 Rangens, Inc. (GAP-015)

Margin of Safety = Implicit

STREAM Q cfs	TP TARGET mg/l	LOADING CAPACITY	FACILITY Q cfs	NET mg/L	FACILITY LOAD	NPS	STORM WATER	NET NPS
TOTAL PHOSPHORUS, lb/day								
10.0	0.100	5.39	8.83	0.072	3.43	1.96	0.04	1.92
20.0	0.100	10.78	17.66	0.072	6.85	3.93	0.08	3.85
30.0	0.100	16.17	26.49	0.072	10.28	5.89	0.12	5.77
40.0	0.100	21.56	35.32	0.072	13.71	7.85	0.16	7.70
50.0	0.100	26.95	44.15	0.072	17.13	9.82	0.20	9.62
60.0	0.100	32.34	52.98	0.072	20.56	11.78	0.24	11.54
70.0	0.100	37.73	61.81	0.072	23.99	13.74	0.27	13.47
80.0	0.100	43.12	70.64	0.072	27.41	15.71	0.31	15.39
90.0	0.100	48.51	79.47	0.072	30.84	17.67	0.35	17.32
100.0	0.100	53.90	88.30	0.072	34.27	19.63	0.39	19.24
TOTAL SUSPENDED SOLIDS, ton/year								
10.0	25.0	245.92	8.83	5.0	43.43	202.49	4.05	198.44
20.0	25.0	491.84	17.66	5.0	86.86	404.98	8.10	396.88
30.0	25.0	737.76	26.49	5.0	130.29	607.47	12.15	595.32
40.0	25.0	983.68	35.32	5.0	173.72	809.96	16.20	793.76
50.0	25.0	1229.59	44.15	5.0	217.15	1012.45	20.25	992.20

60.0	25.0	1475.51	52.98	5.0	260.58	1214.94	24.30	1190.64
70.0	25.0	1721.43	61.81	5.0	304.00	1417.43	28.35	1389.08
80.0	25.0	1967.35	70.64	5.0	347.43	1619.92	32.40	1587.52
90.0	25.0	2213.27	79.47	5.0	390.86	1822.41	36.45	1785.96
100.0	25.0	2459.19	88.30	5.0	434.29	2024.89	40.50	1984.40
GAP = General Aquaculture Permit. Q = Flow. TP = Total Phosphorus. NPS = Nonpoint source = agriculture, grazing, private land ownership, and in-stream corridor erosion factors.								

Existing mean low flow conditions indicate a stream channel flow of 23.22 cfs with a facility flow of 20.50 cfs. Under these conditions the loading capacity, facility load, and nonpoint source components would be summarized as follows:

TP Loading Capacity = 23.22 cfs x 0.100 mg/L TP x 5.39 = 12.51 lb/day TP
TP Facility Capacity = 20.50 cfs x 0.072 mg/L TP x 5.39 = 7.96 lb/day TP
TP Total Nonpoint Source = 12.51 lb/day – 7.96 lb/day = 4.56 lb/day TP
TP 2% Storm Water Load = 4.56 lb/day TP x 2% = 0.09 lb/day TP
TP Net Nonpoint Source Load = 4.56 lb/day – 0.09 lb/day = 4.47 lb/day TP

TSS Loading Capacity = 23.22 cfs x 25.0 mg/L TSS x 5.39 x 0.1825 = 570.93 ton/year TSS
TSS Facility Capacity = 20.50 cfs x 5.0 mg/L TSS x 5.39 x 0.1825 = 100.83 ton/year TSS
TSS Total Nonpoint Source = 570.93 ton/year – 100.83 ton/year = 470.11 ton/year TSS
TSS 2% Storm Water Load = 470.11 ton/year TSS x 2% = 9.40 ton/year TSS
TSS Net Nonpoint Source Load = 470.11 ton/year – 9.40 ton/year = 460.70 ton/year TSS

Table 7.1 shows that irrespective of stream flow, but with a facility net concentration of 0.072 mg/L TP or 5.0 mg/L TSS, and an in-stream target of 0.100 mg/L TP, there is sufficient reasonable assurance that the loading capacity of the stream will not be exacerbated above the in-stream concentration target for TP or TSS.

7.2 SPRINGS CREEK

Springs Creek is a tributary of Billingsley Creek with average flow conditions of about 5.0 cfs. Two point sources exist on Spring Creek – Lee Fish Hatchery and Johnson Fish Hatchery. Based on consumptive diversions the average availability of water from the stream channel to the facility under low flow conditions is 94.8% at the Lee Fish Hatchery and 83.3% at the Johnson Fish Hatchery. Table 7.2 provides the point sources (Lee's Fish Hatchery [GAP-050] and Johnson's Fish Hatchery [GAP-130]) and nonpoint source components for the headwaters of Billingsley Creek (from Curren Springs to Spring Creek) as part of the loading capacity for the stream segment. No other point sources exist. Nonpoint sources are defined as in Part 1 and Part 2 – agriculture, grazing, private land ownership, and in-stream corridor erosion factors.

Table 7.2 Lee's and Johnson's Fish Hatcheries (GAP-050 and GAP-130)

Margin of Safety = Implicit

STREAM Q cfs	TP TARGET mg/L	LOADING CAPACITY	FACILITY Q cfs	NET mg/L	FACILITY LOAD	TOTAL NPS	STORM WATER	NET NPS
LEE'S FISH HATCHERY (GAP-050)								
Lee's Fish Hatchery: TP, lb/day								
5.0	0.100	2.70	4.74	0.058	1.48	1.21	0.02	1.19
10.0	0.100	5.39	9.48	0.058	2.96	2.43	0.05	2.38

Lee's Fish Hatchery: TSS, ton/year								
5.0	25.0	122.96	4.74	5.0	23.31	99.65	1.99	97.65
10.0	25.0	245.92	9.48	5.0	46.63	199.29	3.99	195.31
JOHNSON'S FISH HATCHERY (GAP-130)								
Johnson's Fish Hatchery: TP, lb/day								
5.0	0.100	2.70	4.17	0.043	0.97	1.73	0.03	1.70
10.0	0.100	5.39	8.33	0.043	1.93	3.46	0.07	3.39
Johnson's Fish Hatchery: TSS, ton/year								
5.0	25.0	122.96	4.17	5.0	20.49	102.47	2.05	102.47
10.0	25.0	245.92	8.33	5.0	40.97	204.95	4.10	200.85
GAP = General Aquaculture Permit. Q = Flow. TP = Total Phosphorus. NPS = Nonpoint source = agriculture, grazing, private land ownership, and in-stream corridor erosion factors.								

Existing mean low flow conditions for the Lee Fish Hatchery indicate a stream channel flow of 3.48 cfs with a facility flow of 3.30 cfs. For the Johnson Fish Hatchery the stream channel flow is 3.48 cfs with facility flow of 2.90 cfs. Under these conditions the loading capacity, facility load, and nonpoint source components would be summarized as follows:

Lee Fish Hatchery (GAP-050)

TP Loading Capacity = 3.48 cfs x 0.100 mg/L TP x 5.39 = 1.88 lb/day TP
TP Facility Capacity = 3.30 cfs x 0.058 mg/L TP x 5.39 = 1.03 lb/day TP
TP Total Nonpoint Source = 1.88 lb/day – 1.03 lb/day = 0.84 lb/day TP
TP 2% Storm Water Load = 0.84 lb/day TP x 2% = 0.02 lb/day TP
TP Net Nonpoint Source Load = 0.84 lb/day – 0.02 lb/day = 0.83 lb/day TP

TSS Loading Capacity = 3.48 cfs x 25.0 mg/L TSS x 5.39 x 0.1825 = 85.60 ton/year TSS
TSS Facility Capacity = 3.30 cfs x 5.0 mg/L TSS x 5.39 x 0.1825 = 16.23 ton/year TSS
TSS Total Nonpoint Source = 85.60 ton/year – 16.23 ton/year = 69.37 ton/year TSS
TSS 2% Storm Water Load = 69.37 ton/year TSS x 2% = 1.39 ton/year TSS
TSS Net Nonpoint Source Load = 69.37 ton/year – 1.39 ton/year = 67.99 ton/year TSS

Johnson Fish Hatchery (GAP-130)

TP Loading Capacity = 3.48 cfs x 0.100 mg/L TP x 5.39 = 1.88 lb/day TP
TP Facility Capacity = 2.90 cfs x 0.043 mg/L TP x 5.39 = 0.67 lb/day TP
TP Total Nonpoint Source = 1.88 lb/day – 0.67 lb/day = 1.20 lb/day TP
TP 2% Storm Water Load = 1.20 lb/day TP x 2% = 0.02 lb/day TP
TP Net Nonpoint Source Load = 1.20 lb/day – 0.02 lb/day = 1.18 lb/day TP

TSS Loading Capacity = 3.48 cfs x 25.0 mg/L TSS x 5.39 x 0.1825 = 85.61 ton/year TSS
TSS Facility Capacity = 2.90 cfs x 5.0 mg/L TSS x 5.39 x 0.1825 = 14.26 ton/year TSS
TSS Total Nonpoint Source = 85.61 ton/year – 14.26 ton/year = 71.35 ton/year TSS
TSS 2% Storm Water Load = 71.35 ton/year TSS x 2% = 1.43 ton/year TSS
TSS Net Nonpoint Source Load = 71.35 ton/year – 1.43 ton/year = 69.92 ton/year TSS

Table 7.2 shows that irrespective of stream flow, but with a facility net concentration of 0.058 mg/L TP or 5.0 mg/L TSS, for Lee's Fish Hatchery; or, a facility net concentration of 0.043 mg/L TP or 5.0 mg/L TSS, for Johnson's Fish Hatchery, and an in-stream target of 0.100 mg/L TP or 25.0 mg/L TSS, there is sufficient reasonable assurance that the loading capacity of the stream will not be exacerbated above the in-stream concentration target for TP or TSS.

7.3 WEATHERBY SPRINGS COMPLEX

The Weatherby Springs Complex for the Jones Fish Hatchery is a combination of the Hoagland Tunnel and Weatherby Springs. Based on consumptive diversions the average availability of water from the stream channel to the facility under low flow conditions at the Jones Fish Hatchery is 88.5%. Only one point source (Jones Fish Hatchery) utilizes the water from the Weatherby Springs Complex but discharges to Billingsley Creek. Table 7.3 provides the point source (Jones Fish Hatchery, GAP-005) and nonpoint source components for this segment of Billingsley Creek (from Spring Creek to Weatherby Springs) as part of the loading capacity for the stream segment. No other point sources exist. Nonpoint sources are defined as in Part 1 and Part 2 – agriculture, grazing, private land ownership, and in-stream corridor erosion factors.

Table 7.3 Jones Fish Hatchery (GAP-005)

Margin of Safety = Implicit

STREAM Q cfs	TP TARGET mg/l	LOADING CAPACITY	FACILITY Q cfs	NET mg/L	FACILITY LOAD	TOTAL NPS	STORM WATER	NET NPS
TOTAL PHOSPHORUS, lb/day								
10.0	0.100	5.39	8.83	0.090	4.28	1.11	0.02	1.08
20.0	0.100	10.78	17.66	0.090	8.57	2.21	0.04	2.17
30.0	0.100	16.17	26.49	0.090	12.85	3.32	0.07	3.25
40.0	0.100	21.56	35.32	0.090	17.13	4.43	0.09	4.34
50.0	0.100	26.95	44.15	0.090	21.42	5.53	0.11	5.42
60.0	0.100	32.34	52.98	0.090	25.70	6.64	0.13	6.51
70.0	0.100	37.73	61.81	0.090	29.98	7.75	0.15	7.59
80.0	0.100	43.12	70.64	0.090	34.27	8.85	0.18	8.68
TOTAL SUSPENDED SOLIDS, ton/year								
10.0	25.0	245.92	8.83	5.0	43.43	202.49	4.05	198.44
20.0	25.0	491.84	17.66	5.0	86.86	404.98	8.10	396.88
30.0	25.0	737.76	26.49	5.0	130.29	607.47	12.15	595.32
40.0	25.0	983.68	35.32	5.0	173.72	809.96	16.20	793.76
50.0	25.0	1229.59	44.15	5.0	217.15	1012.45	20.25	992.20
60.0	25.0	1475.51	52.98	5.0	260.58	1214.94	24.30	1190.64
70.0	25.0	1721.43	61.81	5.0	304.00	1417.43	28.35	1389.08
80.0	25.0	1967.35	70.64	5.0	347.43	1619.92	32.40	1587.52

GAP = General Aquaculture Permit. Q = Flow. TP = Total Phosphorus. NPS = Nonpoint source = agriculture, grazing, private land ownership, and in-stream corridor erosion factors.

Existing mean low flow conditions indicate a stream channel flow of 42.71 cfs with a facility flow of 37.80 cfs. Under these conditions the loading capacity, facility load, and nonpoint source components would be summarized as follows:

TP Loading Capacity = 42.71 cfs x 0.100 mg/L TP x 5.39 = 23.02 lb/day TP
TP Facility Capacity = 37.80 cfs x 0.090 mg/L TP x 5.39 = 18.34 lb/day TP
TP Total Nonpoint Source = 23.02 lb/day – 18.34 lb/day = 4.68 lb/day TP
TP 2% Storm Water Load = 4.68 lb/day TP x 2% = 0.09 lb/day TP
TP Net Nonpoint Source Load = 4.68 lb/day – 0.09 lb/day = 4.59 lb/day TP

TSS Loading Capacity = 42.71 cfs x 25.0 mg/L TSS x 5.39 x 0.1825 = 1050.36 ton/year TSS

TSS Facility Capacity = 37.80 cfs x 5.0 mg/L TSS x 5.39 x 0.1825 = 185.91 ton/year TSS
TSS Total Nonpoint Source = 1050.36 ton/year – 185.91 ton/year = 864.45 ton/year TSS
TSS 2% Storm Water Load = 864.45 ton/year TSS x 2% = 17.29 ton/year TSS
TSS Net Nonpoint Source Load = 864.45 ton/year – 17.29 ton/year = 847.16 ton/year TSS

Table 7.3 shows that irrespective of stream flow, but with a facility net concentration of 0.090 mg/L TP or 5.0 mg/L TSS, for Jones Fish Hatchery; and an in-stream target of 0.100 mg/L TP or 25.0 mg/L TSS, there is sufficient reasonable assurance that the loading capacity of the stream will not be exacerbated above the in-stream concentration target for TP or TSS.

7.4 POTTER SPRINGS COMPLEX

The Potter Springs Complex for the Billingsley Creek Ranch (GAP-066) is a combination of Potter Springs, Hewitt Springs (which is now dry), Big Springs, and Three Springs. Based on consumptive diversions the average availability of water from the stream channel to the facility under low flow conditions is 97.0% at the Billingsley Creek Ranch.

Table 7.4 Billingsley Creek Ranch (GAP-066)

Margin of Safety = Implicit

STREAM Q cfs	STREAM TARGET mg/L	LOADING CAPACITY	FACILITY Q cfs	NET mg/L	FACILITY LOAD	TOTAL NPS	STORM WATER	NET NPS
TOTAL PHOSPHORUS, lb/day								
5.0	0.100	2.70	4.85	0.060	1.57	1.13	0.02	1.11
10.0	0.100	5.39	9.70	0.060	3.14	2.25	0.05	2.21
TOTAL SUSPENDED SOLIDS, ton/year								
5.0	25.0	122.96	4.85	5.0	23.85	99.11	1.98	97.12
10.0	25.0	245.92	9.70	5.0	47.71	198.21	3.96	194.21
GAP = General Aquaculture Permit. Q = Flow. TP = Total Phosphorus. NPS = Nonpoint source = agriculture, grazing, private land ownership, and in-stream corridor erosion factors.								

Existing mean low flow conditions indicate a stream channel flow of 7.32 cfs with a facility flow of 7.10 cfs. Under these conditions the loading capacity, facility load, and nonpoint source components would be summarized as follows:

TP Loading Capacity = 7.32 cfs x 0.100 mg/L TP x 5.39 = 3.95 lb/day TP
TP Facility Capacity = 7.10 cfs x 0.060 mg/L TP x 5.39 = 2.30 lb/day TP
TP Total Nonpoint Source = 3.95 lb/day – 2.30 lb/day = 1.65 lb/day TP
TP 2% Storm Water Load = 1.65 lb/day TP x 2% = 0.03 lb/day TP
TP Net Nonpoint Source Load = 1.65 lb/day – 0.03 lb/day = 1.62 lb/day TP

TSS Loading Capacity = 7.32 cfs x 25.0 mg/L TSS x 5.39 x 0.1825 = 180.00 ton/year TSS
TSS Facility Capacity = 7.10 cfs x 5.0 mg/L TSS x 5.39 x 0.1825 = 34.92 ton/year TSS
TSS Total Nonpoint Source = 180.00 ton/year – 34.92 ton/year = 145.08 ton/year TSS
TSS 2% Storm Water Load = 145.08 ton/year TSS x 2% = 2.90 ton/year TSS
TSS Net Nonpoint Source Load = 145.08 ton/year – 2.90 ton/year = 142.18 ton/year TSS

Table 7.4 shows that irrespective of stream flow, but with a facility net concentration of 0.060 mg/L TP or 5.0 mg/L TSS, for Billingsley Creek Ranch; and an in-stream target of 0.100 mg/L TP or 25.0 mg/L TSS, there is sufficient reasonable assurance that the loading capacity of the stream will not be exacerbated above the in-stream concentration target for TP or TSS.

7.5 UNIVERSITY OF IDAHO #1 AND #2

The University of Idaho (GAP-001; formerly Idaho Springs) is divided into two components – (1) The first component is from the Billingsley Creek side; and, (2) The second component is from the Big Springs complex via Fisher Lake. Based on the consumptive diversions of the first component, the average availability of water from the stream channel to the facility is 93.4% on the Billingsley Creek side. The second component, which is made up of Tupper Springs, Fisher Lake, and Big Springs; and based on the consumptive diversions of the second component, has an average availability from the stream channel to the facility of 92.3% on the spring complex side. Thus, the average water availability from #1 and #2 is 92.85%. Table 7.5 provides the point source (University of Idaho, GAP-001) and nonpoint source components for this segment of Billingsley Creek as part of the loading capacity for the stream segment. No other point sources exist. Nonpoint sources are defined as in Part 1 and Part 2 – agriculture, grazing, private land ownership, and in-stream corridor erosion factors.

Table 7.5 University of Idaho #1 and #2 (GAP-001)

Margin of Safety = Implicit

STREAM Q cfs	TP TARGET mg/L	LOADING CAPACITY	FACILITY Q cfs	NET mg/L	FACILITY LOAD	TOTAL NPS	STORM WATER	NET NPS
TOTAL PHOSPHORUS, lb/day								
10.0	0.100	5.39	9.29	0.033	1.65	3.74	0.07	3.66
25.0	0.100	13.48	23.21	0.033	4.13	9.35	0.19	9.16
50.0	0.100	26.95	46.43	0.033	8.26	18.69	0.37	18.32
75.0	0.100	40.43	69.64	0.033	12.39	28.04	0.56	27.48
100.0	0.100	53.90	92.85	0.033	16.52	37.38	0.75	36.64
125.0	0.100	67.38	116.06	0.033	20.64	46.73	0.93	45.80
150.0	0.100	80.85	139.28	0.033	24.77	56.08	1.12	54.96
175.0	0.100	94.33	162.49	0.033	28.90	65.42	1.31	64.11
TOTAL SUSPENDED SOLIDS, ton/year								
10.0	25.0	245.92	9.29	5.0	45.67	200.25	4.01	196.25
25.0	25.0	614.80	23.21	5.0	114.17	500.63	10.01	490.62
50.0	25.0	1229.59	46.43	5.0	228.34	1001.26	20.03	981.23
75.0	25.0	1844.39	69.64	5.0	342.50	1501.89	30.04	1471.85
100.0	25.0	2459.19	92.85	5.0	456.67	2002.52	40.05	1962.47
125.0	25.0	3073.98	116.06	5.0	570.84	2503.15	50.06	2453.08
150.0	25.0	3688.78	139.28	5.0	685.01	3003.77	60.08	2943.70
175.0	25.0	4303.58	162.49	5.0	799.17	3504.40	70.09	3434.32

GAP = General Aquaculture Permit. Q = Flow. TP = Total Phosphorus. NPS = Nonpoint source = agriculture, grazing, private land ownership, and in-stream corridor erosion factors.

Existing mean low flow conditions indicate a stream channel flow of 116.32 cfs with a facility flow of 108.00 cfs. Under these conditions the loading capacity, facility load, and nonpoint source components would be summarized as follows:

TP Loading Capacity = 116.32 cfs x 0.100 mg/L TP x 5.39 = 62.69 lb/day TP
TP Facility Capacity = 108.00 cfs x 0.033 mg/L TP x 5.39 = 19.21 lb/day TP
TP Total Nonpoint Source = 62.69 lb/day – 19.21 lb/day = 43.48 lb/day TP
TP 2% Storm Water Load = 43.48 lb/day TP x 2% = 0.87 lb/day TP
TP Net Nonpoint Source Load = 43.48 lb/day – 0.87 lb/day = 42.62 lb/day TP

TSS Loading Capacity = 116.32 cfs x 25.0 mg/L TSS x 5.39 x 0.1825 = 2860.44 ton/year TSS
TSS Facility Capacity = 108.00 cfs x 5.0 mg/L TSS x 5.39 x 0.1825 = 531.18 ton/year TSS
TSS Total Nonpoint Source = 2860.44 ton/year – 531.18 ton/year = 2329.26 ton/year TSS
TSS 2% Storm Water Load = 2329.26 ton/year TSS x 2% = 46.59 ton/year TSS
TSS Net Nonpoint Source Load = 2329.26 ton/year – 46.59 ton/year = 2282.67 ton/year TSS

Table 7.5 shows that irrespective of stream flow, but with a facility net concentration of 0.033 mg/L TP or 5.0 mg/L TSS, for the University of Idaho Fish Hatchery; and an in-stream target of 0.100 mg/L TP or 25.0 mg/L TSS, there is sufficient reasonable assurance that the loading capacity of the stream will not be exacerbated above the in-stream concentration target for TP or TSS.

7.6 TUPPER SPRINGS COMPLEX

The Tupper Springs component for the Tupper Springs Fish Hatchery is strictly for Tupper Springs. Based on consumptive diversions the average availability of water from the stream channel to the facility under low flow conditions is 66.7%.

Table 7.6 Tupper Springs Fish Hatchery (GAP-131)

Margin of Safety = Implicit

STREAM Q cfs	STREAM TARGET mg/L	LOADING CAPACITY	FACILITY Q cfs	NET mg/L	FACILITY LOAD	TOTAL NPS	STORM WATER	NET NPS
TOTAL PHOSPHORUS, lb/day								
5.0	0.100	2.70	3.34	0.045	0.81	1.89	0.04	1.85
10.0	0.100	5.39	6.67	0.045	1.62	3.77	0.08	3.70
TOTAL SUSPENDED SOLIDS, ton/year								
5.0	25.0	122.96	3.34	5.0	16.40	106.56	2.13	104.43
10.0	25.0	245.92	6.67	5.0	32.81	213.11	4.26	208.85
GAP = General Aquaculture Permit. Q = Flow. TP = Total Phosphorus. NPS = Nonpoint source = agriculture, grazing, private land ownership, and in-stream corridor erosion factors.								

Existing mean low flow conditions indicate a stream channel flow of 1.95 cfs with a facility flow of 1.30 cfs. Under these conditions the loading capacity, facility load, and nonpoint source components would be summarized as follows:

TP Loading Capacity = 1.95 cfs x 0.100 mg/L TP x 5.39 = 1.05 lb/day TP
TP Facility Capacity = 1.30 cfs x 0.045 mg/L TP x 5.39 = 0.32 lb/day TP
TP Total Nonpoint Source = 1.05 lb/day – 0.32 lb/day = 0.74 lb/day TP
TP 2% Storm Water Load = 0.74 lb/day TP x 2% = 0.01 lb/day TP
TP Net Nonpoint Source Load = 0.74 lb/day – 0.01 lb/day = 0.72 lb/day TP

TSS Loading Capacity = 1.95 cfs x 25.0 mg/L TSS x 5.39 x 0.1825 = 47.93 ton/year TSS
TSS Facility Capacity = 1.30 cfs x 5.0 mg/L TSS x 5.39 x 0.1825 = 6.39 ton/year TSS
TSS Total Nonpoint Source = 47.93 ton/year – 6.39 ton/year = 41.54 ton/year TSS
TSS 2% Storm Water Load = 41.54 ton/year TSS x 2% = 0.83 ton/year TSS
TSS Net Nonpoint Source Load = 41.54 ton/year – 0.83 ton/year = 40.71 ton/year TSS

Table 7.6 shows that irrespective of stream flow, but with a facility net concentration of 0.045 mg/L TP or 5.0 mg/L TSS, for Tupper Springs Fish Hatchery; and an in-stream target of 0.100 mg/L TP or 25.0

mg/L TSS, there is sufficient reasonable assurance that the loading capacity of the stream will not be exacerbated above the in-stream concentration target for TP or TSS.

7.7 HIDDEN SPRINGS

The Hidden Springs component for the Hidden Springs Fish Hatchery is strictly for Hidden Springs. Based on consumptive diversions the average availability of water from the stream channel to the facility under low flow conditions is 93.7%.

Table 7.7 Hidden Springs Fish Hatchery (GAP-048)

Margin of Safety = Implicit

STREAM Q cfs	STREAM TARGET mg/L	LOADING CAPACITY	FACILITY Q cfs	NET mg/L	FACILITY LOAD	TOTAL NPS	STORM WATER	NET NPS
TOTAL PHOSPHORUS, lb/day								
5.0	0.100	2.70	4.69	0.060	1.52	1.18	0.02	1.16
10.0	0.100	5.39	9.37	0.060	3.03	2.36	0.05	2.31
20.0	0.100	10.78	18.74	0.060	6.06	4.72	0.09	4.63
30.0	0.100	16.17	28.11	0.060	9.09	7.08	0.14	6.94
TOTAL SUSPENDED SOLIDS, ton/year								
5.0	25.0	122.96	4.69	5.0	23.04	99.92	2.00	97.92
10.0	25.0	245.92	9.37	5.0	46.09	199.83	4.00	195.84
20.0	25.0	491.84	18.74	5.0	92.17	399.67	7.99	391.67
30.0	25.0	737.76	28.11	5.0	138.26	599.50	11.99	587.51

GAP = General Aquaculture Permit. Q = Flow. TP = Total Phosphorus. NPS = Nonpoint source = agriculture, grazing, private land ownership, and in-stream corridor erosion factors.

Existing mean low flow conditions indicate a stream channel flow of 10.57 cfs with a facility flow of 9.90 cfs. Under these conditions the loading capacity, facility load, and nonpoint source components would be summarized as follows:

TP Loading Capacity = 10.57 cfs x 0.100 mg/L TP x 5.39 = 5.69 lb/day TP
TP Facility Capacity = 9.90 cfs x 0.060 mg/L TP x 5.39 = 3.20 lb/day TP
TP Total Nonpoint Source = 5.69 lb/day – 3.20 lb/day = 2.49 lb/day TP
TP 2% Storm Water Load = 2.49 lb/day TP x 2% = 0.05 lb/day TP
TP Net Nonpoint Source Load = 2.49 lb/day – 0.05 lb/day = 2.44 lb/day TP

TSS Loading Capacity = 10.57 cfs x 25.0 mg/L TSS x 5.39 x 0.1825 = 259.83 ton/year TSS
TSS Facility Capacity = 9.90 cfs x 5.0 mg/L TSS x 5.39 x 0.1825 = 48.69 ton/year TSS
TSS Total Nonpoint Source = 259.83 ton/year – 48.69 ton/year = 211.14 ton/year TSS
TSS 2% Storm Water Load = 211.14 ton/year TSS x 2% = 4.22 ton/year TSS
TSS Net Nonpoint Source Load = 211.14 ton/year – 4.22 ton/year = 206.91 ton/year TSS

Table 7.7 shows that irrespective of stream flow, but with a facility net concentration of 0.060 mg/L TP or 5.0 mg/L TSS, for Hidden Springs Fish Hatchery; and an in-stream target of 0.100 mg/L TP or 25.0 mg/L TSS, there is sufficient reasonable assurance that the loading capacity of the stream will not be exacerbated above the in-stream concentration target for TP or TSS.

7.8 FISHERIES DEVELOPMENT – CREEK SIDE AND SPRING SIDE

The Fisheries Development is divided into two components – (1) the first component is from the Billingsley Creek side; and, (2) The second component is from the Ruby Springs side. Based on the consumptive diversions of the first component, the average availability of water from the stream channel to the facility is 64.7% on the Billingsley Creek side. The second component, which is made up of Ruby Springs alone, and based on the consumptive diversions of the second component, has an average availability from the stream channel to the facility of 97.9% on the spring complex side. A weighted mean value of the average water availability would be 70.9%.

Table 7.8 Fisheries Development #1 and #2 (GAP-017)

Margin of Safety = Implicit

STREAM Q cfs	TP TARGET mg/L	LOADING CAPACITY	FACILITY Q cfs	NET mg/L	FACILITY LOAD	TOTAL NPS	STORM WATER	NET NPS
TOTAL PHOSPHORUS, lb/day								
10.0	0.100	5.39	7.09	0.065	2.48	2.91	0.06	2.85
25.0	0.100	13.48	17.73	0.065	6.21	7.27	0.15	7.12
50.0	0.100	26.95	35.45	0.065	12.42	14.53	0.29	14.24
75.0	0.100	40.43	53.18	0.065	18.63	21.80	0.44	21.36
100.0	0.100	53.90	70.90	0.065	24.84	29.06	0.58	28.48
125.0	0.100	67.38	88.63	0.065	31.05	36.33	0.73	35.60
150.0	0.100	80.85	106.35	0.065	37.26	43.59	0.87	42.72
TOTAL SUSPENDED SOLIDS, ton/year								
10.0	25.0	245.92	7.09	5.0	34.87	211.05	4.22	206.83
25.0	25.0	614.80	17.73	5.0	87.18	527.62	10.55	517.07
50.0	25.0	1229.59	35.45	5.0	174.36	1055.24	21.10	1034.13
75.0	25.0	1844.39	53.18	5.0	261.53	1582.86	31.66	1551.20
100.0	25.0	2459.19	70.90	5.0	348.71	2110.47	42.21	2068.27
125.0	25.0	3073.98	88.63	5.0	435.89	2638.09	52.76	2585.33
150.0	25.0	3688.78	106.35	5.0	523.07	3165.71	63.31	3102.40

GAP = General Aquaculture Permit. Q = Flow. TP = Total Phosphorus. NPS = Nonpoint source = agriculture, grazing, private land ownership, and in-stream corridor erosion factors.

Existing mean low flow conditions indicate a stream channel flow of 94.89 cfs with a facility flow of 92.90 cfs. Under these conditions the loading capacity, facility load, and nonpoint source components would be summarized as follows:

TP Loading Capacity = 94.89 cfs x 0.100 mg/L TP x 5.39 = 51.15 lb/day TP
TP Facility Capacity = 92.90 cfs x 0.065 mg/L TP x 5.39 = 32.55 lb/day TP
TP Total Nonpoint Source = 51.15 lb/day – 32.55 lb/day = 18.60 lb/day TP
TP 2% Storm Water Load = 18.60 lb/day TP x 2% = 0.37 lb/day TP
TP Net Nonpoint Source Load = 18.60 lb/day – 0.37 lb/day = 18.23 lb/day TP

TSS Loading Capacity = 94.89 cfs x 25.0 mg/L TSS x 5.39 x 0.1825 = 2333.59 ton/year TSS
TSS Facility Capacity = 92.90 cfs x 5.0 mg/L TSS x 5.39 x 0.1825 = 456.92 ton/year TSS
TSS Total Nonpoint Source = 2333.59 ton/year – 456.92 ton/year = 1876.67 ton/year TSS
TSS 2% Storm Water Load = 1876.67 ton/year TSS x 2% = 37.53 ton/year TSS
TSS Net Nonpoint Source Load = 1856.67 ton/year – 37.53 ton/year = 1839.14 ton/year TSS

Table 7.8 shows that irrespective of stream flow, but with a facility net concentration of 0.065 mg/L TP or 5.0 mg/L TSS, for the Fisheries Development Fish Hatchery; and an in-stream target of 0.100 mg/L

TP or 25.0 mg/L TSS, there is sufficient reasonable assurance that the loading capacity of the stream will not be exacerbated above the in-stream concentration target for TP or TSS.

7.9 FLORENCE LIVESTOCK SPRINGS

The Florence Livestock Springs component for the Emerald Valley Ranch Fish Hatchery (or Idaho State Park) is strictly for the Florence Livestock Springs. Based on consumptive diversions the average availability of water from the stream channel to the facility under low flow conditions is 97.4%%.

Table 7.9 Emerald Valley Ranch Fish Hatchery (GAP-132)

Margin of Safety = Implicit

STREAM Q cfs	STREAM TARGET mg/L	LOADING CAPACITY	FACILITY Q cfs	NET mg/L	FACILITY LOAD	TOTAL NPS	STORM WATER	NET NPS
TOTAL PHOSPHORUS, lb/day								
5.0	0.100	2.70	4.87	0.043	1.13	1.57	0.03	1.54
10.0	0.100	5.39	9.74	0.043	2.26	3.13	0.06	3.07
TOTAL SUSPENDED SOLIDS, ton/year								
5.0	25.0	122.96	4.87	5.0	23.95	99.01	1.98	97.03
10.0	25.0	245.92	9.74	5.0	47.93	198.01	3.96	194.05
GAP = General Aquaculture Permit. Q = Flow. TP = Total Phosphorus. NPS = Nonpoint source = agriculture, grazing, private land ownership, and in-stream corridor erosion factors.								

Existing mean low flow conditions indicate a stream channel flow of 3.80 cfs with a facility flow of 3.70 cfs. Under these conditions the loading capacity, facility load, and nonpoint source components would be summarized as follows:

TP Loading Capacity = 3.80 cfs x 0.100 mg/L TP x 5.39 = 2.05 lb/day TP
TP Facility Capacity = 3.70 cfs x 0.043 mg/L TP x 5.39 = 0.86 lb/day TP
TP Total Nonpoint Source = 2.05 lb/day – 0.86 lb/day = 1.19 lb/day TP
TP 2% Storm Water Load = 1.19 lb/day TP x 2% = 0.02 lb/day TP
TP Net Nonpoint Source Load = 1.19 lb/day – 0.02 lb/day = 1.17 lb/day TP

TSS Loading Capacity = 3.80 cfs x 25.0 mg/L TSS x 5.39 x 0.1825 = 93.42 ton/year TSS
TSS Facility Capacity = 3.70 cfs x 5.0 mg/L TSS x 5.39 x 0.1825 = 18.20 ton/year TSS
TSS Total Nonpoint Source = 93.42 ton/year – 18.20 ton/year = 75.22 ton/year TSS
TSS 2% Storm Water Load = 75.22 ton/year TSS x 2% = 1.50 ton/year TSS
TSS Net Nonpoint Source Load = 75.22 ton/year – 1.50 ton/year = 73.72 ton/year TSS

Table 7.9 shows that irrespective of stream flow, but with a facility net concentration of 0.043 mg/L TP or 5.0 mg/L TSS, for the Emerald Valley Ranch Fish Hatchery; and an in-stream target of 0.100 mg/L TP or 25.0 mg/L TSS, there is sufficient reasonable assurance that the loading capacity of the stream will not be exacerbated above the in-stream concentration target for TP or TSS.

7.10 TALBOTT'S FISH HATCHERY

The Billingsley Creek portion has a component for the Talbott Fish Hatchery that is strictly from the Billingsley Creek side. Its component is the average availability of water from the stream channel to the facility under low flow conditions and is 20.6%.

Table 7.10 Talbott's Fish Hatchery (GAP-083)

Margin of Safety = Implicit

STREAM Q cfs	STREAM TARGET mg/L	LOADING CAPACITY	FACILITY Q cfs	NET mg/L	FACILITY LOAD	TOTAL NPS	STORM WATER	NET NPS
TOTAL PHOSPHORUS, lb/day								
5.0	0.100	2.70	1.03	0.043	0.24	2.46	0.05	2.41
10.0	0.100	5.39	2.06	0.043	0.48	4.91	0.10	4.81
15.0	0.100	8.09	3.09	0.043	0.72	7.37	0.15	7.22
20.0	0.100	10.78	4.12	0.043	0.95	9.83	0.20	9.63
TOTAL SUSPENDED SOLIDS, ton/year								
5.0	25.0	122.96	1.03	5.0	5.07	117.89	2.36	115.54
10.0	25.0	245.92	2.06	5.0	10.13	235.79	4.72	231.07
15.0	25.0	368.88	3.09	5.0	15.20	353.68	7.07	346.61
20.0	25.0	491.84	4.12	5.0	20.26	471.57	9.43	462.14

GAP = General Aquaculture Permit. Q = Flow. TP = Total Phosphorus. NPS = Nonpoint source = agriculture, grazing, private land ownership, and in-stream corridor erosion factors.

Existing mean low flow conditions indicate a stream channel flow of 51.94 cfs with a facility flow of 10.70 cfs. Under these conditions the loading capacity, facility load, and nonpoint source components would be summarized as follows:

TP Loading Capacity = 51.94 cfs x 0.100 mg/L TP x 5.39 = 28.00 lb/day TP
TP Facility Capacity = 10.70 cfs x 0.043 mg/L TP x 5.39 = 2.48 lb/day TP
TP Total Nonpoint Source = 28.00 lb/day – 2.48 lb/day = 25.52 lb/day TP
TP 2% Storm Water Load = 25.52 lb/day TP x 2% = 0.51 lb/day TP
TP Net Nonpoint Source Load = 25.52 lb/day – 0.51 lb/day = 25.01 lb/day TP

TSS Loading Capacity = 51.94 cfs x 25.0 mg/L TSS x 5.39 x 0.1825 = 1277.34 ton/year TSS
TSS Facility Capacity = 10.70 cfs x 5.0 mg/L TSS x 5.39 x 0.1825 = 52.63 ton/year TSS
TSS Total Nonpoint Source = 1277.34 ton/year – 52.63 ton/year = 1224.72 ton/year TSS
TSS 2% Storm Water Load = 1224.72 ton/year TSS x 2% = 24.49 ton/year TSS
TSS Net Nonpoint Source Load = 1224.72 ton/year – 24.49 ton/year = 1200.22 ton/year TSS

Table 7.10 shows that irrespective of stream flow, but with a facility net concentration of 0.043 mg/L TP or 5.0 mg/L TSS, for Talbott's Fish Hatchery; and an in-stream target of 0.100 mg/L TP or 25.0 mg/L TSS, there is sufficient reasonable assurance that the loading capacity of the stream will not be exacerbated above the in-stream concentration target for TP or TSS.

7.11 BOYER'S FISH HATCHERY

The South Lateral Billingsley Creek portion has a component for the Boyer Fish Hatchery that is strictly from the South Lateral Billingsley Creek side. Its component is the average availability of water from the stream channel to the facility under low flow conditions and is 57.5%.

Table 7.11 Boyer's Fish Hatchery (GAP-096)

Margin of Safety = Implicit

STREAM Q cfs	STREAM TARGET	LOADING CAPACITY	FACILITY Q cfs	NET mg/L	FACILITY LOAD	TOTAL NPS	STORM WATER	NET NPS

	mg/L							
TOTAL PHOSPHORUS, lb/day								
5.0	0.100	2.70	2.88	0.043	0.67	2.03	0.04	1.99
10.0	0.100	5.39	5.75	0.043	1.33	4.06	0.08	3.98
15.0	0.100	8.09	8.63	0.043	2.00	6.09	0.12	5.96
TOTAL SUSPENDED SOLIDS, ton/year								
5.0	25.0	122.96	2.88	5.0	14.14	108.82	2.18	106.64
10.0	25.0	245.92	5.75	5.0	28.28	217.64	4.35	213.29
15.0	25.0	368.88	8.63	5.0	42.42	326.46	6.53	319.93
GAP = General Aquaculture Permit. Q = Flow. TP = Total Phosphorus. NPS = Nonpoint source = agriculture, grazing, private land ownership, and in-stream corridor erosion factors.								

Existing mean low flow conditions indicate a stream channel flow of 9.41 cfs with a facility flow of 5.41 cfs. Under these conditions the loading capacity, facility load, and nonpoint source components would be summarized as follows:

TP Loading Capacity = 9.41 cfs x 0.100 mg/L TP x 5.39 = 5.07 lb/day TP
TP Facility Capacity = 5.41 cfs x 0.043 mg/L TP x 5.39 = 1.25 lb/day TP
TP Total Nonpoint Source = 5.07 lb/day – 1.25 lb/day = 3.82 lb/day TP
TP 2% Storm Water Load = 3.82 lb/day TP x 2% = 0.08 lb/day TP
TP Net Nonpoint Source Load = 3.82 lb/day – 0.08 lb/day = 3.74 lb/day TP

TSS Loading Capacity = 9.41 cfs x 25.0 mg/L TSS x 5.39 x 0.1825 = 231.38 ton/year TSS
TSS Facility Capacity = 5.41 cfs x 5.0 mg/L TSS x 5.39 x 0.1825 = 26.61 ton/year TSS
TSS Total Nonpoint Source = 231.38 ton/year – 26.61 ton/year = 204.77 ton/year TSS
TSS 2% Storm Water Load = 204.77 ton/year TSS x 2% = 4.1 ton/year TSS
TSS Net Nonpoint Source Load = 204.77 ton/year – 4.1 ton/year = 200.67 ton/year TSS

Table 7.11 shows that irrespective of stream flow, but with a facility net concentration of 0.043 mg/L TP or 5.0 mg/L TSS, for Hidden Springs Fish Hatchery; and an in-stream target of 0.100 mg/L TP or 25.0 mg/L TSS, there is sufficient reasonable assurance that the loading capacity of the stream will not be exacerbated above the in-stream concentration target for TP or TSS.

7.12 SUMMARY OF EXISTING CONDITIONS

Table 7.12 summarizes the existing average conditions relative to water volume and what the wasteload allocations would ultimately end up being assuming conditions remained “as is”. If water volume increases due to more favorable aquifer conditions, then the existing conditions would need to be modified accordingly and thus reflect such changes in their NPDES permit. There is no guarantee that former water conditions will return even if existing conditions change for the better. Under existing conditions with Curren Springs discharging 25.0 cfs or less into Billingsley Creek, the discharge of water from Billingsley Creek into the Snake River is less than 12.0 cfs. Bear in mind that average conditions as presently existing represent a very low flow scenario.

Table 7.12 Summary of Existing Conditions on Billingsley Creek and in the Facilities

Margin of Safety = Implicit

GAP NO.	STREAM FLOW cfs	LOADING CAPACITY	FACILITY FLOW cfs	NET mg/L	FACILITY LOAD	TOTAL NPS LOAD	STORM WATER LOAD	NET NPS LOAD
TOTAL PHOSPHORUS, lb/day								

GAP-015	23.22	12.51	20.50	0.072	7.96	4.56	0.09	4.47
GAP-050	3.48	1.88	3.30	0.058	1.03	0.84	0.02	0.83
GAP-130	3.48	1.88	2.90	0.043	0.67	1.20	0.02	1.18
GAP-005	42.71	23.02	37.80	0.090	18.34	4.68	0.09	4.59
GAP-066	7.32	3.95	7.10	0.060	2.30	1.65	0.03	1.62
GAP-001	116.32	62.69	108.00	0.033	19.21	43.48	0.87	42.62
GAP-131	1.95	1.05	1.30	0.045	0.32	0.74	0.01	0.72
GAP-048	10.57	5.69	9.90	0.060	3.20	2.49	0.05	2.44
GAP-017	94.89	51.15	92.90	0.065	32.55	18.60	0.37	18.23
GAP-132	3.80	2.05	3.70	0.043	0.86	1.19	0.02	1.17
GAP-083	51.94	28.00	10.70	0.043	2.48	25.52	0.51	25.01
GAP-096	9.41	5.07	5.41	0.043	1.25	3.82	0.08	3.74
TOTAL	369.08	198.94	303.51	0.055[A]	90.16	108.78	2.18	106.60
TOTAL SUSPENDED SOLIDS, ton/year								
GAP-015	23.22	570.93	20.50	5.0	100.83	470.11	9.40	460.70
GAP-050	3.48	85.60	3.30	5.0	16.23	69.37	1.39	67.99
GAP-130	3.48	85.61	2.90	5.0	14.26	71.35	1.43	69.92
GAP-005	42.71	1050.36	37.80	5.0	185.91	864.45	17.29	847.16
GAP-066	7.32	180.00	7.10	5.0	34.92	145.08	2.90	142.18
GAP-001	116.32	2860.44	108.00	5.0	531.18	2329.26	46.59	2282.67
GAP-131	1.95	47.93	1.30	5.0	6.39	41.54	0.83	40.71
GAP-048	10.57	259.83	9.90	5.0	48.69	211.14	4.22	206.91
GAP-017	94.89	2333.59	92.90	5.0	456.92	1876.67	37.53	1839.14
GAP-132	3.80	93.42	3.70	5.0	18.20	75.22	1.50	73.72
GAP-083	51.94	1277.34	10.70	5.0	52.63	1224.72	24.49	1200.22
GAP-096	9.41	231.38	5.41	5.0	26.61	204.77	4.1	200.67
TOTAL	369.08	9076.45	303.51	5.0[A]	1492.78	7583.68	151.67	7432.00
GAP = General Aquaculture Permit. [A] The Net mg/L represents a weighted mean value.								

There is a reasonable assurance that water quality standards and beneficial uses will be met due to the following conditions:

1. Relative to the in-stream standard of 0.100 mg/L TP as a surrogate for beneficial use attainment, there is a high probability that it will be achieved because recent water quality monitoring of Billingsley Creek indicates that the TP concentrations are at or below the instream standard. Billingsley Creek water quality TP monitoring ranged from 0.056 mg/L to 0.090 mg/L TP with a mean value of 0.073 mg/L TP.

2. Relative to the net TP discharge from each facility, there is a high probability that individually and collectively the discharge concentration will be substantially less than the in-stream 0.100 mg/L TP concentration based on the actual net discharge from each facility. The range of the TP concentration in the effluent is from 0.033 mg/L to 0.090 mg/L TP with a weighted mean of 0.055 mg/L TP.

3. Relative to the in-stream standard of 25.0 mg/L TSS as a surrogate for beneficial use attainment, there is a high probability that it will be achieved because recent water quality monitoring of Billingsley Creek indicates that the TSS concentrations are at or below the instream standard. Billingsley Creek

water quality TSS monitoring was well below the 25.0 mg/L TSS in-stream standard.

4. Relative to the net TSS discharge from each facility, there is a high probability that individually and collectively the discharge concentration will be substantially less than the facility net 5.0 mg/L TSS concentration based on the actual net discharge from each facility. The TSS concentration in the effluent is substantially less than 5.0 mg/L TSS, which is also substantially less than 25.0 mg/L in-stream surrogate water quality standard for TSS.

8.0 REASONABLE ASSURANCE IN BENEFICIAL USE ATTAINMENT

Reasonable assurance in beneficial use attainment has been reviewed previously in each stream segment of Billingsley Creek (including its tributaries) in §7.0. Consequently, we may conclude that if the loading capacities of these stream segments and tributaries are met, the loading capacity of Billingsley Creek will be met, and thus beneficial uses will be attained in the creek and in its tributaries. As such,

1. Point Source Reasonable Assurance. There is a reasonable assurance that point sources will meet their wasteload allocations because the Clean Water Act requires NPDES permits contain limits consistent with approved wasteload allocations. Each TMDL that has a point source has the point source wasteload allocation intended to achieve, in conjunction with reductions from nonpoint sources, compliance with Water Quality Standards and beneficial use attainment. Within the body of the Upper Snake Rock TMDL Modification, Billingsley Creek has been set up purposefully to meet the in-stream surrogate targets (0.100 mg/L TP and 25.0 mg/L TSS). In so doing, there is reasonable assurance that beneficial uses will be achieved.

2. Nonpoint Source Reasonable Assurance. There is a reasonable assurance that nonpoint sources will meet their wasteload allocations and thereby help achieve compliance with Water Quality Standards. Nonpoint source load allocations will be implemented by stakeholders in compliance with designated agencies' best management practices pursuant to Idaho Code §39-3612 and the Water Quality Standards. Within Billingsley Creek there exist nonpoint sources that are specifically structured to meet the surrogate water quality targets for beneficial use attainment. Presently, there are implementation projects ongoing in Billingsley Creek to help achieve beneficial use.

3. Tributaries' Load Capacity. The load capacity of all tributaries is subject to instream water quality targets of 0.100 mg/L TP and 25.0 mg/L TSS. The water quality targets of 0.100 mg/L TP and 25.0 mg/L TSS are based on free-flowing streams discharging into other free-flowing streams. In streams where the designation is special resource water or drinking water supply, a 25.0 mg/L TSS water quality target has been used with a 0.100 mg/L TP target. All point sources and nonpoint sources have been assigned wasteload and load allocations to meet the water quality targets for beneficial use attainment. No aquaculture facility on Billingsley Creek caused any tributary to exceed the TMDL instream targets. We can thus assume that if these surrogate targets are indeed met by the Year 2010, the beneficial uses of the tributaries will be attained.

4. Groundwater Load Capacity. Billingsley Creek is a springfed system. Therefore, all springs that are discharging into Billingsley Creek or an associated tributary have been set to an instream water quality target surrogate of 0.020 mg/L TP and 1.3

mg/L TSS. In the event that the water quality in the groundwater for TP or TSS elevates statistically to a significant level, then DEQ with the Mid-Snake WAG will re-evaluate the entire TMDL for additional reduction goals. The main premise of the present Upper Snake Rock TMDL is based on groundwater water quality not elevating to significant levels above 0.020 mg/L TP or 1.3 mg/L TSS.

Based on the foregoing discussion, there is reasonable assurance that water quality standards and beneficial uses will be reached for TP and TSS as a consequence of the wasteload allocations for the various aquaculture facilities and load allocations for nonpoint sources. A preliminary mid-course assessment is scheduled for Year 2005 with a final assessment in the Year 2010.

9.0 REFERENCES

The following references are cited within this Part 3 TMDL modification document and originally appeared in the Part 1 document.

Buhidar B. B. 1997. The Middle Snake River Watershed Management Plan – Phase I. [*Also referred to as the Mid-Snake TMDL*.] Twin Falls (ID): IDEQ-TFRO.

Buhidar B. B. 1999A. The Upper Snake Rock Watershed Management Plan. [*Also referred to as the Upper Snake Rock TMDL*.] Twin Falls (ID): IDEQ-TFRO.

Buhidar B. B. 1999B. Technical Support Document (TSD) for the Development of the Upper Snake Rock Watershed Management Plan. Twin Falls (ID): IDEQ-TFRO.

Buhidar B. B. 2000. TMDL Executive Summary (for) Upper Snake/Rock Subbasin TMDL. [*Also referred to as the Executive Summary*.] Twin Falls (ID): IDEQ-TFRO.

Buhidar B. B. 2004. Upper Snake Rock TMDL Modification – Part 1 – Draft. Twin Falls (ID): IDEQ-TFRO.

Buhidar B. B. and Sharpnack R. 2003. Draft Staff Analysis: A Determination of Reasonable Assurance Using Localized Impacts and Accumulative Impacts Assessments on the Proposed Aquaculture Industry Wasteload Allocations for the Middle Snake River and Its Tributaries. Twin Falls (ID): IDEQ-TFRO.

Clemen B. 2001. Assessing 10-50-90s: A Surprise. Decision Analysis Newsletter, Volume 20, Number 1 (April 2001). Englewood (CO): Decision Analysis Society.

IDEQ-TFRO. 1995. The Middle Snake River Nutrient Management Plan Public Review Draft. Twin Falls (ID): IDEQ-TFRO.

Hauer F. R. and Lamberti G. A. 1996. Methods in stream ecology. San Diego (CA): Academic Press.

Smith R. A. and Alexander R. B. ca2000. Sources of Nutrients in the Nation's Watersheds. Internet site: Reston (VA): USGS.

Thomann R. V. and Mueller J. A. 1987. Principles of surface water quality modeling and control. New York (NY): Harper Collins Publishers Inc.

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