Lower Boise River TMDL

2015 Total Phosphorus Addendum

Hydrologic Unit Code 17050114

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Cover Photo: Anglers in the lower Boise River near Star, Idaho (October 30, 2013).

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Prepared by
Idaho Department of Environmental Quality
Boise Regional Office
1445 N. Orchard Street
Boise, Idaho 83706

In Consultation with the
Lower Boise Watershed Council

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Abbreviations, Acronyms, and Symbols

§	section (usually a section of federal or state rules or statutes)
§303(d)	refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired water bodies required by this section
ACHD	Ada County Highway District
AU	assessment unit
BAG	basin advisory group
BMP	best management practice
BURP	Beneficial Use Reconnaissance Program
CFR	Code of Federal Regulations (refers to citations in the federal administrative rules)
cfs	cubic feet per second
CGP	Construction General Permit
CWAL	cold water aquatic life
DEQ	Idaho Department of Environmental Quality
DMR	discharge monitoring report
DO	dissolved oxygen
DWx	dry weather
EPA	United States Environmental Protection Agency
FS	fully supporting
GIS	geographic information system
IDAPA	Refers to citations of Idaho administrative rules
IDFG	Idaho Department of Fish and Game
IDL	Idaho Department of Lands
ISDA	Idaho State Department of Agriculture
ISWCC	Idaho Soil and Water Conservation Commission
LA	load allocation
lb	pound
LBWC	Lower Boise Watershed Council
LC	load capacity
mg/L	milligrams per liter
mgd	million gallons per day
mL	milliliter
MOS	margin of safety
MS4	municipal separate storm sewer system
MSGP	Multi-Sector General Permit
n/a	not applicable
NA	not assessed
NB	natural background
NFS	not fully supporting
NPDES	National Pollutant Discharge Elimination System
NTU	nephelometric turbidity unit

OP	orthophosphate
PCR	primary contact recreation
POTW	publicly owned treatment works
RM	river mile
SCR	secondary contact recreation
SR-HC	Snake River-Hells Canyon
SS	salmonid spawning
SSC	suspended sediment concentration
SWPPP	stormwater pollution prevention plan
TAC	technical advisory committee
TMDL	total maximum daily load
TN	total nitrogen
TP	total phosphorus
UA	urbanized area
US	United States
USC	United States Code
USGS	United States Geological Survey
WAG	watershed advisory group
WLA	wasteload allocation
WWx	wet weather
µg	microgram

Executive Summary

The federal Clean Water Act requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 303 of the Clean Water Act, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters. Section 303(d) of the Clean Water Act establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards).

States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. Currently, this list is published every 2 years as the list of Category 5 water bodies in Idaho's Integrated Report. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. This document addresses 2 assessment units (AUs) of the lower Boise River that have been placed in Category 5 of Idaho's most recent federally approved Integrated Report (DEQ 2014c).

This document is an addendum to the *Lower Boise River TMDL: Subbasin Assessment, Total Maximum Daily Loads* (DEQ 1999). The subbasin assessment portion of the document (sections 1–4) describes the key physical and biological characteristics of the subbasin; water quality concerns and status; total phosphorus (TP) sources; and recent TP pollution control actions in the Lower Boise River subbasin, located in southwest Idaho. For more detailed information about the subbasin, see the Lower Boise River subbasin assessment and TMDL, addendums, and 5-year review (DEQ 1999, 2008a, 2009, 2010b).

The TMDL analysis (section 5) establishes TP targets and load capacities, estimates existing TP loads, and allocates responsibility for TP load reductions needed to return listed waters to a condition meeting water quality standards. It also identifies implementation strategies—including reasonable time frames, approach, responsible parties, and monitoring strategies—necessary to achieve load reductions and meet water quality standards in the future.

This addendum addresses TP in the lower Boise River between Diversion Dam and Parma. Nuisance levels of aquatic growth associated with TP in the lower Boise River from Middleton to the mouth were associated with impaired cold water aquatic life and contact recreation beneficial uses in the 2012 Integrated Report (DEQ 2014c). The Lower Boise River subbasin is a physically complex network that includes multiple sources that contribute to TP levels and nuisance algae. These sources include tributaries, irrigation conveyances, ground water inflows, unmeasured flows, publicly owned treatment works (POTW), municipal separate storm sewer systems (MS4s), industrial wastewater and stormwater, and other nonpoint and point sources.

This subbasin assessment and TMDL addendum quantifies TP pollutant sources and identifies responsibility for load and wasteload allocations needed for the lower Boise River to achieve water quality standards. For more detailed information about the subbasin, see the following documents:

- *Lower Boise River: TMDL Five-Year Review* (DEQ 2009b)
- *Lower Boise River Implementation Plan Total Phosphorus* (DEQ 2008)

- *Sediment and Bacteria Allocations Addendum to the Lower Boise River TMDL* (DEQ and LBWC 2008)
- *Snake River – Hells Canyon Total Maximum Daily Load (TMDL)* (DEQ and ODEQ 2004)
- *Implementation Plan for the Lower Boise River Total Maximum Daily Load* (DEQ 2003)
- *Lower Boise River TMDL: Subbasin Assessment, Total Maximum Daily Loads* (DEQ 1999)
- *Lower Boise River Nutrient & Tributary Subbasin Assessments* (DEQ 2001c)
- *Lake Lowell TMDL: Addendum to the Lower Boise River Subbasin Assessment and Total Maximum Daily Loads* (DEQ 2010b)

Subbasin at a Glance

The Lower Boise River subbasin is identified in the Idaho water quality standards as water body ID17050114, with 36 AUs and several site-specific standards (IDAPA 58.01.02.140.12). The subbasin drains approximately 1,290 square miles of rangeland, forests, agricultural lands, and urban areas into the Snake River at the confluence between the cities of Adrian and Nyssa, Oregon. The lower Boise River is a 64-mile long 7th-order stream that flows northwest from the Lucky Peak Dam outfall east of Boise, through Ada and Canyon Counties, to its mouth on the Snake River near Parma, Idaho. The subbasin also drains portions of Elmore, Gem, Payette, and Boise Counties. The lower Boise River has at least seven 3rd-order, one 4th-order, and one 6th-order tributaries (Figure A).

This addendum specifically addresses the following two impaired AUs:

- Boise River—Indian Creek to Mouth (ID17050114SW001_06)
- Boise River—Middleton to Indian Creek (ID17050114SW005_06b)

Tributary and upstream AUs that are not listed as impaired are addressed as pollutant sources to the downstream impaired AUs.

The impaired beneficial uses in the subbasin are cold water aquatic life, contact recreation, and salmonid spawning. TP pollutant sources to the lower Boise River include contributions from upstream of Lucky Peak Dam (considered background for purposes in this TMDL), tributaries, POTWs, stormwater, industrial discharges, agricultural and irrigation returns, ground water, and unmeasured sources (e.g., drains and septic systems).

The lower Boise River is one of five major tributaries to the Snake River that received a TP allocation of ≤0.07 milligrams per liter (mg/L) from May 1 through September 30 in the Snake River-Hells Canyon (SR-HC) TMDL (DEQ and ODEQ 2004).

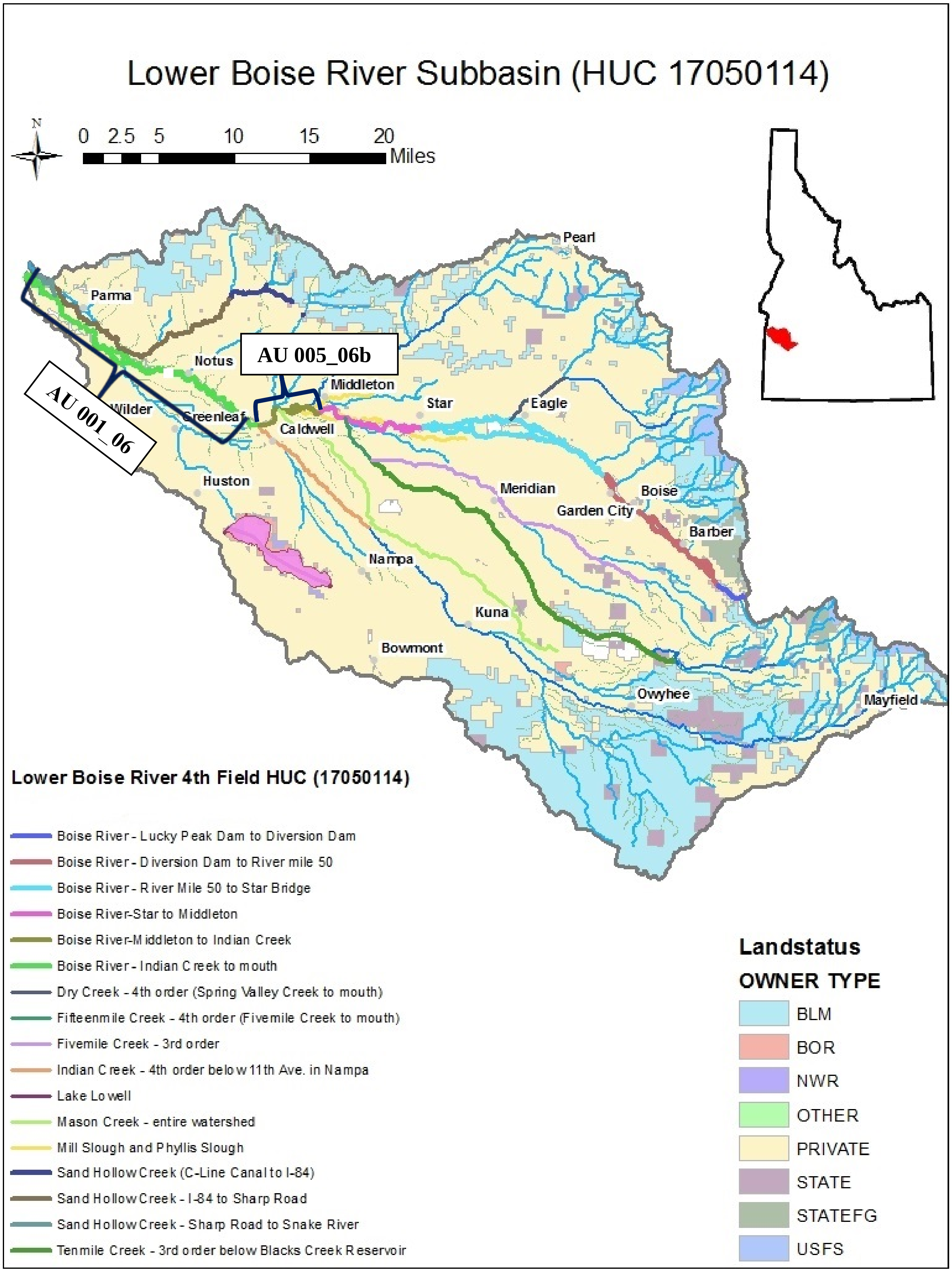

Figure A. The Lower Boise River subbasin.

The impaired AUs (ID17050114SW001_06 and ID17050114SW005_06b) on the lower Boise River are specifically addressed in this TMDL addendum and are identified by their AU number on Figure A.

Key Findings

The lower Boise River from Middleton to the confluence with the Snake River is listed as impaired (Category 5) from TP or nutrients suspected in the 2012 Integrated Report (Table A). In addition, upstream and tributary AUs that are not listed as impaired in the 2012 Integrated Report are addressed as pollutant sources for the impaired AUs. This TMDL does not address potential impairment in the unlisted AUs of the Lower Boise River subbasin. The lower Boise River has designated or existing beneficial uses of cold water aquatic life, salmonid spawning, and contact recreation.

These beneficial uses are impaired by TP from point and nonpoint sources. Increasing concentrations of TP in the river can result in elevated benthic (attached) and sestonic (suspended) algae and negatively impact ecological and recreational conditions such as dissolved oxygen, pH, macroinvertebrate and fish abundances and community composition, swimming, fishing, boating, and aesthetics.

Table A. Summary of 303(d)-listed assessment units and outcomes in this TMDL.

Water Body	Assessment Unit	Pollutant	TMDL Completed	Recommended Changes to the Next Integrated Report	Justification
Boise River—Indian Creek to Mouth	ID17050114SW001_06	Total phosphorus	Yes	Move to Category 4a	TP TMDL completed
Boise River—Middleton to Indian Creek	ID17050114SW005_06b	Total phosphorus	Yes	Move to Category 4a	TP TMDL completed

The 2012 Integrated Report also places the lower Boise River, from Diversion Dam to the mouth, in Category 4c—waters of the state not impaired by a pollutant but by pollution. The 1999 TMDL states the following:

> Many of man's activities in the lower Boise River watershed contribute to degradation of flow and habitat conditions. Flow manipulation for flood control, irrigation, impoundments, flood control activities such as clearing debris and construction of levees, gravel mining, unscreened diversions, angling pressure and barriers in the river all have adverse effects on habitat. It is DEQ's position that habitat modification and flow alteration, which may adversely affect beneficial uses, are not pollutants under Section 303(d) of the Clean Water Act. There are no water quality standards for habitat or flow, nor are they suitable for estimation of load capacity or load allocations. Because of these practical limitations, TMDLs will not be developed to address habitat modification or flow alteration. (DEQ 1999, p. 48)

This addendum relies on a staged implementation strategy as referenced in the US Environmental Protection Agency's (EPA's) phased TMDL clarification memo (EPA 2006). The staged implementation strategy for the lower Boise River acknowledges that National Pollutant Discharge Elimination System (NPDES)-permitted point sources will strive to achieve the

TMDL target as soon as possible through compliance schedules that will be written into the NPDES permits consistent with 40 CFR 122.47.

However, this addendum does not define an implementation time frame for agricultural and other nonpoint sources; rather, implementation should begin as soon as possible and continue until the load allocation targets are met. Successfully achieving the TMDL targets and nonpoint source allocations will depend on voluntary measures, including but not limited to, available funding, cost-sharing, willing partners, and opportunities for water quality trading.

The Idaho Department of Environmental Quality (DEQ), through this addendum, encourages water quality trading to the extent possible and practicable. Upon EPA approval of the TMDL addendum, water quality trading implementation and details specific to the Lower Boise River subbasin will subsequently be updated in the lower Boise River water quality trading framework. Additionally, an updated implementation plan will be developed by designated management agencies, including the Idaho Soil and Water Conservation Commission (ISWCC), to address load reductions.

Idaho Code §39-3611 provides for the review of TMDLs, their allocations, and their assumptions every 5 years. Accordingly, the lower Boise River TP TMDL addendum should include compliance monitoring to assess the 5-year benchmarks, and new data obtained during implementation will help measure the success of reaching water quality goals for both the SR-HC target attainment and beneficial use attainment in the Lower Boise River subbasin. During implementation, monitoring and analyses should be conducted under DEQ, US Geological Survey (USGS), EPA, or other scientifically defensible and approved protocols.

Recognizing the many uncertainties in achieving the agricultural and other nonpoint source load allocations over the long-term, an adaptive management-type approach for implementation should address the following:

- Available funding, cost-sharing, and willing partners to help manage agricultural and other nonpoint source TP contributions
- Effectiveness of agricultural best management practices (BMPs)
- Ability of ground water phosphorus levels to recover in land conversion and nutrient reduction areas
- Future drainage and water management policies
- Rate of land use conversion
- Effects of land use conversion on runoff and infiltration

TMDL Targets

This TMDL addendum focuses on two primary targets:

1. **May 1–September 30 TP Concentration:** TP concentrations (and TP load equivalents[1]) $\leq$ 0.07 mg/L in the lower Boise River near Parma to achieve the 2004 SR-HC TMDL TP target (Table B)

[1] TP load equivalent, for purposes of this TMDL, is defined as the mass of TP (e.g., pounds per day) that corresponds with an identified TP concentration (in milligrams per liter).

2. **Mean Monthly Benthic Chlorophyll-*a*:** TP concentrations (and TP load equivalents) correlated with a mean monthly benthic chlorophyll *a* (periphyton) level $\leq$ 150 mg/m^2 within the two §303(d)-listed (impaired) AUs on the main stem lower Boise River— ID17050114SW005_06b (Middleton to Indian Creek) and ID17050114SW001_06 (Indian Creek to the mouth)
   a. With different TP allocations to achieve the mean monthly periphyton target for the seasons:
      - May 1–September 30 (Table B)
      - October 1–April 30 (Table C)

Table B. Total phosphorus current loads, load capacities, and water quality targets for May 1–September 30, presented as per day monthly averages. These are calculated for the Boise River near Parma (AU ID17050114SW001_06).

Parma Flow	Current Background TP Inputs[a]		Current NPDES WWTF and Industry TP Inputs[b]			Current Fish Hatchery TP Inputs[c]			Current Tributary TP Inputs w/o NPDES Flows and Loads[d]			Current Ground Water TP Inputs[e]			Current Dry Weather Nontormwater TP Inputs (Accounted for in Tribs)[f]			Current Wet Weather Stormwater TP Inputs[g]			Current Total TP Inputs	TP Inputs Reaching Parma	Current Parma TP Load	Parma TP Load Reduction Needed
(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(lbs/day)	(%)	(lbs/day)	(%)
3268	0.018	317	85.3	3.27	1506	32	0.05	9	853	0.25	1144	-1390	0.21	-1573	168	0.44	394	30	0.44	71	1474	254%	3747	67%
912	0.018	88	85.3	3.27	1506	32	0.05	9	853	0.25	1144	164	0.21	186	168	0.44	394	30	0.44	71	3005	51%	1531	78%
705	0.018	68	85.3	3.27	1506	32	0.05	9	853	0.25	1144	300	0.21	340	168	0.44	394	30	0.44	71	3139	38%	1190	78%
624	0.015	50	84.0	3.18	1440	NA	0.06	9	888	0.18	880	485	0.21	562	168	0.44	394	No Storm Event			2942	34%	1010	77%
383	0.018	37	85.3	3.27	1506	32	0.05	9	853	0.25	1144	398	0.21	450	168	0.44	394	30	0.44	71	3218	23%	738	80%

Note: The USGS-derived values highlighted in green are only for comparing the USGS mass balance data with long-term flow and load duration data and not for allocation purposes. The USGS August 2012 mass balance model estimated the total diversions as -1,590 cubic feet per second (cfs) at 0.22 mg/L TP, resulting in 1,890 lb/day.

[a] Background TP concentration of 0.018 mg/L was utilized based on 2005–2013 USGS Diversion Dam data, with detection levels of 0.01 mg/L. Long-term median data and the USGS 2012–2013 synoptic data (Etheridge 2013) indicate background concentrations of 0.02 and 0.015 mg/L.

[b] POTW and industrial discharge data are calculated for May 1–September 30, 2012, and represented in Table 15. The USGS August 2012 synoptic sample data represent only POTW contributions from Lander, West Boise, Meridian, Middleton, Nampa, and Caldwell facilities (Etheridge 2013).

[c] Fish hatchery data represent the Idaho Department of Fish and Game Eagle and Nampa facilities identified in Table 15.

[d] Tributary data were calculated by removing POTW, industrial, and aquaculture flows, concentrations, and loads that discharge into tributaries. The USGS August 2012 synoptic sample calculated tributaries by removing the contributions from only the Meridian and Nampa facilities (Etheridge 2013).

[e] The USGS August 2012 mass balance model was used to adjust ground water flows, including ground water loss (-1,315) under various river flow scenarios (Alex Etheridge, pers. comm., 2014). The USGS August 2012 synoptic sampling identified ground water flows as 485 cfs with 0.21 mg/L TP concentration (Etheridge 2013).

[f] Nonstormwater (dry weather) contributions were derived from data provided by the Lower Boise Watershed Council (LBWC) stormwater workgroup (Appendix C). Current nonstormwater flows and loads are a subcomponent of, and not summed separately from, tributary and ground water/unmeasured discharge.

[g] Stormwater (wet weather) contributions were derived from data provided by the LBWC stormwater workgroup (Appendix C). These flows and loads represent specific precipitation (storm) events and were not captured as part of the USGS August 2012 synoptic sample (Etheridge 2013).

*The current wet weather TP concentration (0.75 mg/L) and current dry weather TP concentration (0.12 mg/L) were averaged in order to provide a broad estimate given the low number of data points and high range in flows. ((.75+.12)/2=.435 mg/l)

Table C. Total phosphorus loads and water quality targets for October 1–April 30, expressed per day as monthly averages. These are calculated for the lower Boise River near Parma (AU ID17050114SW001_06).

Flow[a] (cfs)	Flow Rank (%)	Current Load[a]		Water Quality Targets[b]			
		TP Conc. (mg/L)	TP Load (lb/day)	TP Allocations (lb/day as a monthly average)	TP Load Reductions (lb/day as a monthly average)	TP Conc. (mg/L)	TP Load Reductions (%)
1,293	Mean	0.3	2,302	815	-1,487	0.11	65%

[a] Based on a data from October 1–April 30, 1987 through 2012.

[b] Mean load capacities and water quality targets calculated and applied as instream conditions.

May 1–September 30 TP ≤ 0.07 mg/L

The final SR-HC TMDL was approved by EPA in September 2004 (DEQ and ODEQ 2004). The TMDL addressed point and nonpoint sources within the 2,500 square miles that discharge or drain directly to the Snake River from where it intersects the Oregon/Idaho border near Adrian, Oregon (river mile 409) to immediately upstream of the inflow of the Salmon River (river mile 188). Five major tributaries received gross phosphorus allocations at their mouths, including the lower Boise River. The SR-HC TMDL was developed with the assumption that the three major Idaho and two major Oregon tributaries would receive individual nutrient TMDLs or implementation plans that satisfy final SR-HC nutrient TMDL requirements. Load allocations were developed to achieve target TP concentrations of ≤0.07 mg/L in the Snake River and Brownlee Reservoir, particularly during periods when dissolved oxygen levels are low. In this addendum, compliance with the SR-HC TMDL was determined by applying a TP target of ≤0.07 mg/L at the mouth of the lower Boise River (near Parma) from May 1–September 30.

This TMDL uses a flow duration curve with water quality targets to develop a tiered load reduction approach needed to achieve the May 1–September 30 TP target of ≤0.07 mg/L. This analysis used the USGS August 2012 mass balance model (Etheridge 2013), along with long-term flow and TP concentration data from the lower Boise River. The final TP allocations were developed to also achieve a mean monthly periphyton target of ≤150 mg/m^2 in the lower Boise River. As a result, the TP allocations in this TMDL represent the TP loadings that are assumed to achieve both the SR-HC TMDL and lower Boise River mean monthly periphyton target, not the maximum potential TP loadings into the lower Boise River that would solely achieve the SR-HC TMDL target.

Mean Monthly Benthic Chlorophyll *a* Target

This addendum also uses the AQUATOX model, USGS 2012 and 2013 synoptic sampling data, historical data, and other available information to develop TP allocations needed to achieve a mean monthly benthic (periphyton) chlorophyll *a* target of ≤150 mg/m^2 within the two impaired AUs. If it appears that full support of beneficial uses in the lower Boise River is not being attained during the 5-year review or subsequent post-TMDL implementation, other habitat measures may be considered to further reduce periphyton growth.

TMDL Allocation Scenario

The final AQUATOX model scenario and TMDL allocation structure that achieves the May 1–September 30 TP target near Parma and the mean monthly periphyton target included the following inputs and results:

- Point sources at 0.1 mg/L TP May–September
- Point sources at 0.35 mg/L TP October–April (except Idaho Department of Fish and Game [IDFG] Eagle and Nampa facilities set at 0.1 year-round)
- Agricultural tributaries and ground water at 0.07 mg/L TP year-round
- Stormwater (wet weather) TP loads reduced by 42%
- Nonstormwater (dry weather) TP loads by 84%

May 1–September 30 TMDL Allocations

The following TP sector allocations (Table D and Table E) represent the load reductions necessary to achieve both targets. Figure B displays current loads versus the load allocations for these sectors.

Table D. Gross load and wasteload allocations by sector for the lower Boise River, May 1–September 30, presented per day as monthly averages. DEQ intends that wasteload allocations are to be expressed as average monthly limits

Parma Flow	Background TP Allocations[a] (per day as monthly average)		NPDES POTW and Industry TP Allocations[b] (per day as monthly average)			Fish Hatchery TP Allocations[c] (per day as monthly average)			Tributary TP Allocations w/o NPDES Flows and TP Loads[d] (per day as monthly average)			Ground Water TP Allocations[e] (per day as monthly average)			Dry Weather Nonstormwater TP Allocations (Accounted for in Tribs)[f] (per day as monthly average)			Wet Weather Stormwater TP Allocations[g] (per day as monthly average)			TP Input Allocations (per day as monthly average)	TP Inputs Reaching Parma	Parma TP Load w/ Allocations (per day as monthly average)	Parma TP Load Reduction
(cfs)	(mg/L)	(lb/day)	(cfs)	(mg/L)	(lb/day)	(cfs)	(mg/L)	(lb/day)	(cfs)	(mg/L)	(lb/day)	(cfs)	(mg/L)	(lb/day)	(cfs)	(mg/L)	(lb/day)	(cfs)	(mg/L)	(lb/day)	(lb/day)	(%)	(lb/day)	(%)
3268	0.018	317	135.6	0.10	73	37	0.10	20	822	0.07	310	-1390	0.07	-524	168	n/a	63	30	n/a	41	237	254%	601	84%
912	0.018	88	135.6	0.10	73	37	0.10	20	822	0.07	310	164	0.07	62	168	n/a	63	30	n/a	41	594	51%	303	80%
705	0.018	68	135.6	0.10	73	37	0.10	20	822	0.07	310	300	0.07	113	168	n/a	63	30	n/a	41	625	38%	237	80%
624	0.015	50	120.0	0.10	65	34	0.10	18	888	0.07	335	485	0.07	183	168	n/a	63	No Storm Event			651	34%	224	78%
383	0.018	37	135.6	0.10	73	37	0.10	20	822	0.07	310	398	0.07	150	168	n/a	63	30	n/a	41	631	23%	145	80%

Note: The green highlight represents data derived from the USGS August 2012 mass balance model for the lower Boise River (Etheridge 2013). The USGS-derived values are only for comparing the USGS mass balance data with long-term flow and load duration data and not for TP allocation purposes.

[a] Background TP concentration of 0.018 mg/L was used based on 2005–2013 USGS Diversion Dam data, with detection levels of 0.01 mg/L (see section 3.2.2). Long-term median data and the USGS 2012–2013 synoptic data (Etheridge 2013) indicate background concentrations of 0.02 and 0.015 mg/L.

[b] POTW and industrial discharge data are based on facility design flows, represented in Table 15. The USGS August 2012 synoptic sample data represent only POTW contributions from Lander, West Boise, Meridian, Middleton, Nampa, and Caldwell facilities (Etheridge 2013).

[c] Fish hatchery data represent the Idaho Department of Fish and Game Eagle and Nampa facilities identified in Table 15.

[d] Tributary data were calculated by removing all POTW, industrial, and aquaculture design flows, concentrations, and loads that discharge into tributaries. The USGS August 2012 synoptic sample calculated tributaries by removing the contributions from only the Meridian and Nampa facilities (Etheridge 2013).

[e] The USGS August 2012 mass balance model was used to adjust ground water flows, including ground water loss (-1,315 cfs) under various river flow scenarios (Alex Etheridge, pers. comm., 2014). The USGS August 2012 synoptic sample identified ground water flows as 485 cfs with a 0.21 mg/L TP concentration (Etheridge 2013).

[f] Nonstormwater (dry weather) allocations were derived from data provided by the LBWC stormwater workgroup (Appendix C) and represent an 84% TP load reduction on average across all MS4s in order to achieve a 0.07 mg/L TP load equivalent under current flows. Nonstormwater flows and loads are largely unmeasured throughout the subbasin and are a subcomponent of, and not summed separately from, tributary and ground water load allocations.

[g] Stormwater (wet weather) allocations were derived from the data provided by the LBWC stormwater workgroup (Appendix C) and represent a 42% TP load reduction on average across all MS4s. These flows and loads represent specific precipitation (storm) events and were not captured as part of the USGS August 2012 synoptic sample (Etheridge 2013).

Table E. Gross load and wasteload allocations by sector for the lower Boise River, May 1–September 30, presented per day as monthly averages. DEQ intends that wasteload allocations are to be expressed as average monthly limits.

Sector	Current TP Conc. (mg/L)	Current TP Load (lb/day)	Target TP Conc. (mg/L)	TP Allocation (lb/day as a monthly average)	Percent Reduction	Notes
Average Daily Background	0.018	37	0.018	37	**0%**	Background TP concentration of 0.018 mg/L was used based on 2005–2013 USGS Diversion Dam data, with detection levels of 0.01 mg/L (see section 3.2.2). Background was based on the quantity of water reaching Parma under the 90th percentile low flow conditions.
Average Daily NPDES POTW and Industry	3.27	1,506	0.1	73	**-95%**	Publicly owned treatment works (POTW) and industrial discharge data are based on facility design flows, represented in Table 15.
Average Fish Hatchery	0.05	9	0.1	20	**110%**	Fish hatchery data represent the Idaho Department of Fish and Game Eagle and Nampa facilities identified in Table 15
Average Tributary (w/o NPDES Flows and Loads)	0.25	1,144	0.07	310	**-73%**	Tributary data (Table 17) were calculated by removing all POTW, industrial, and aquaculture design flows, concentrations, and loads that discharge into tributaries.
Average Ground Water and Unmeasured	0.21	450	0.07	150	**-67%**	The USGS August 2012 mass balance model was used to estimate average ground water flows. Ground water was based on the 90th percentile low flow conditions.
Average Nonstormwater Dry Weather	0.44	394	n/a	n/a	**-84%**	Nonstormwater (dry weather) allocations were derived from the data provided by the LBWC stormwater workgroup (Table 8 and Appendix C). Nonstormwater flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.
Average Stormwater Wet Weather	n/a	71	n/a	n/a	**-42%**	Stormwater (wet weather) allocations were derived from the data provided by the LBWC stormwater workgroup (Table 8 and Appendix C). These flows and loads represent specific precipitation (storm) events.

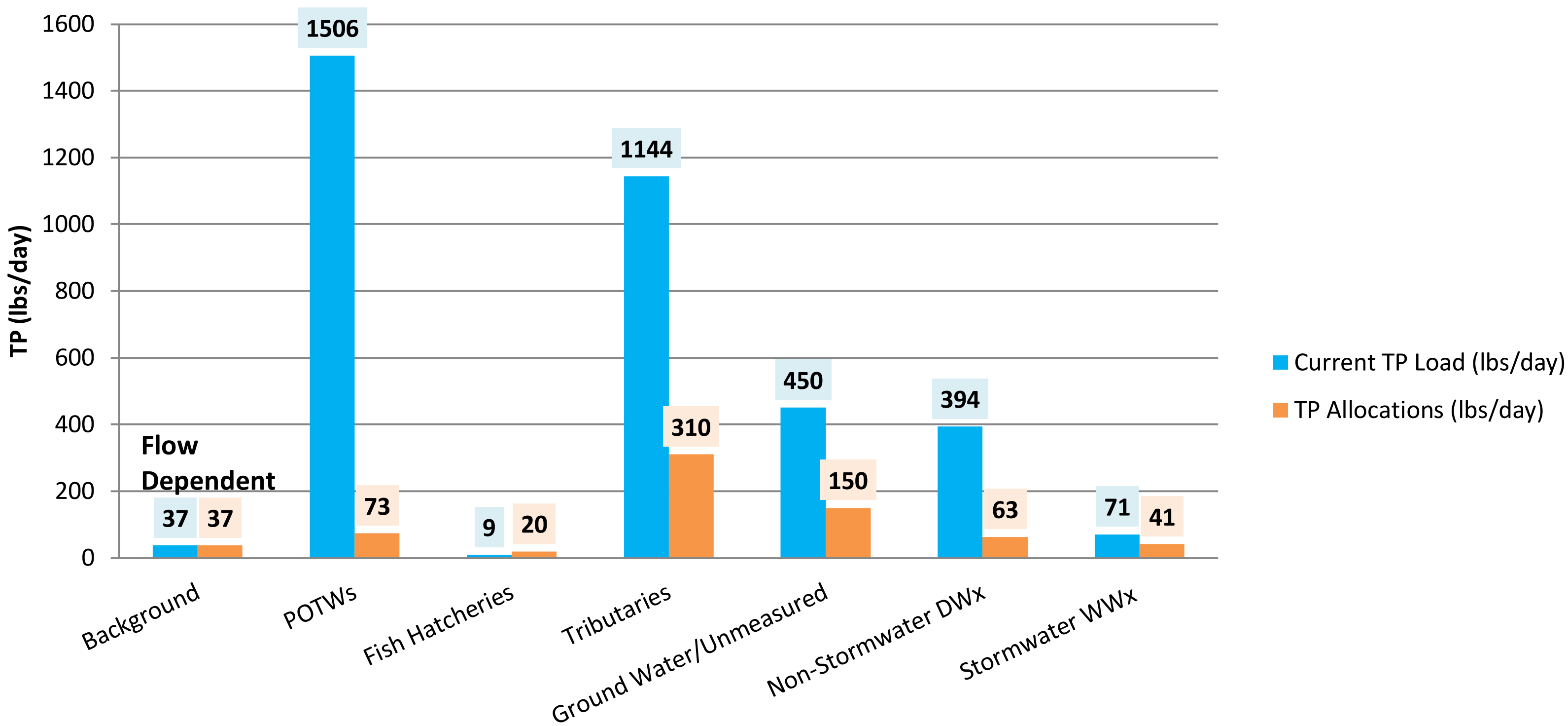

Figure B. Current TP loads versus allocations for the lower Boise River, May 1–September 30.

Notes: Stormwater (wet weather; WWx) flows and loads are associated with precipitation (storm) events conveyed through permitted and nonpermitted MS4s. Stormwater (wet weather) allocations represent a 42% TP load reduction on average across all MS4s.

Nonstormwater (dry weather; DWx) allocations represent an 84% TP load reduction on average across all MS4s in order to achieve a 0.07 mg/L TP load equivalent under current flows. Nonstormwater flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.

October 1–April 30 TMDL Allocations

The following TP sector allocations (Table F) represent the reductions necessary to achieve the following:

- Mean monthly periphyton target of ≤ 150 mg/m^2 within the impaired AUs of the lower Boise River
- Average TP load reductions in the lower Boise River fully supporting beneficial uses and TP concentrations are at or near the EPA Gold Book recommended value of 0.1 mg/L (EPA 1986)

Figure C displays current loads versus the October–April load allocation for these sectors.

Table F. Gross load and wasteload allocations by sector for the lower Boise River, October 1–April 30, presented per day as monthly averages. DEQ intends that wasteload allocations are to be expressed as average monthly limits.

Sector	Current TP Conc. (mg/L)	Current TP Load (lb/day)	Target TP Conc. (mg/L)	TP Allocation (lb/day as a monthly average)	Percent Reduction	Notes
Average Daily Background	0.018	Flow dependent	0.018	Flow dependent	**0%**	Background TP concentration of 0.018 mg/L was used based on 2005–2013 USGS Diversion Dam data, with detection levels of 0.01 mg/L (see section 3.2.2). The actual background loading (in pounds) is variable depending on the river inflow from upstream, ground water, and tributary/drain sources.
Average NPDES POTW and Industry	3.32	1,394	0.35	256	**-82%**	POTW and industrial discharge data are based on facility design flows, represented in Table 20.
Average Fish Hatchery	0.07	13	0.1	20	**+50%**	Fish hatchery data represent the Idaho Department of Fish and Game Eagle and Nampa facilities identified in Table 20.
Average Tributary (w/o NPDES Flows and Loads)	0.22	580	0.07	178	**-69%**	Tributary data (Table 21) were calculated by removing all POTW, industrial, and aquaculture design flows, concentrations, and loads that discharge into tributaries.
Average Ground Water and Unmeasured	0.15	127	0.07	57	**-55%**	The USGS October 2012 and March 2013 mass balance models were used to estimate average ground water flows.
Average Nonstormwater Dry Weather	n/a	44	**n/a**	**n/a**	**-84%**	Nonstormwater (dry weather) allocations were derived from the data provided by the LBWC stormwater workgroup and represent an 84% TP load reduction on average across all MS4s in order to achieve a ≤0.07 mg/L TP load equivalent under current flows. Nonstormwater (dry weather) flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.
Average Stormwater Wet Weather	n/a	107	**n/a**	**n/a**	**-43%**	Stormwater (wet weather) allocations were derived from the data provided by the LBWC stormwater workgroup and represent a 43% TP load reduction on average across all MS4s. These flows and loads represent specific precipitation (storm) events.

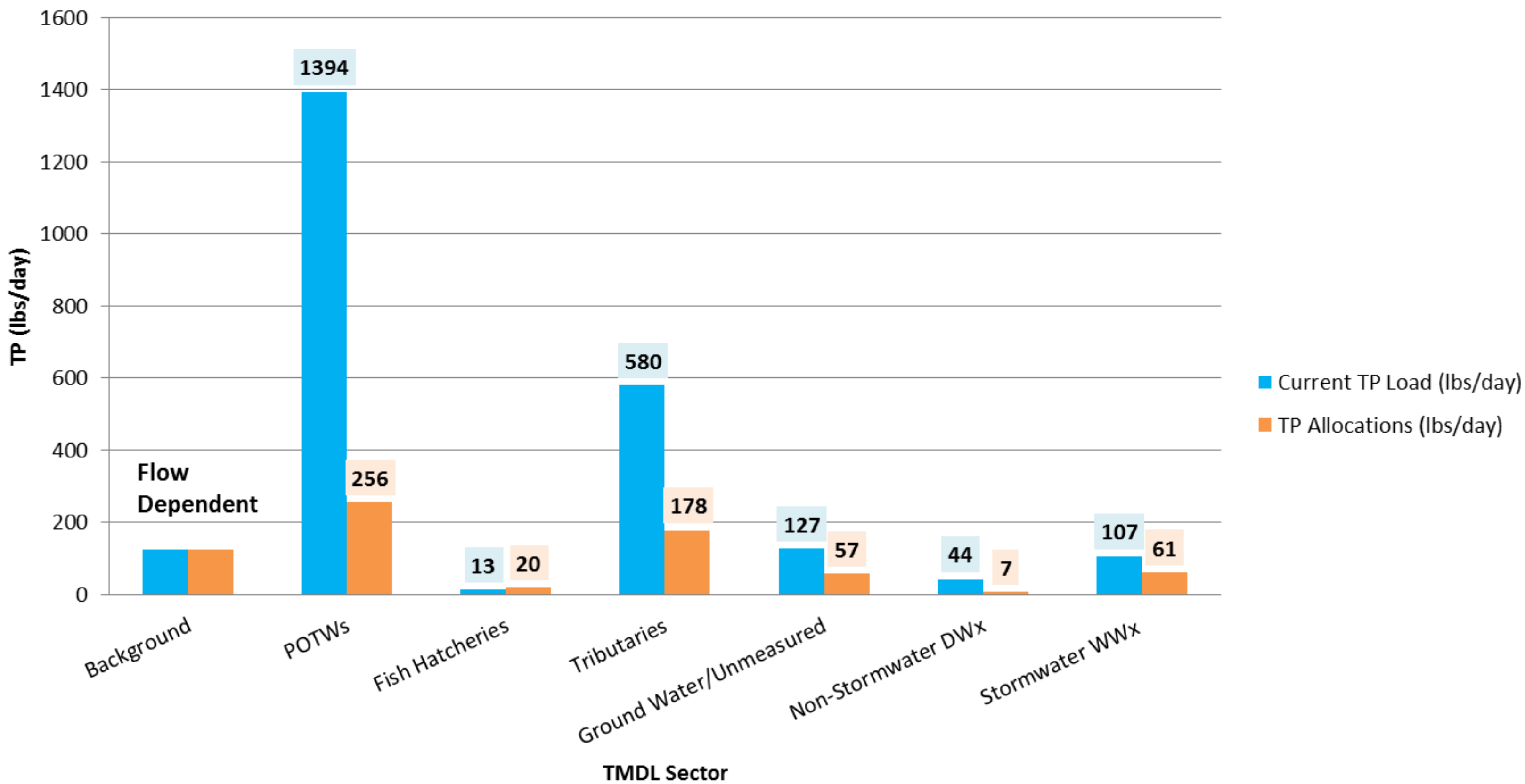

Figure C. Current TP loads versus allocations for the lower Boise River, October 1–April 30.

Notes: Stormwater (wet weather; WWx) flows and loads are associated with precipitation (storm) events conveyed through permitted and nonpermitted MS4s. Stormwater (wet weather) allocations represent a 43% TP load reduction on average across all MS4s.

Nonstormwater (dry weather; DWx) allocations represent an 84% TP load reduction on average across all MS4s in order to achieve a 0.07 mg/L TP load equivalent under current flows. Nonstormwater flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.

Instream TP and Periphyton Reductions

The final TMDL model scenario and TMDL allocation described above reduces TP concentrations and loads in the lower Boise River and the predicted year-round periphyton growth. Specifically, the final TMDL model scenario and TP allocation structure accomplishes the following:

- Includes the TP allocations necessary to achieve the May 1–September 30 target of ≤0.07 mg/L TP at the mouth of the lower Boise River near Parma based on long-term load duration data.
- Achieves the mean monthly benthic chlorophyll *a* target of ≤150 mg/m^2 in the impaired AUs of the lower Boise River. Multiple lines of evidence indicate that the TMDL phosphorus reductions are sufficient to achieve the mean monthly periphyton target on an AU basis, as well as achieve TP concentrations at or near the EPA Gold Book recommended value of 0.1 mg/L (EPA 1986). Although brief periods of elevated periphyton may occur during August and September in portions of the river, these are likely due to growth of low-nutrient diatoms that can proliferate under low-nutrient and other habitat conditions. These rationales are further discussed in the model report (DEQ 2014a).

The TMDL analysis illustrates a point of diminishing returns, beyond which further TP reductions do not result in significant reductions in periphyton, likely due to other environmental factors and organic enrichment in the system. TP reductions beyond those modeled in the final TMDL model scenario do not yield measureable improvements in periphyton reductions. Figure D further represents the annual average periphyton in segments 9–13 (the two impaired AUs of the lower Boise River) under the various model scenarios. Large reductions in periphyton growth are expected to occur under Scenario 3 (the final model scenario), but additional TP reductions would result in only slight periphyton reductions.

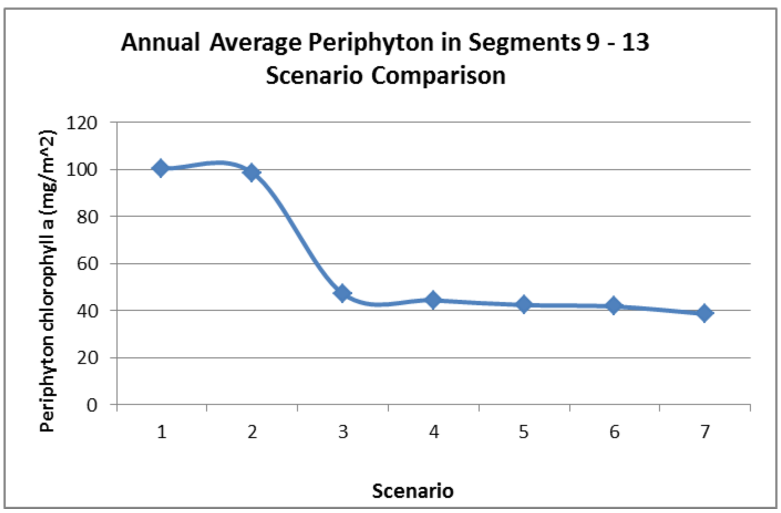

Figure D. Annual average periphyton concentrations in model segments 9–13 (the impaired AUs of the lower Boise River) under seven model scenarios. Full descriptions of the model scenarios are available in section 5.4.2 of this TMDL.

Public Participation

Throughout the TMDL development process, DEQ frequently consulted, coordinated, and met with the Southwest Basin Advisory Group (BAG), Lower Boise Watershed Council (LBWC), technical advisory committee (TAC) and other workgroups, EPA, USGS, and other interested stakeholders. Since revitalizing this specific TMDL effort in March 2012, DEQ has consulted with these interested stakeholders in more than 100 meetings, of which, nearly all were open and announced to the public. This continual stakeholder participation was, and will be, critical before, after the public comment period in June-July 2015 and in the subsequent TMDL implementation. In addition to these meetings, DEQ also kept the public informed by posting specific TMDL-related information on the DEQ Lower Boise River Watershed Advisory Group webpage: *www.deq.idaho.gov/regional-offices-issues/boise/basin-watershed-advisory-groups/lower-boise-river-wag*. Posted information includes drafts of the TMDL and model report and more.

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Introduction

This document addresses two assessment units (AUs) in the lower Boise River that have been placed in Category 5 of Idaho's most recent federally approved Integrated Report (DEQ 2014c). The purpose of this total maximum daily load (TMDL) addendum is to characterize and document total phosphorus (TP) pollutant loads within the Lower Boise River subbasin. The first portion of this document presents key characteristics or updated information for the subbasin assessment, which is divided into four major sections: subbasin characterization (section 1), water quality concerns and status (section 2), pollutant source inventory (section 3), and a summary of past and present pollution control efforts (section 4). While the subbasin assessment is not a requirement of the TMDL, the Idaho Department of Environmental Quality (DEQ) performs the assessment to ensure impairment listings are up-to-date and accurate.

The subbasin assessment is used to develop a TMDL for each pollutant of concern for the subbasin. The TMDL (section 5) is a plan to improve water quality by limiting pollutant loads. Specifically, a TMDL is an estimate of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (40 CFR Part 130). Consequently, a TMDL is water body- and pollutant-specific. The TMDL also allocates allowable discharges of individual pollutants among the various sources discharging the pollutant.

Regulatory Requirements

This document was prepared in compliance with both federal and state regulatory requirements. The federal government, through the United States Environmental Protection Agency (EPA), assumed the dominant role in defining and directing water pollution control programs across the country. DEQ implements the Clean Water Act in Idaho, while EPA oversees Idaho and certifies the fulfillment of Clean Water Act requirements and responsibilities.

Congress passed the Federal Water Pollution Control Act, more commonly called the Clean Water Act, in 1972. The goal of this act was to "restore and maintain the chemical, physical, and biological integrity of the nation's waters" (33 USC §1251). The act and the programs it has generated have changed over the years as experience and perceptions of water quality have changed. The Clean Water Act has been amended 15 times, most significantly in 1977, 1981, and 1987. One of the goals of the 1977 amendment was protecting and managing waters to ensure "swimmable and fishable" conditions. These goals relate water quality to more than just chemistry.

The Clean Water Act requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to §303 of the Clean Water Act, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. DEQ must review those standards every 3 years, and EPA must approve Idaho's water quality standards. Idaho adopts water quality standards to protect public health and welfare, enhance water quality, and protect biological integrity. A water quality standard defines the goals of a water body by designating the use or uses for the water, setting criteria necessary to protect those uses, and preventing degradation of water quality through antidegradation provisions.

Section 303(d) of the Clean Water Act establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. Currently, this list is published every 2 years as the list of Category 5 waters in Idaho's Integrated Report. For waters identified on this list, states and tribes must develop a TMDL for the pollutants, set at a level to achieve water quality standards.

DEQ monitors and assesses waters, and for those not meeting water quality standards, DEQ must establish a TMDL for each pollutant impairing the waters. However, some conditions that impair water quality do not require TMDLs. EPA considers certain unnatural conditions—such as flow alteration, human-caused lack of flow, or habitat alteration—that are not the result of discharging a specific pollutant as "pollution." TMDLs are not required for water bodies impaired by pollution, rather than a specific pollutant. A TMDL is only required when a pollutant can be identified and in some way quantified.

1 Subbasin Assessment—Subbasin Characterization

This document is an addendum to the *Lower Boise River TMDL: Subbasin Assessment, Total Maximum Daily Load* (DEQ 1999). Addendums address waters within a hydrologic unit code that did not previously receive a TMDL for a specific pollutant or require an update to an existing EPA-approved TMDL. This TMDL addresses the two AUs (ID17050114SW001_06 and ID17050114SW005_06b) in the main stem of the lower Boise River that are currently on Idaho's §303(d) list for TP and do not have TMDLs.

A separate addendum is needed for the remaining list of pollutants in the lower Boise River tributaries. Additionally, a separate addendum to the Snake River-Hells Canyon (SR-HC) TMDL will be prepared for Sand Hollow Creek, a tributary to the Snake River, which is also impaired for cause unknown—nutrients suspected.

1.1 Physical, Biological, and Cultural Characteristics

A thorough discussion of the physical, biological, and cultural characteristics of the Lower Boise River subbasin are provided in the 1999 TMDL (DEQ 1999), the *Lower Boise River Implementation Plan Total Phosphorus* (DEQ 2008), and the *Lower Boise River: TMDL Five-Year Review* (DEQ 2009b).

1.2 Subwatershed Characteristics

The Lower Boise River subbasin is one of the more complex watersheds in Idaho (Figure 1; DEQ 2009). Figure 2 shows the conveyance network (DEQ 2009b), and Figure 3 provides a simplified schematic of the diversions, drains, and tributaries along the lower Boise River (Etheridge 2013). Figure 4 displays the daily mean flows at the upper end of the lower Boise River at Diversion Dam, at Glenwood Bridge, near Middleton, and near the mouth at Parma.

Detailed discussions of the streams within the subbasin are provided in the following documents:

- *Fivemile and Tenmile Creek Subbasin Assessment* (DEQ 2001a)

- *Mason Creek Subbasin Assessment* (DEQ 2001e)
- *Sand Hollow Creek Subbasin Assessment* (DEQ 2001f)
- *Indian Creek Subbasin Assessment* (DEQ 2001b)
- *Water in the Boise Valley: A History of the Nampa and Meridian Irrigation District* (Stevens 2014, unpublished)
- *When the River Rises: Flood Control on the Boise River* (Stacy 1993)

The following description of flow characteristics in the lower Boise River comes from the 1999 TMDL:

> The presence of upper Boise (Anderson Ranch and Arrowrock) and lower Boise (Lucky Peak, Diversion Dam, and Barber Dam) reservoirs and dams, numerous diversions, and local flood control policies have significantly altered the flow regime and the physical and biological characteristics of the lower Boise River.
>
> Lucky Peak Dam, the structure controlling flow at the upstream end of the watershed, was constructed and began regulating flow in 1957. Water is released from the reservoir to the Boise River just a few miles upstream from Boise. Water releases from the reservoir are managed primarily for flood control and irrigation. Other management considerations include power generation, recreation, maintenance of minimum stream flows during low flow periods and release of water to augment salmon migration flows in the Snake River.
>
> Flow regulation for flood control has replaced natural, short duration (two to three months), flushing peak flows with longer (four to six months), and greatly reduced, peak flows. Water management has increased discharge during the summer irrigation season and significantly decreased winter low flows.
>
> The regulated annual hydrograph can be divided into three flow regimes. Low flow conditions generally begin in mid-October when irrigation diversions end. The low flow period extends until flood control releases begin, sometime between the end of January and March. Flood flows generally extend through June, and releases for irrigation control flows from July through mid-October[2].
>
> The U.S. Bureau of Reclamation (USBR) reserves 102,300 acre-feet of storage to maintain instream flows during the winter low flow period. Storage water provides winter instream flows of 80 cfs from Lucky Peak Dam. The Idaho Fish and Game (IDFG) seeks a minimum target release of 150 cfs for fish protection. IDFG has secured 50,000 acre-feet of storage water in Lucky Peak Reservoir to augment winter low flows. With both of these sources it is frequently possible to maintain winter flows of 240 cfs. Flood season flows for the Boise River below Lucky Peak Dam range from about 2000 to 6500 cfs. Irrigation season flows typically range from 2000 to 4000 cfs. (DEQ 1999)

In addition, the TMDL provides a concise description of the movement and management of water between Diversion Dam and Parma, which still applies to the current management:

> During the irrigation season, numerous diversions carry water to irrigate fields along the north and south sides of the river. Based on location and quantity of diversions and drains the lower Boise River can be divided in two parts at Middleton. The majority of the water that is diverted from the river is removed beginning at Diversion Dam and ending at the Star Road diversion. Over half of the average annual discharge of the river is diverted before it passes the City of Boise. Most drains return to the river below Middleton. Many return flows join the river in the vicinity of Caldwell, while two other large return flows enter between Caldwell and Parma. The reach from Middleton to Caldwell usually has the lowest flows

[2] Flood flow timing can range from none or occur from January to early July, depending on the water year. Irrigation flows begin after flood flows and can begin from April 1 to early July. The end of irrigation season is also a range depending on water supply but generally ends mid-September to mid-October.

> during the irrigation season...During the irrigation season, the monthly average flows at Middleton and Parma are significantly less than at the upstream gaging station. In low water years, diversions have reduced instream flows to as low as 200 cfs at Middleton during the irrigation season.
>
> Diversions from the Boise River typically exceed total river discharge in low flow years, because return flows are rediverted for irrigation in a lower stretch of the river. The repeated use and reuse of water is a complicating factor in determining the fate of pollutants discharged to the river and the effects of pollutant reductions at different locations. The sheer number of canals and laterals in the watershed suggest the complexity of interpreting flow conditions and pollutant fate (Figure 7).
>
> In addition to affecting river flows, irrigation practices have also altered drainage patterns in the watershed. Water does not follow natural drainage paths in much of the lower Boise valley. Natural drainages in the lowlands and irrigated areas of the valley have been deepened, lengthened, straightened, and diverted while drains, laterals, and canals have been constructed. The stream alterations and man-made waterways have created new drainage areas that are significantly different from the natural subwatershed areas. (DEQ 1999)

In addition to being listed in Category 5 due to excess nutrients, the 2012 Integrated Report (DEQ 2014c) identifies the lower Boise River, from Diversion Dam to the mouth, as in Category 4c—waters of the state not impaired by a pollutant but by pollution—in recognition of the impact of flow and habitat alteration on beneficial use support.

> Many of man's activities in the lower Boise River watershed contribute to degradation of flow and habitat conditions. Flow manipulation for flood control, irrigation, impoundments, flood control activities such as clearing debris and construction of levees, gravel mining, unscreened diversions, angling pressure and barriers in the river all have adverse effects on habitat. It is DEQ's position that habitat modification and flow alteration, which may adversely affect beneficial uses, are not pollutants under Section 303(d) of the Clean Water Act. There are no water quality standards for habitat or flow, nor are they suitable for estimation of load capacity or load allocations. Because of these practical limitations, TMDLs will not be developed to address habitat modification or flow alteration. (DEQ 1999, p. 48)

Sources of phosphorus are diverse due to the landownership and management in the watershed (Figure 5) and include wastewater treatment discharges, stormwater, agriculture, background (from Lucky Peak Reservoir releases), and ground water return flows. Phosphorus from these sources is routed through a physically complex network of river, tributaries, and irrigation conveyances.

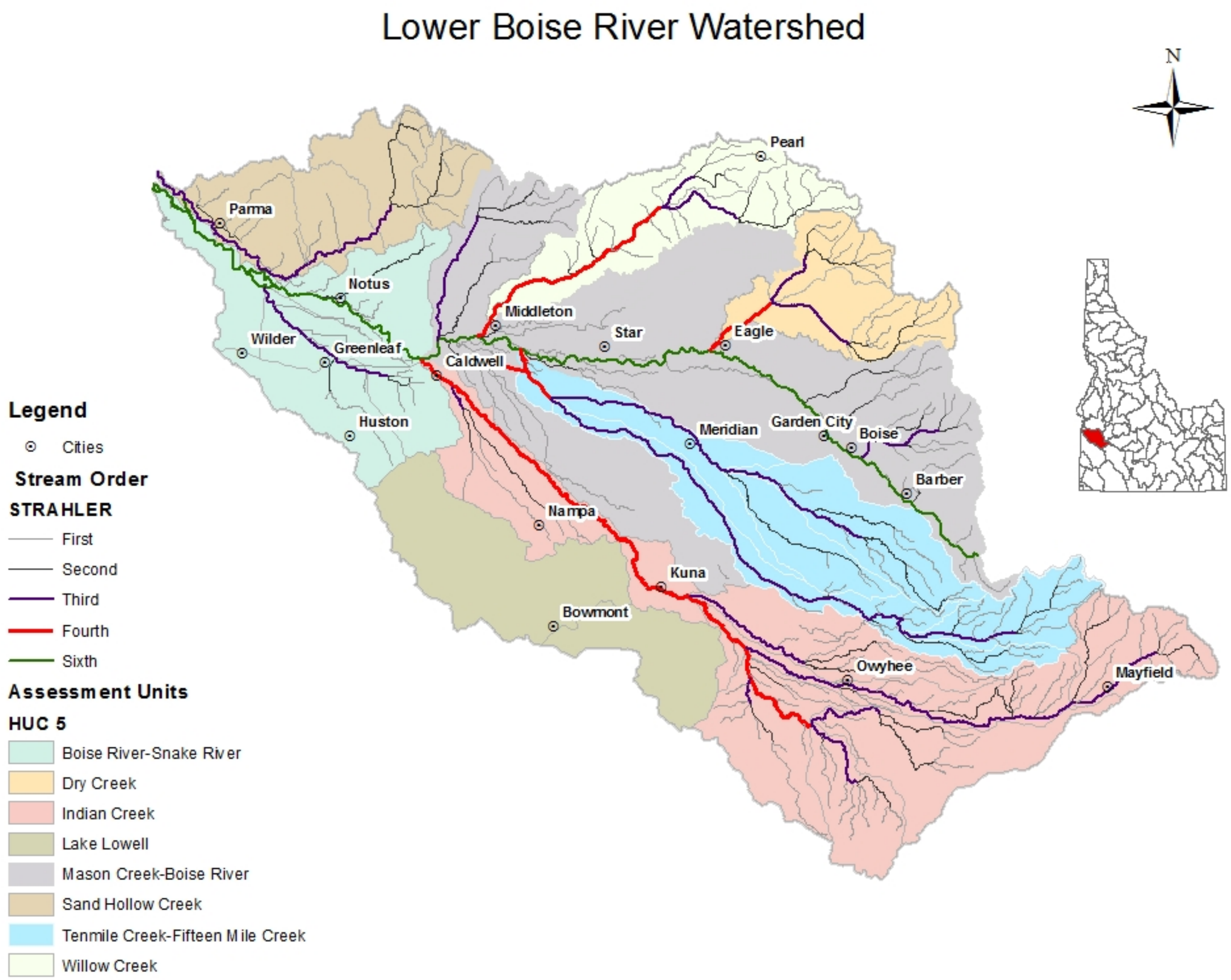


Figure 1. The Lower Boise River subbasin and delineation of subwatersheds (DEQ 2009b).

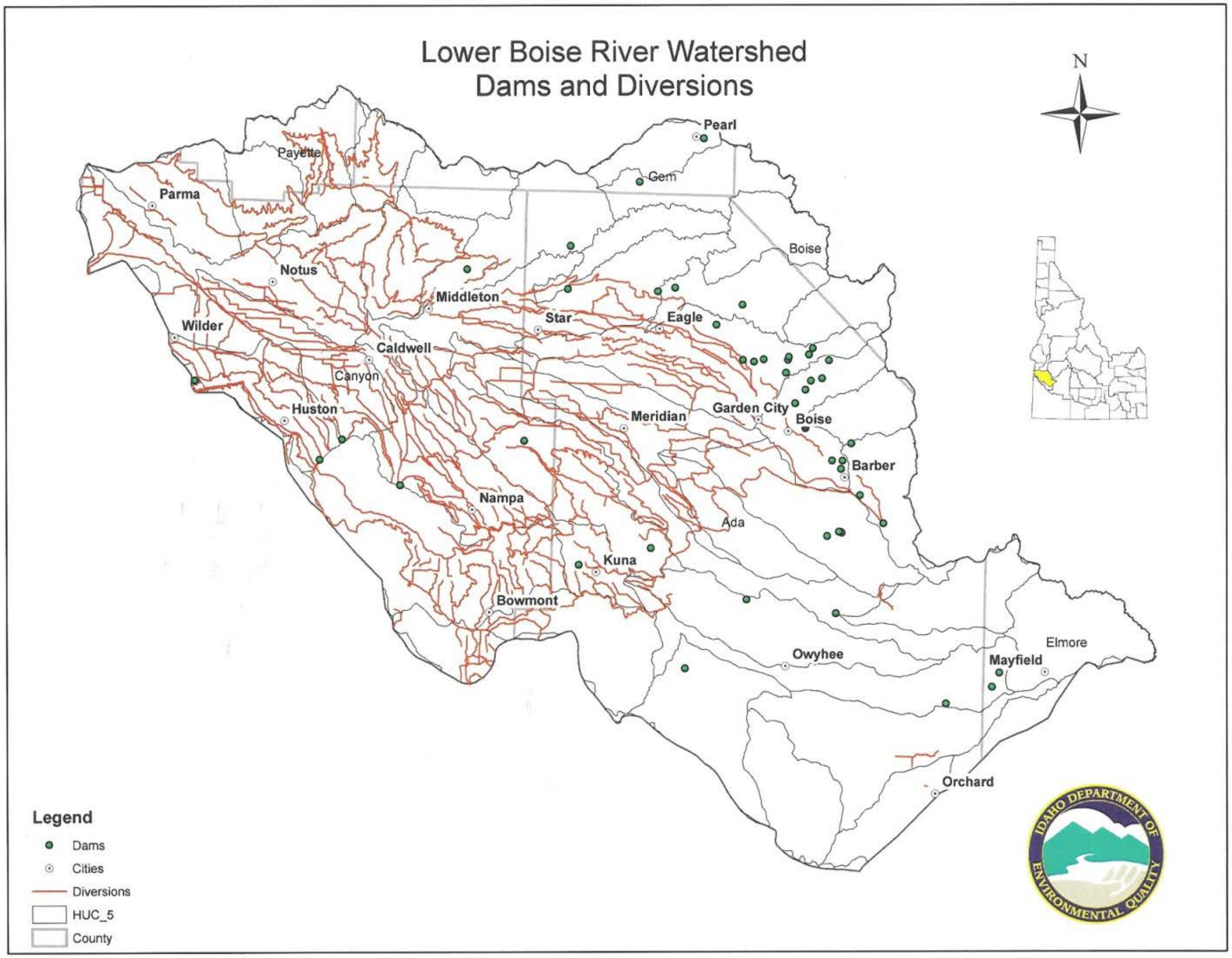


Figure 2. Lower Boise River dams and diversions (canals) permitted through the Idaho Department of Water Resources (DEQ 2009b).

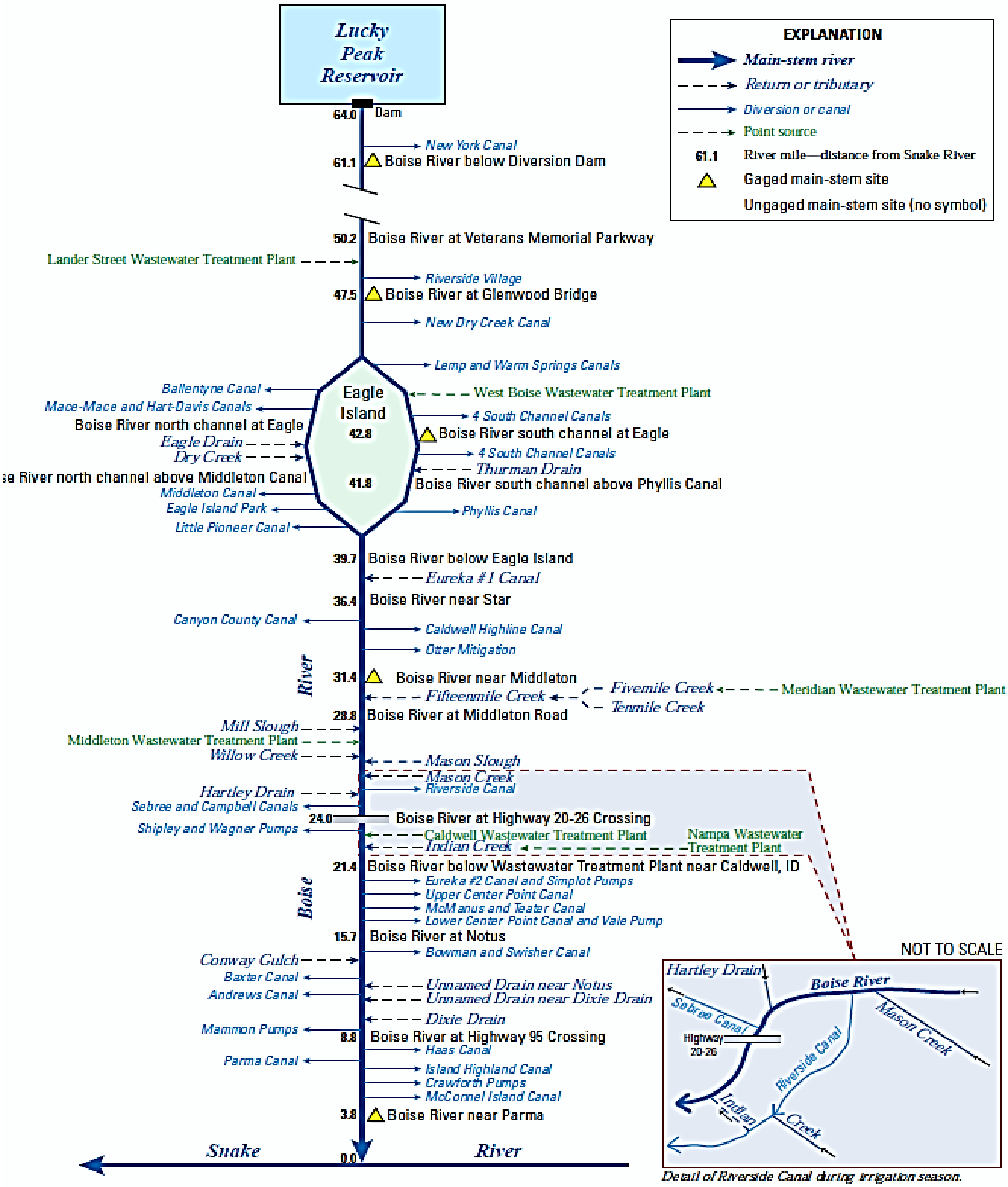


Figure 3. Diversions, drains, and tributaries along the lower Boise River (Source: Etheridge 2013).

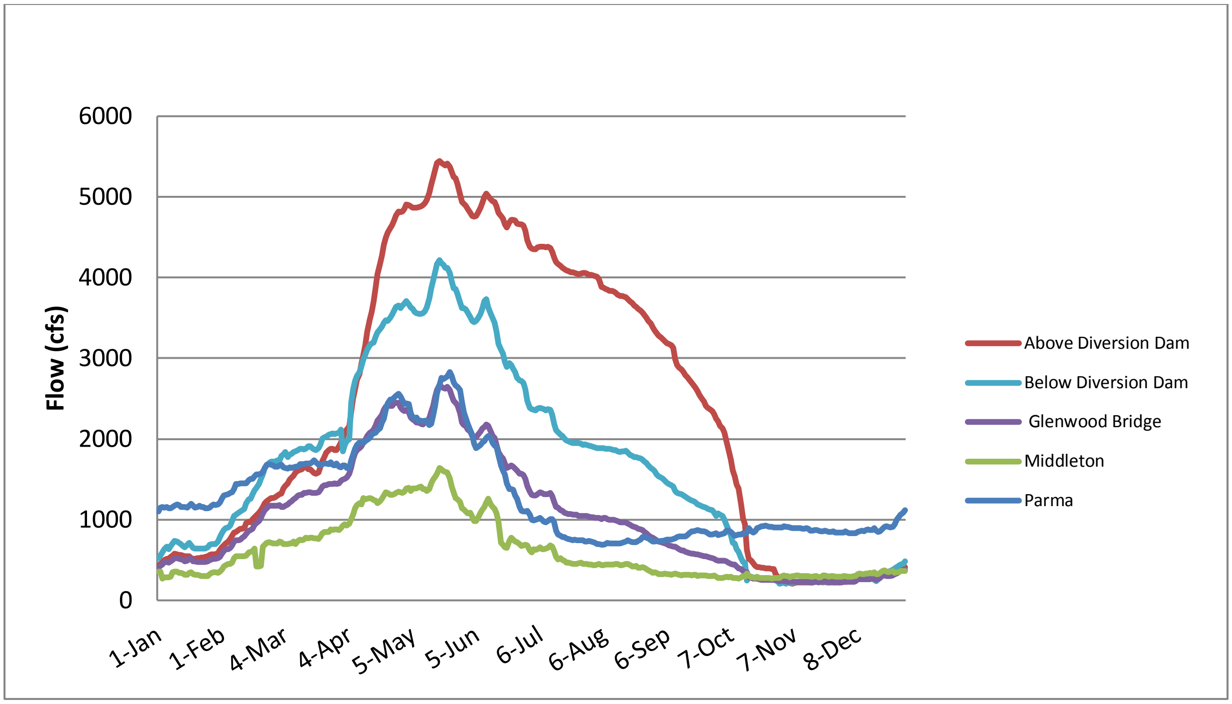


Figure 4. Daily mean flows (in cubic feet per second, cfs) in the lower Boise River above Diversion Dam (US Bureau of Reclamation, 1987–2012), below Diversion Dam (US Bureau of Reclamation and US Geological Survey, 1987–2012), at Glenwood Bridge (US Geological Survey, 1987–2012), near Middleton (Idaho Power Company, 1988–2012), and near Parma (US Geological Survey, 1987–2012).

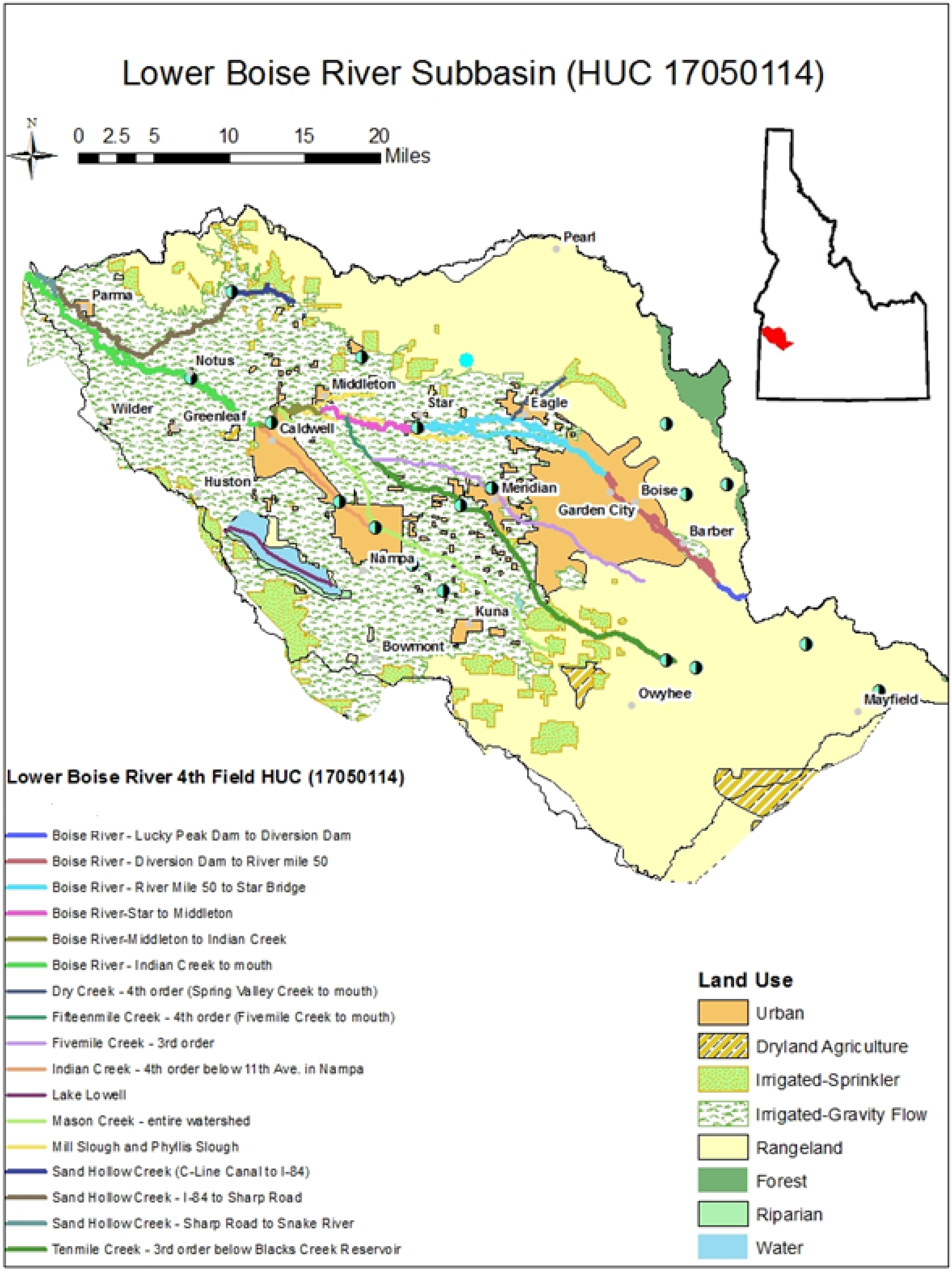


Figure 5. Land use in the Lower Boise River subbasin.

This TMDL addresses two lower Boise River main stem AUs identified as impaired on the 2012 §303(d) list (Figure 6):

- Boise River—Indian Creek to Mouth (ID17050114SW001_06)
- Boise River—Middleton to Indian Creek (ID17050114SW005_06b)

Tributary and upstream AUs that are not listed as impaired for TP are addressed as pollutant sources to the impaired AUs.

The lower Boise River is a 64-mile stretch of river that flows through Ada and Canyon Counties. The river flows in a northwesterly direction from Lucky Peak Dam to its confluence with the Snake River near Parma, Idaho. Major tributaries include Fifteenmile Creek, Mill Slough, Mason Creek, Indian Creek, Conway Gulch, and Dixie Drain. The perennial nature of these tributaries may be the result of agricultural diversion and drain deepening activities in the early 20th century due to elevated ground water levels associated with agricultural irrigation practices (Stevens 2014, unpublished).

Detailed discussions of the Lower Boise River subbasin were provided in the 1999 TMDL (DEQ 1999) and 5-year review (DEQ 2009b).

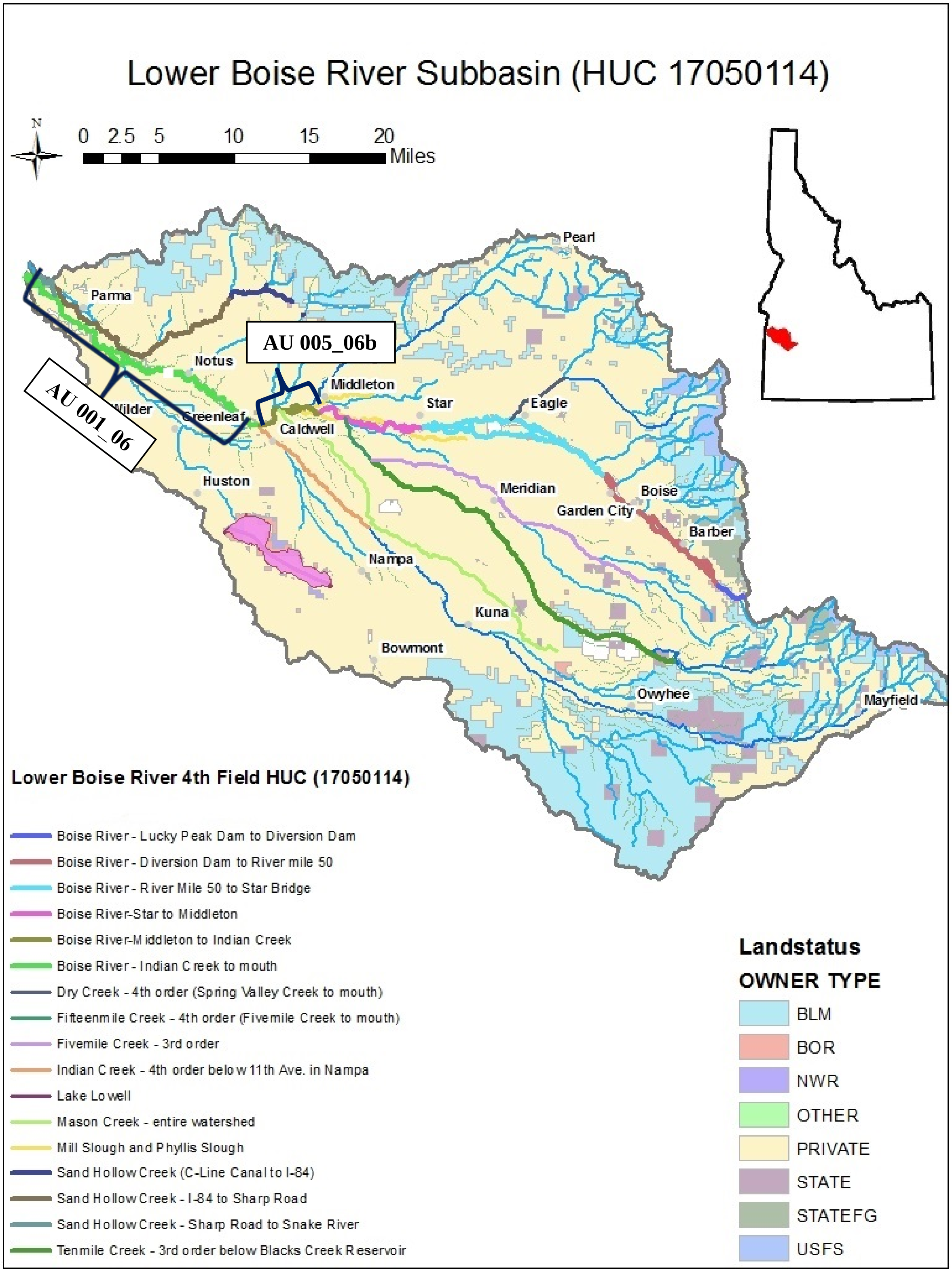


Figure 6. The Lower Boise River subbasin. The impaired AUs specifically addressed in this TMDL are identified by their AU number on the map (impaired AUs in this TMDL begin with ID17050114SW).

2 Subbasin Assessment—Water Quality Concerns and Status

This section includes a description of water quality concerns and the status and attainability of designated uses and water quality criteria for the water bodies in the watershed. It also provides additional information about the §303(d)-listed waters that are addressed in the TMDL, including listing history, rationales for listing, listed pollutants, a description of the designated uses and whether the uses are attainable, the criteria to protect the designated uses, and a summary and analyses of existing water quality data.

2.1 Water Quality Limited Assessment Units Occurring in the Subbasin

Section 303(d) of the Clean Water Act states that waters that are unable to support their beneficial uses and do not meet water quality standards must be listed as water quality limited. Subsequently, these waters are required to have TMDLs developed to bring them into compliance with water quality standards.

2.1.1 Assessment Units

AUs are groups of similar streams that have similar land use practices, ownership, or land management. However, stream order is the main basis for determining AUs—even if ownership and land use change significantly, the AU usually remains the same for the same stream order.

Using AUs to describe water bodies offers many benefits, primarily that all waters of the state are defined consistently. AUs are a subset of water body identification numbers, which allows them to relate directly to the water quality standards.

Table 1 shows the pollutants listed and the basis for listing for each §303(d)-listed AU in the subbasin that is addressed in this TMDL. Two AUs on the main stem lower Boise River are listed as impaired for TP. In 2009, EPA partially approved Idaho's final 2008 §303(d) list (DEQ 2009a). In that decision, EPA disapproved delisting of the lower Boise River for nutrients (total phosphorus) because DEQ did not demonstrate good cause to delist and provided insufficient rationale to justify the exclusion of existing and readily available data. EPA subsequently took public comment on this disapproval. EPA concluded in its final decision letter dated October 13, 2009, that the lower Boise River is water quality-limited and returned the lower Boise River to Idaho’s §303(d) list (EPA 2009a).

Table 1. Lower Boise River subbasin §303(d)-listed assessment units addressed in this TMDL.

Assessment Unit Name	Assessment Unit Number	Listed Pollutants	Listing Basis
Boise River—Indian Creek to mouth	ID17050114SW001_06	Total phosphorus	1996 §303(d) list—Nutrients
Boise River—Middleton to Indian Creek	ID17050114SW005_06b	Total phosphorus	1996 §303(d) list—Nutrients

2.2 Applicable Water Quality Standards and Beneficial Uses

Idaho water quality standards (IDAPA 58.01.02) list beneficial uses and set water quality goals for waters of the state. Idaho water quality standards require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing uses, designated uses, and presumed uses as described briefly in the following paragraphs. The *Water Body Assessment Guidance* (Grafe et al. 2002) provides a more detailed description of beneficial use identification for use assessment purposes. Applicable water quality standards are described in more detail in Appendix A.

Beneficial uses include the following:

- Aquatic life support—cold water, seasonal cold water, warm water, salmonid spawning, and modified
- Contact recreation—primary (swimming) or secondary (boating)
- Water supply—domestic, agricultural, and industrial
- Wildlife habitats
- Aesthetics

2.2.1 Existing Uses

Existing uses under the Clean Water Act are "those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards" (40 CFR 131.3). The existing instream water uses and the level of water quality necessary to protect the uses shall be maintained and protected (IDAPA 58.01.02.051.01). Existing uses need to be protected, whether or not the level of water quality to fully support the uses currently exists. A practical application of this concept would be to apply the existing use of salmonid spawning to a water that supported salmonid spawning since November 28, 1975, but does not now due to other factors, such as blockage of migration, channelization, sedimentation, or excess heat.

2.2.2 Designated Uses

Designated uses under the Clean Water Act are "those uses specified in water quality standards for each water body or segment, whether or not they are being attained" (40 CFR 131.3). Designated uses are simply uses officially recognized by the state. In Idaho, these include uses such as aquatic life support, recreation in and on the water, domestic water supply, and agricultural uses. Multiple uses often apply to the same water; in this case, water quality must be sufficiently maintained to meet the most sensitive use (designated or existing). Designated uses may be added or removed using specific procedures provided for in state law, but the effect must not be to preclude protection of an existing higher quality use such as cold water aquatic life or salmonid spawning. Designated uses are described in the Idaho water quality standards (IDAPA 58.01.02.100) and specifically listed by water body in sections 110–160.

2.2.3 Undesignated Surface Waters and Presumed Use Protection

In Idaho, due to a change in scale of cataloging waters in 2000, most water bodies listed in the tables of designated uses in the water quality standards do not yet have specific use designations (IDAPA 58.01.02.110–160). The water quality standards have three sections that address nondesignated waters. Sections 101.02 and 101.03 specifically address nondesignated man-made waterways and private waters. Man-made waterways and private waters have no presumed use protections. Man-made waters are protected for the use for which they were constructed unless otherwise designated in the water quality standards. Private waters are not protected for any beneficial uses unless specifically designated in the water quality standards.

All other undesignated waters are addressed by section 101.01. Under this section, absent information on existing uses, DEQ presumes that most Idaho waters will support cold water aquatic life and either primary or secondary contact recreation (IDAPA 58.01.02.101.01). To protect these so-called *presumed uses*, DEQ applies the numeric cold water and recreation criteria to undesignated waters. If in addition to *presumed uses*, an additional existing use (e.g., salmonid spawning) exists, then the additional numeric criteria for salmonid spawning would also apply (e.g., intergravel dissolved oxygen, temperature) because of the requirement to protect water quality for that existing use. However, if some other use that requires less stringent criteria for protection (such as seasonal cold aquatic life) is found to be an existing use, then a use designation (rulemaking) is needed before that use can be applied in lieu of cold water criteria (IDAPA 58.01.02.101.01).

2.3 Attainment of Beneficial Uses in the Subbasin

Designated uses must reflect existing uses but also may include uses that do not currently exist if the uses can be attained in the future (Idaho Code §39-3604). The impaired Boise River AUs are designated for cold water aquatic life and recreational uses. Part of the purpose of a subbasin assessment is to review whether the uses that are designated are attainable uses. For the Lower Boise River subbasin, this means looking at whether cold water aquatic life and recreational uses are attainable in the Boise River.

A designated use is attained if it actually occurs or exists, regardless of whether the use is currently fully supported (Idaho Code §§39-3602(2) and (13); §39-3604). DEQ’s review of relevant information establishes that cold water aquatic life and recreational uses are existing or attained uses in the Boise River. In the impaired AUs, contact recreation is documented as an existing use via direct observation, float trips led by Idaho Mountain Recreation (2013) and Idaho Rivers United (2012–2014), and guides describing canoeing (Chelstrom 2009) and paddling (Daly and Watters 1999) of the lower Boise River. The US Geological Survey (USGS) has documented the presence of cold water aquatic fishes and macroinvertebrates throughout the lower Boise River, including the impaired AUs (MacCoy 2004, 2006).

Based on the above described information, the AUs addressed by this addendum are appropriately designated for cold water aquatic life and recreational uses. Beneficial uses of the impaired AUs addressed in this TMDL are presented in Table 2.

Table 2. Lower Boise River subbasin beneficial uses of §303(d)-listed streams addressed in this TMDL.

Assessment Unit Name	Assessment Unit Number	Beneficial Uses[a]	Type of Use
Boise River— Indian Creek to Mouth	ID17050114SW001_06	COLD, PCR, SS[b]	Designated Existing[b]
Boise River— Middleton to Indian Creek	ID17050114SW005_06b	COLD, SS, PCR	Designated

[a] Cold water aquatic life (COLD), salmonid spawning (SS), primary contact recreation (PCR)
[b] Data collected by the USGS in December 1996 and August 1997 suggest that salmonid spawning is an existing use in the Boise River from Caldwell to the mouth (DEQ 1999).

2.3.1 Criteria to Support Beneficial Uses

Beneficial uses are protected by a set of water quality criteria, which include *numeric* criteria for pollutants such as bacteria, dissolved oxygen, pH, ammonia, temperature, and turbidity, and *narrative* criteria for pollutants such as sediment and nutrients (IDAPA 58.01.02.250–251) (Table 3).

Table 3. Numeric criteria supportive of designated beneficial uses in Idaho water quality standards (IDAPA 58.01.02.250–251).

Parameter	Primary Contact Recreation	Secondary Contact Recreation	Cold Water Aquatic Life	Salmonid Spawning[a]
Bacteria	<126 *E. coli*/100 mL[b] calculated as a geometric mean		—	—
pH	—	—	Between 6.5 and 9.0	Between 6.5 and 9.5
Dissolved oxygen (DO)	—	—	DO exceeds 6.0 milligrams/liter (mg/L)	**Water Column DO**: DO exceeds 6.0 mg/L in water column or 90% saturation, whichever is greater **Intergravel DO**: DO exceeds 5.0 mg/L for a 1-day minimum and exceeds 6.0 mg/L for a 7-day average
Temperature[c]	—	—	22 °C or less daily maximum; 19 °C or less daily average **Seasonal Cold Water**: Between summer solstice and autumn equinox: 26 °C or less daily maximum; 23 °C or less daily average	13 °C or less daily maximum; 9 °C or less daily average
Turbidity	—	—	Turbidity shall not exceed background by more than 50 nephelometric turbidity units (NTU) instantaneously or more than 25 NTU for more than 10 consecutive days.	—
Ammonia	—	—	Ammonia not to exceed calculated concentration based on pH and temperature.	—

[a] During spawning and incubation periods for inhabiting species
[b] *Escherichia coli* per 100 milliliters. A water sample exceeding the *E. coli* single sample maximums indicates likely exceedance of the geometric mean criterion but is not alone a violation of water quality standards. If a single sample exceeds the maximums (≤406 *E. coli*/100 mL for primary contact recreation or ≤576 *E. coli*/100 mL for secondary contact recreation) set forth in IDAPA 58.01.02.251.01.b.i–iii, additional samples must be taken as specified in IDAPA 58.01.02.251.01.c.
[c] Temperature exemption: Exceeding the temperature criteria will not be considered a water quality standard violation when the air temperature exceeds the ninetieth percentile of the 7-day average daily maximum air temperature calculated in yearly series over the historic record measured at the nearest weather reporting station (Western Regional Climate Center 2010).

Narrative criteria for excess nutrients are described in the water quality standards:

> Surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses. (IDAPA 58.01.02.200.06)

In consultation with the Lower Boise Watershed Council (LBWC), DEQ has identified and refined a numeric target to describe nuisance aquatic growth that may impair AUs of the lower Boise River: mean monthly benthic (periphyton) chlorophyll $a \leq 150$ mg/m^2. To date, the LBWC has supported this target only seasonally (May 1 through September 30) and for recreational beneficial uses. DEQ expanded the target to annual. The expanded annual target was based on discussions with the watershed advisory group (WAG) related to exceedances outside of the May through September time frame. In addition, recreational uses are known to occur year around.

The periphyton target of ≤150 mg/m^2 was based largely on work conducted in Montana, where 70% of the public identified this level as acceptable for recreation during the growing season from July 1–September 30 (Suplee et al. 2008, 2009). In contrast, less than 30% of the public identified periphyton of ≥200 mg/m^2 as acceptable for recreation. The target is similar to other locations, including Minnesota, Colorado, and the Clark Fork River, for which the maximum summer periphyton target is ≤150 mg/m^2 (TSIC 1998; MDEQ 2008; CDPHE 2013; MPCA 2013).

Additional scientific findings support the use of a benthic chlorophyll *a* target of ≤150 mg/m^2 as appropriate for recreation and cold water aquatic life beneficial uses. For example, literature suggests nuisance aquatic algae become apparent between 100 and 200 mg/m^2, and enriched waters often have benthic chlorophyll *a* concentrations > 150 mg/m^2 (Welch et al. 1988; Dodds and Welch 2000). Biggs (2000) asserted that chlorophyll *a* levels > 150–200 mg/m^2 are very conspicuous in streams, are probably unnaturally high, and can compromise the use of rivers for contact recreation and productive sports fisheries (Welch et al. 1988; Dodds et al. 1998). Some of the management problems caused by enrichment, and associated benthic algal proliferations, include aesthetic degradation, alteration of fish and invertebrate communities, nutrient enrichment and algae proliferation, and degradation of water quality (particularly dissolved oxygen and pH) (Miltner and Rankin 1998; Welch et al. 1988; Biggs 2000; Miltner 2010).

Filamentous green algae can have a less desirable appearance than brown-colored diatoms and can be more problematic for recreation and aquatic life, even when their biomasses are similar (Dodds and Welch 2000). Nevertheless, increased nutrient concentrations lead to some detectable changes in higher trophic levels of rivers and streams, especially for grazing invertebrates, in communities dominated by periphytic diatoms (Miltner and Rankin 1998). Welch et al. (1988) observed that filamentous species tended to dominate the periphyton composition when chlorophyll *a* was above 100 mg/m^2.

Further, research indicates that total nutrients can provide better overall correlation to eutrophication in streams than do soluble nutrients and that total nitrogen (TN) and TP may be minimum acceptable nutrient criteria in addition to other environmental drivers such as light limitation and water velocities (Dodds et al. 1997; Hilton et al. 2006). However, Biggs (2000) identifies advantages and disadvantages of using different nutrient forms in benthic algal biomass-nutrient regression models in streams and rivers.

DEQ's procedure to determine whether a water body fully supports designated and existing beneficial uses is outlined in IDAPA 58.01.02.050.04. The procedure relies heavily on biological parameters and is presented in detail in the *Water Body Assessment Guidance* (Grafe et al. 2002). This guidance requires DEQ to use the most complete data available to make beneficial use support status determinations (Figure 7).

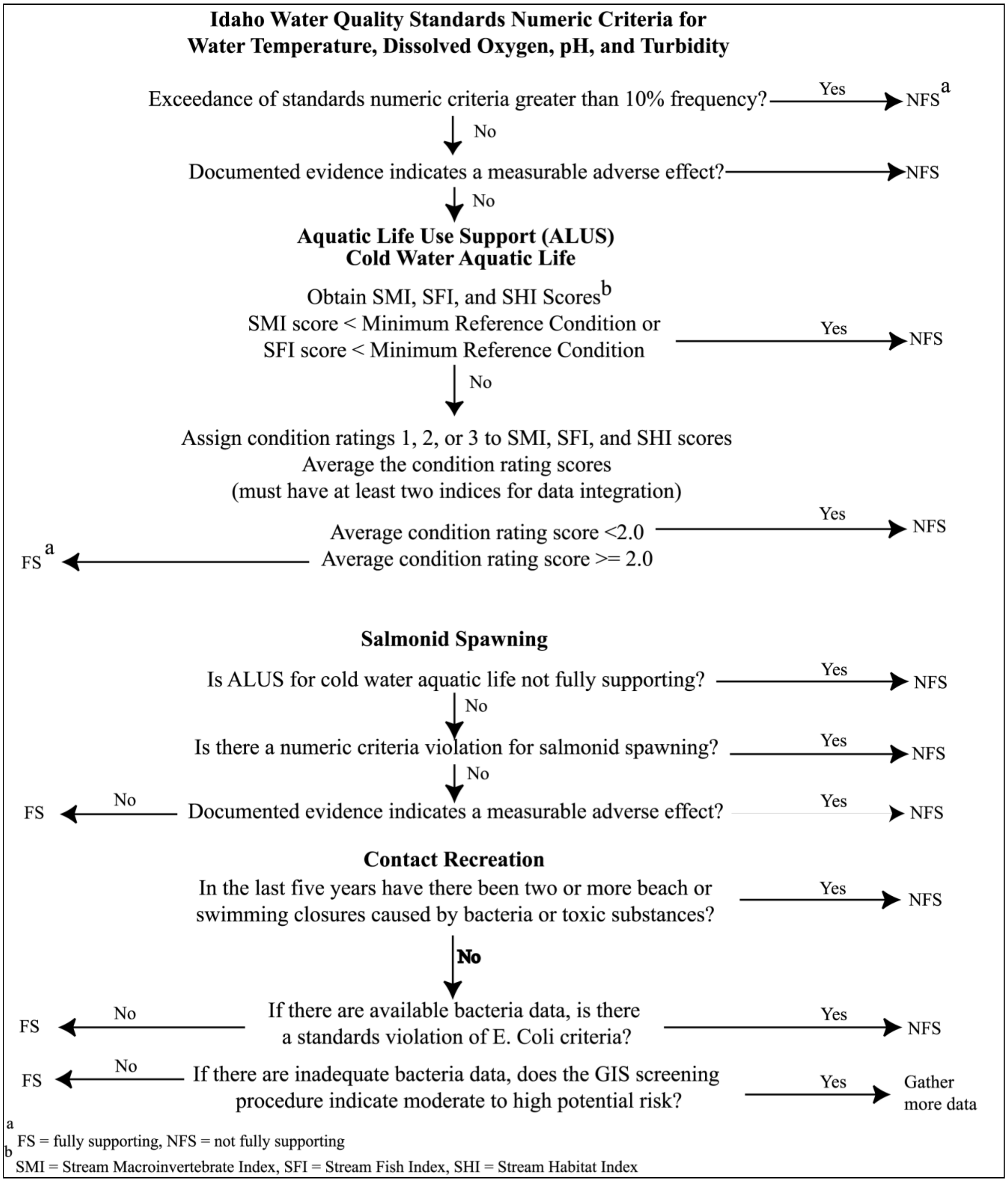


Figure 7. Steps and criteria for determining support status of beneficial uses in wadeable streams (Grafe et al. 2002).

2.4 Summary and Analysis of Existing Water Quality Data

This section addresses water quality data in the Lower Boise River subbasin, focusing on the nutrient-impaired AUs of the lower Boise River.

Since the original TMDL (DEQ 1999) was approved, DEQ has collected data, requested data from other agencies and organizations, searched external databases, and reviewed university publications and municipal or regional resource management plans for additional and recent water quality data. The results of that effort were compiled in the *Lower Boise River: TMDL Five-Year Review* (DEQ 2009b).

Since then, water quality and quantity data have continued to be collected in the Lower Boise River subbasin by DEQ, LBWC, USGS, the Idaho State Department of Agriculture (ISDA), municipalities, and other agencies and organizations (Appendix B).

The DEQ Beneficial Use Reconnaissance Program (BURP) has monitored several sites on the lower Boise River and within the subbasin (Figure 8). BURP protocol focuses on biological indicators and typically doesn't capture nutrient impacts. However, the data can identify and measure conditions involving dissolved oxygen, channel substrates, sediment, habitat, and fish and macroinvertebrate populations.

The mass balance model created by USGS was used in this addendum to develop wasteload allocations to meet the May 1-September 30 TP concentration of ≤ 0.07 milligrams per liter (mg/L) in the lower Boise River near Parma. In addition to the mass balance model, the AQUATOX model was used to develop wasteload allocations to also achieve the mean monthly periphyton target of ≤ 150 mg/m^2 within the two impaired AUs on the main stem of the lower Boise River.

Three synoptic sampling events were conducted on the lower Boise River by USGS for the development of the mass balance model. The model was used to evaluate phosphorus loading and concentrations from multiple sources and land uses throughout various flow regimes, including irrigations season, shortly after irrigation season, and soon before irrigation season commenced. The loads and concentrations derived from the mass balance model were used to develop wasteload allocations that are defined in this document.

The AQUATOX model, which utilized the mass balance model, was used to simulate attached algae biomass under various conditions in order to establish appropriate wasteload allocations to meet the nuisance aquatic algae target of ≤ 150 mg/m^2. The AQUATOX model was used to predict algae growth under various conditions including temperature, water chemistry, light availability, and other environmental factors that could affect aquatic growth rates.

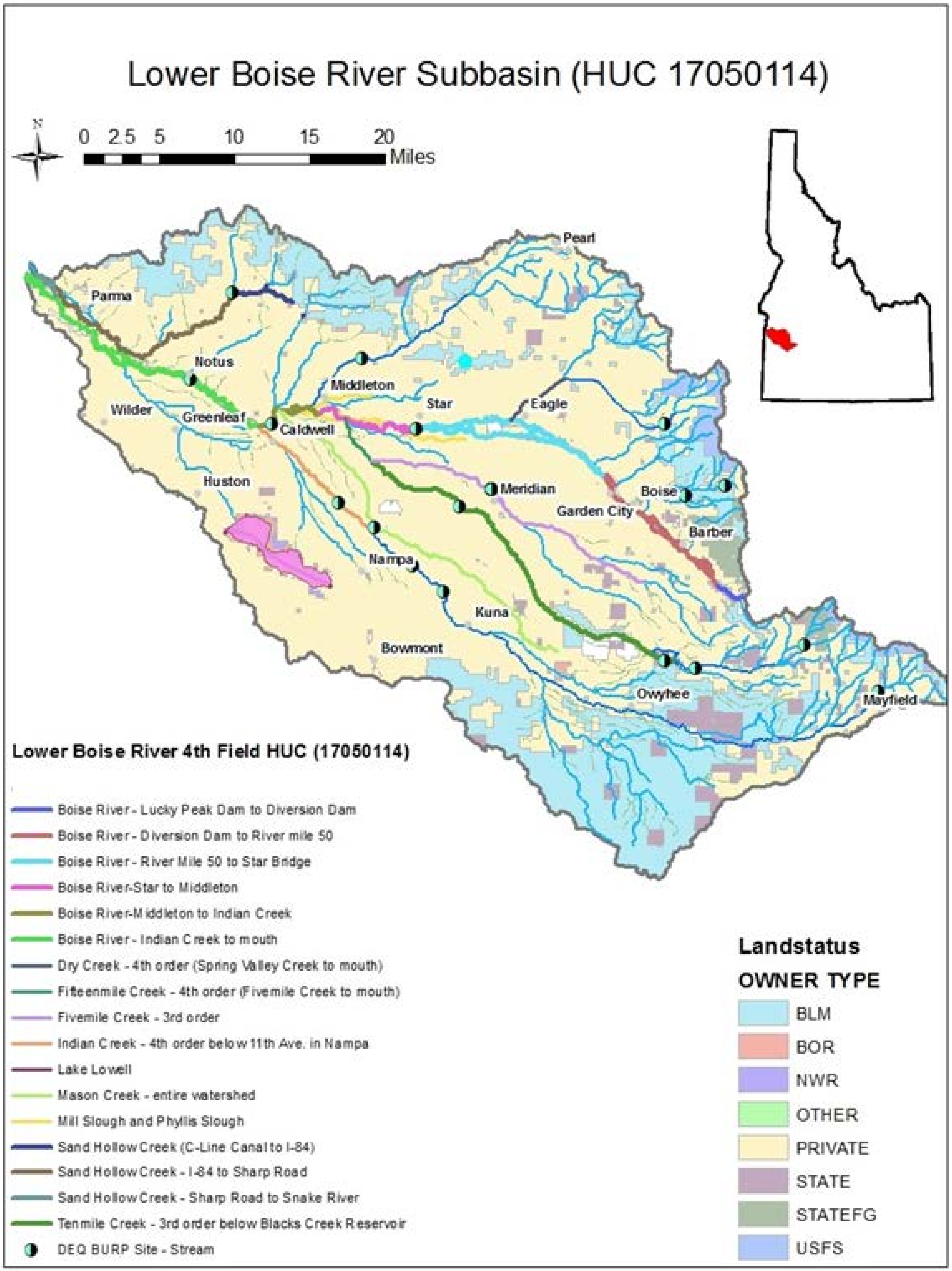


Figure 8. DEQ BURP sites in the Lower Boise River subbasin.

2.4.1 Data Quality and Acceptance

Various current and historical data are analyzed and presented in this TMDL to quantify phosphorus and other environmental conditions in the lower Boise River. These data were collected and provided by various agencies and organizations (Appendix B) and followed standard and accepted collection and analysis methods as deemed to be of adequate quality for inclusion in the agency water quality programs. Data used to help calibrate the AQUATOX model are documented in the model report (DEQ 2014a) and quality assurance project plan (DEQ 2014b).

USGS data, available through the National Water Information System web interface, along with data from the USGS synoptic sampling and mass balance models (Etheridge 2013), were used to develop the May 1–September 30 flow and phosphorus load duration analyses in the lower Boise River. Samples collected by the USGS were typically analyzed for orthophosphate as phosphorus following the ammonium molybdate method procedures (Fishman 1993). Samples collected for the USGS mass-balance model included analysis for total phosphorus and total dissolved phosphorus (Etheridge 2013). USGS collected depth- and width-integrated isokinetic samples at locations where streamflow gages are located and/or other common water quality monitoring locations. Municipalities with wastewater discharge typically follow Standards Methods 4500 for the orthophosphate analysis of their wastewater effluent; in this analysis, ammonium molybdate and potassium antimonyl tartrate react in acid medium with orthophosphate to form a heteropoly phosphomolybdic acid, which is reduced to intensely colored molybdenum blue by ascorbic acid. When organics, if present, are converted to reactive orthophosphate before the analysis, these methods may also be used for reporting total phosphorus. These methods are typically applicable for orthophosphate concentrations in the range of 0.01–6 mg/L.

TP includes particulate, nonparticulate, inorganic, and organic forms of phosphorus. Orthophosphate (OP) is the bioavailable portion of TP that can be readily used by algae. This methodology assumes the orthophosphorus is at a moderate concentration and is completely bioavailable for algal and plant uptake and growth. As orthophosphorus is reduced throughout the watershed, lower level detection methods will be necessary. Additional research shows that all orthophosphorus may not be equally bioavailable for algal and plant uptake and growth. There are different rates for labile and refractory decay of the constituents binding phosphorus that influence the bioavailability of the orthophosphorus. More data and analysis would be necessary to further categorize the orthophosphorus sources throughout the watershed. For this TMDL, DEQ maintains the assumption that orthophosphorus from all sources is completely bioavailable and will be analyzed and modeled as such for a conservative approach. However, DEQ recognizes the potential implications of differing orthophosphorus bioavailability. Therefore, for the long-term success of the TMDL and implementation of source reductions, DEQ will consider bioavailability data from the sources as new information becomes available now and during the 5-year review of the TMDL. Using this conservative approach provides reasonable assurance that this TMDL will achieve water quality standards to support beneficial uses.

2.4.2 Magnitude, Duration, and Frequency

Analyzing existing water quality data includes spatially and temporally examining data using statistical methods to understand and identify water quality conditions in the river relative to water quality standards. Recognized components of these analyses include magnitude, duration, and frequency. Analyzing the water quality data by magnitude, frequency, and duration is important because a similar analysis is used to determine the actual impairment of designated uses and development of the TMDL. The acceptable conditions for these factors are often based on ecological studies of pollutant effects and recovery periods.

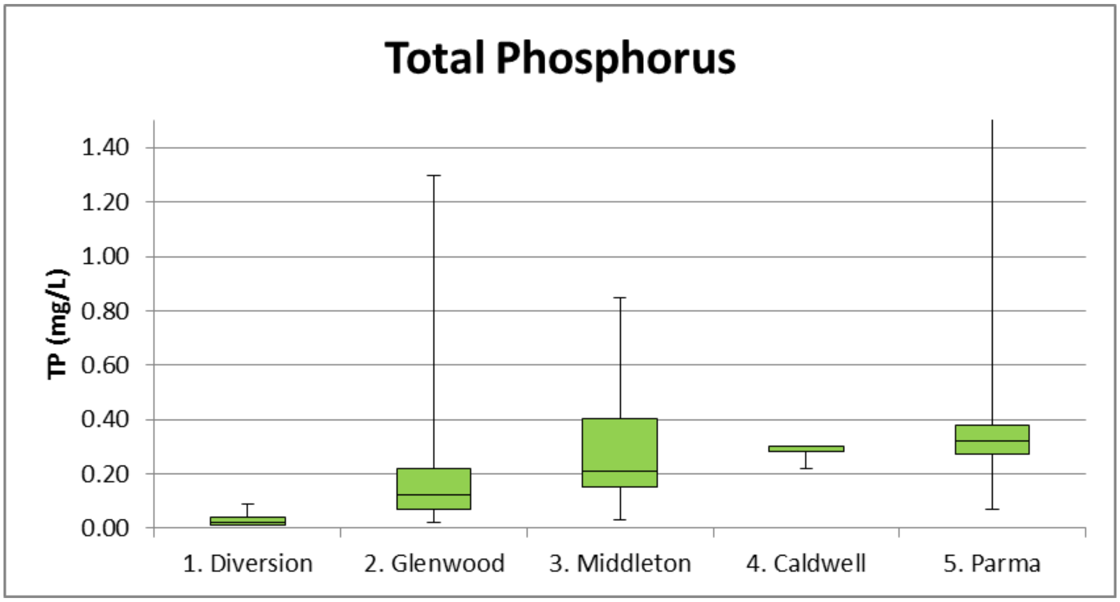
Magnitude refers to water quality and pollutant concentrations that are characteristic or representative of conditions. Magnitude of the water quality dataset is often summarized using statistics such as the minimum, median, average, and maximum.

Duration is the time period over which concentrations can be averaged and beneficial uses can be exposed to elevated levels of pollutants without harm. Since data are often from single instantaneous observations, assumptions are made to estimate the day, week, month, or season that such conditions typically occur. The duration is particularly important for certain pollutants whose effects are long term, such as sediment, nutrients, and algal biomass. These parameters are frequently addressed in TMDLs as seasonal or annual loads. The analysis of existing water quality data described below included a review by duration based on periods used in previous studies. These periods include various flow conditions: May 1–September 30 as used in the SR-HC TMDL and during irrigation season (August 2012), shortly after irrigation ended (October 2012), and shortly before irrigation resumed (March 2013) as used by the USGS (Etheridge 2013).

2.4.3 Lower Boise River Data

BURP monitoring is only appropriate for perennial streams (i.e., 5th order or lower, <15 meter width, <0.4 meter depth). Therefore, the Boise River, because it is significantly larger than the BURP protocols, could not be sampled at these main stem sites, yielding limited data collection and analyses (specifically stated in the 1995SBOIC029 site data and presumed for the remaining two main stem sites). The BURP data and summary reports can be obtained through DEQ's §305(b) Integrated Report webpage at *http://mapcase.deq.idaho.gov/wq2012/*.

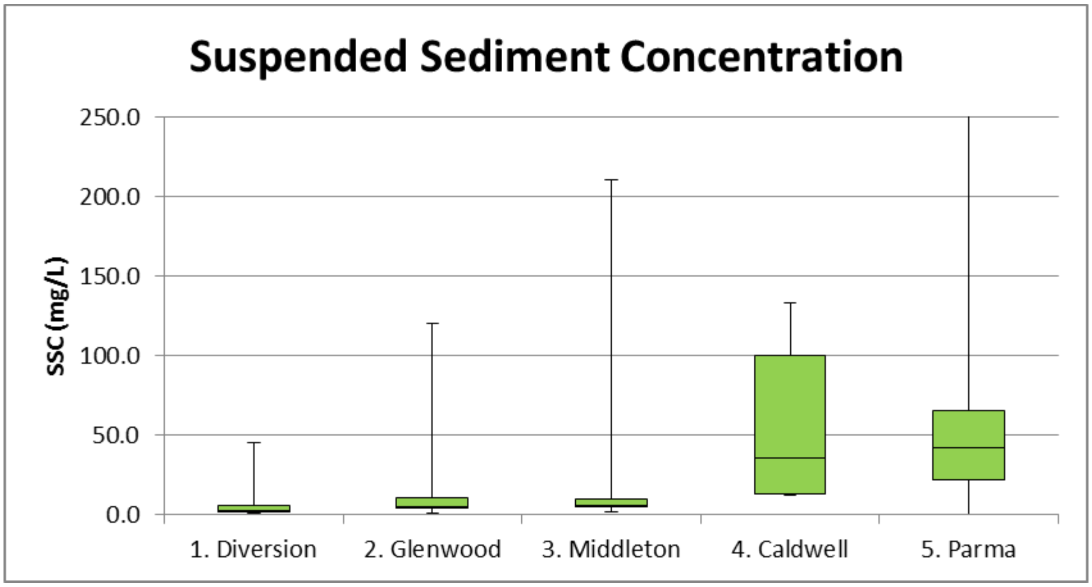
Over the past several decades, water quality and habitat data have been collected in the Lower Boise River subbasin. Historical USGS water quality data on the lower Boise River illustrate variable upstream to downstream patterns depending on the water quality constituent of interest. For example, median TP concentrations at Glenwood Bridge (0.12 mg/L) are approximately 6 times greater than at Diversion Dam (0.02 mg/L); whereas, TP concentrations near Parma (0.32 mg/L) are 2.7 times greater than at Glenwood Bridge (Figure 9). The TP concentrations in the Boise River near Parma are approximately 16 times greater than at the upstream monitoring location of Diversion Dam.



	1. Diversion	2. Glenwood	3. Middleton	4. Caldwell	5. Parma
	n = 123 (1990–2013) (mg/L)	n = 166 (1972–2013) (mg/L)	n = 120 (1976–2013) (mg/L)	n = 5 (1971, 1972, 2013) (mg/L)	n = 830 (1969–2013) (mg/L)
Average	0.03	0.18	0.29	0.28	0.33
Minimum	0.01	0.02	0.03	0.22	0.07
Q1	0.01	0.07	0.15	0.28	0.27
Median	0.02	0.12	0.21	0.28	0.32
Q3	0.04	0.22	0.40	0.30	0.38
Maximum	0.09	1.30	0.85	0.30	3.90

Figure 9. TP data collected by USGS on the lower Boise River. The green boxes, indicate the 25th (Q1) and 75th (Q3) data percentiles and are parted by the line representing the median value. Measured values below the detection limit at Diversion Dam were given the detection limit (0.01 mg/L) as a conservative value. The error bars indicate maximum and minimum observed values. Note: although not fully shown on the figure (for readability), the Parma maximum TP value reaches 3.9 mg/L.

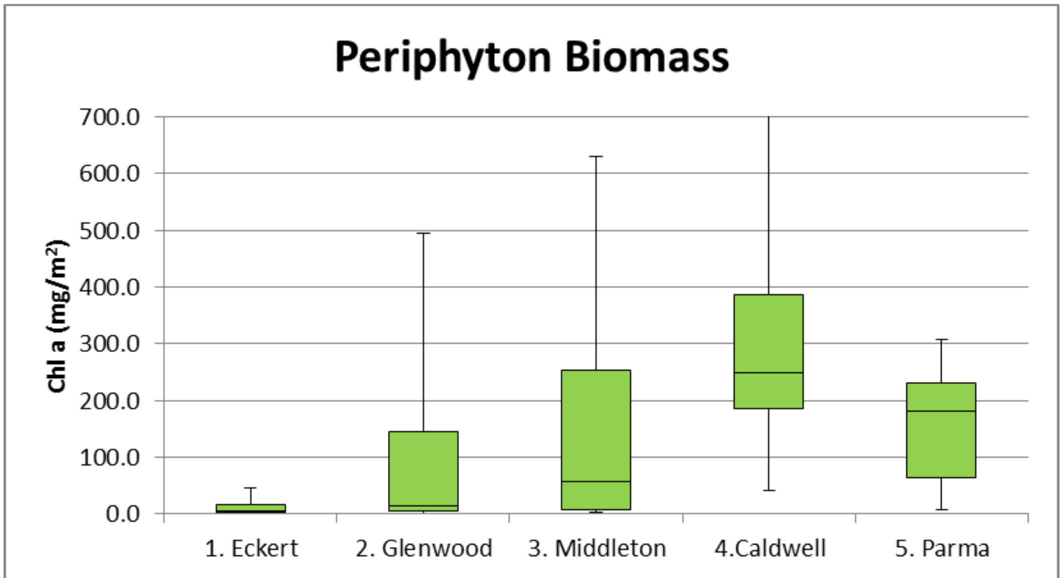
Historical USGS suspended sediment concentration (SSC) data show a similar, but slightly different gradient (Figure 10). Median SSC values increase by approximately 1.2 to 1.7 times from each upstream monitoring station, with the exception of Caldwell. Median SSC values at Caldwell (26.0 mg/L) are approximately 4.3 times greater than those at Middleton (6.0 mg/L). However, similar to TP, SSC in the Boise River near Parma is approximately 14 times greater than at the upstream monitoring location of Diversion Dam.



	1. Diversion	2. Glenwood	3. Middleton	4. Caldwell	5. Parma
	n = 113 (1990–2013) (mg/L)	n = 159 (1989–2013) (mg/L)	n = 108 (1991–2013) (mg/L)	n = 5 (1971, 1972, 2013) (mg/L)	n = 303 (1974–2013) (mg/L)
Average	5.8	11.2	11.4	45.8	55.7
Minimum	1.0	1.0	2.0	12.0	0.0
Q1	2.0	4.0	5.0	14.5	22.0
Median	3.0	5.0	6.0	26.0	42.0
Q3	6.0	10.5	10.3	55.8	65.5
Maximum	45.0	120.0	211.0	133.0	664.0

Figure 10. Suspended sediment concentration (SSC) data collected by USGS on the lower Boise River. The green boxes, indicate the 25th (Q1) and 75th (Q3) data percentiles and are parted by the line representing the median value. The error bars indicate maximum and minimum observed values. Note: although not fully shown on the figure (for readability), the Parma maximum SSC value reaches 664 mg/L.

USGS periphyton chlorophyll *a* data show a different upstream to downstream pattern (Figure 11). Median chlorophyll *a* is approximately 2.7 times greater at Glenwood Bridge (13.9 mg/m^2) than Eckert Road (5.0 mg/m^2). The median chlorophyll *a* increases by approximately 4.2 times from Glenwood to Middleton (58.2 mg/m^2) and Middleton to Caldwell (249.0 mg/m^2). However, chlorophyll *a* at Parma (181.0 mg/m^2) decreases by approximately 30% relative to Caldwell. This observed periphyton relationship between Parma and Caldwell may be due to a number of site-specific anthropogenic and environmental factors, including water velocity; SSC; available light, phosphorus, and other nutrient sources; and water temperatures, to name a few.



	1. Eckert	2. Glenwood	3. Middleton	4.Caldwell	5. Parma
	n = 43 (1995–2013) (mg/m^2)	n = 64 (1995–2013) (mg/m^2)	n = 62 (1995–2013) (mg/m^2)	n = 34 (1995–2013) (mg/m^2)	n = 29 (1995–2013) (mg/m^2)
Average	11.4	90.7	149.5	308.5	157.7
Minimum	0.0	0.0	2.5	41.7	8.3
Q1	1.9	4.7	8.5	185.8	63.0
Median	5.0	13.9	58.2	249.0	181.0
Q3	17.5	144.8	254.5	387.5	232.0
Maximum	46.0	496.0	630.0	933.0	307.0

Figure 11. Periphyton chlorophyll *a* data collected by USGS on the lower Boise River. The green boxes indicate the 25th (Q1) and 75th (Q3) data percentiles and are parted by the line representing the median value. The error bars indicate maximum and minimum observed values. Note: although not fully shown on the figure (for readability), the Caldwell maximum chlorophyll *a* value reaches 933 mg/m^2.

2.4.3.1 Algae Community Composition

The lower Boise River algal community composition analyses conducted by Rushforth Phycology (2007) reports organism presence—to genus or species level in most cases—in the Boise River for study dates in October 2005, September 2006, and March 2007. DEQ related the study's periphytic algae presence data with river locations to model periphyton and nutrient relationships (DEQ 2014a) (Figure 12):

- Rare—present in <10% of microscope fields
- Common—present in 10–20% of microscope fields
- Abundant—present in >20% of microscope fields

DEQ then created a visual display of the community composition by assigning values to algae presence:

- None = 0

- Rare = 1
- Common = 5
- Abundant = 8

Although the Rushforth study did not provide data that could be used as direct biomass input for modeling, the charts created by DEQ (Figure 13) help identify relative abundance of the algal groups in various reaches of the river during March, September, and October. From this, it appears that the periphyton community composition in the river can differ both by season and location, including high- and low-nutrient diatoms, green and blue-green algae, and filamentous algae (*Cladophora*).

Periphyton community composition summarized from Rushforth 2007

Model segment	River Mile	Site	Lat	Long	
1	***61.1***	Diversion	43.54531	-116.099469	
	Blue-greens	*Cladophora*	*Greens*	*High-nutrient diatoms*	*Low-nutrient diatoms*
March	rare	rare	common	abundant	common
September	none	abundant	common	abundant	none
October	none	none	abundant	common	none
2	***58.3***	Eckert Road	43.56572	-116.132058	USGS Site ID 13203760
	Blue-greens	*Cladophora*	*Greens*	*High-nutrient diatoms*	*Low-nutrient diatoms*
March	common	rare	common	abundant	common
September	abundant	rare	rare	abundant	none
October	common	none	none	common	none
3	***50.17***	Veteran's Parkway	43.63606	-116.2411417	USGS Site ID 13205642
	Blue-greens	*Cladophora*	*Greens*	*High-nutrient diatoms*	*Low-nutrient diatoms*
March	common	none	rare	abundant	rare
September	none	abundant	none	abundant	rare
October	abundant	none	abundant	abundant	none
4	***47.5***	Glenwood	43.66104	-116.2796389	USGS Site ID 13206000
5	***45.51***	Loss to N Channel	43.67043	-116.30753	GIS
6	**45.51**	LOSS TO NORTH CHANNEL	43.67043	-116.30753	GIS
7	**44.16**	Boise WWTP West Boise	43.67271	-116.331657	GIS
8	**40.2**	GAIN FROM NORTH CHANNEL	43.68138	-116.424625	GIS
	Blue-greens	*Cladophora*	*Greens*	*High-nutrient diatoms*	*Low-nutrient diatoms*
March	none	common	rare	abundant	common
September	common	none	common	abundant	none
October	common	none	rare	abundant	none
9	***31.43***	Boise River NR Middleton	43.68704	-116.5867694	USGS Site ID 13210815
	Blue-greens	*Cladophora*	*Greens*	*High-nutrient diatoms*	*Low-nutrient diatoms*
March	common	rare	rare	abundant	common
September	rare	rare	rare	abundant	abundant
October	common	none	rare	abundant	none
10	***23.98***	Boise River at HWY 20-26	43.68898	-116.6862333	USGS Site ID 13211000
11	***15.66***	Boise River at Notus	43.72088	-116.7980028	USGS Site ID 13212500
12	***10.6***	Above Dixie Drain	43.73225	-116.889004	GIS
13	***8.77***	Boise River at HWY 95 Crossing	43.74721	-116.9124611	USGS Site ID 13212900
	Blue-greens	*Cladophora*	*Greens*	*High-nutrient diatoms*	*Low-nutrient diatoms*
March	rare	abundant	rare	abundant	none
September	none	common	common	abundant	common
October	abundant	none	rare	abundant	none
END	***3.8***	Parma	43.78151	-116.9727944	USGS Site ID 13213000

Figure 12. Summary of periphytic algal community compositions on the lower Boise River (Rushforth Phycology 2007, as displayed in DEQ 2014a).

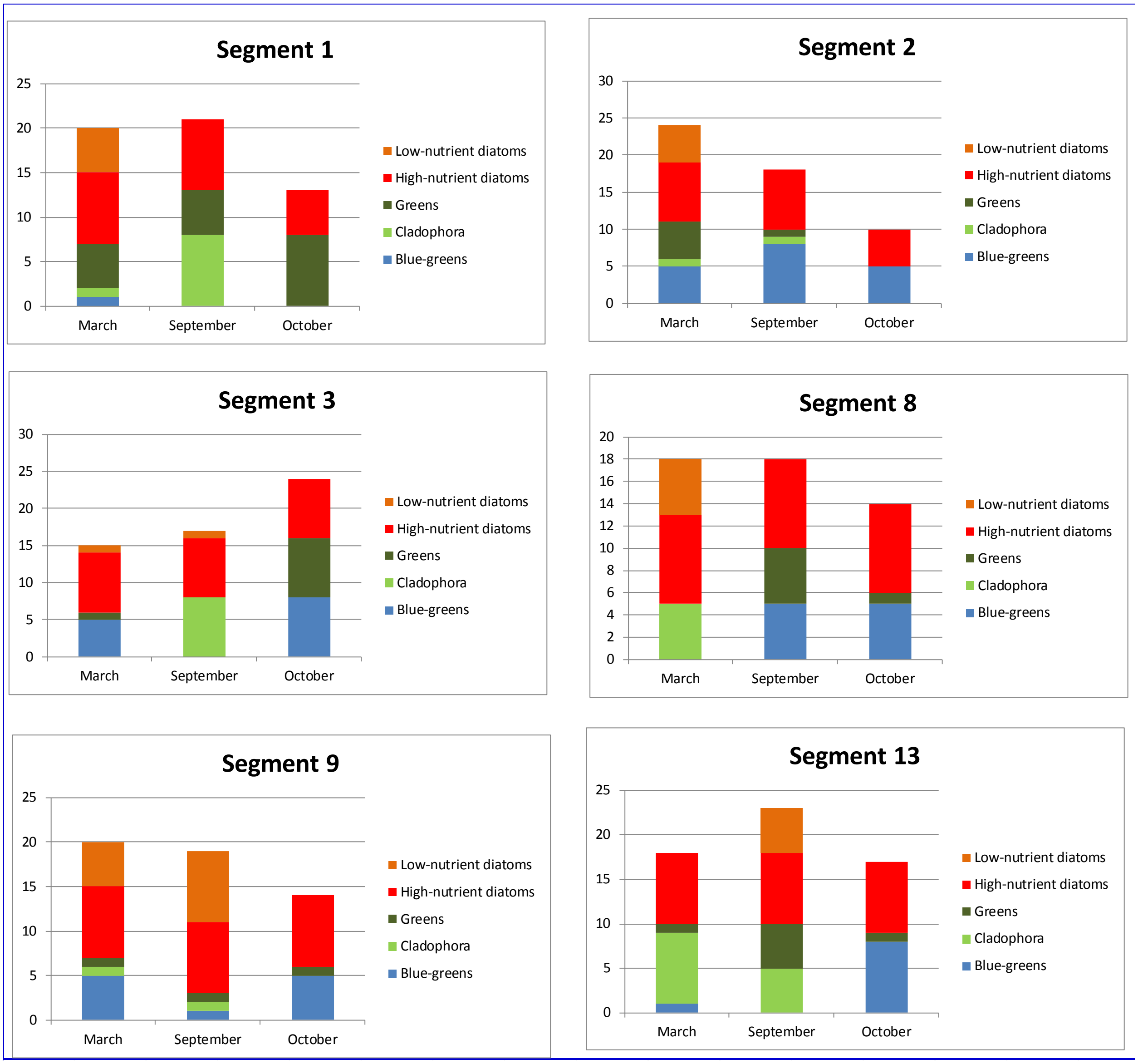


Figure 13. DEQ depiction (DEQ 2014a) of algal community composition in sampled segments, based on previous analyses in the lower Boise River (Rushforth Phycology 2007). Segment 1 = Diversion Dam to Eckert Road; Segment 2 = Eckert Road to Veteran's Parkway; Segment 3 = Veteran's Parkway to Glenwood Bridge; Segment 8 =Gain from North Channel to Middleton; Segment 9 = Middleton to Caldwell; Segment 13 = Boise River at HWY 95 crossing to Parma.

2.4.3.2 Synoptic Sampling

The USGS, in cooperation with DEQ and the LBWC, collected TP and other water quality data during three synoptic sampling events in the lower Boise River during August and October 2012 and March 2013. Synoptic sampling is a sampling event that takes place over a relatively short time frame and under relatively stable hydrologic conditions, in this case, each event was conducted over a week. The resulting mass balance model and report spanned 46.4 river miles (RM) along the Boise River from Veteran's Parkway in Boise (RM 50.2) to Parma (RM 3.8). The USGS measured streamflow at 14 sites on the main stem of the Boise River, 2 sites on the north channel of the Boise River, 2 sites on the Snake River (one upstream and one downstream of the mouth of the Boise River), and 17 tributary and return flow sites. Additional samples were collected from treated effluent at six publicly owned treatment works (POTWs) and two fish hatcheries. Idaho Department of Water Resources diversion flow measurements were used within the sampled reaches (Etheridge 2013).

USGS developed a TP mass-balance model to evaluate sources of phosphorus to the Boise River during the sampling time frame (Etheridge 2013). The timing of each synoptic sampling event allowed the USGS to evaluate phosphorus inputs and outputs to the lower Boise River during irrigation season (August 2012), shortly after irrigation ended (October 2012), and shortly before irrigation resumed (March 2013).

The USGS mass-balance model and report noted the following:

> …point and nonpoint sources (including ground water) contributed phosphorus loads to the Boise River during irrigation season. Ground water exchange within the Boise River in October 2012 and March 2013 was not as considerable as that measured in August 2012. However, ground water discharge to agricultural tributaries and drains during non-irrigation season was a large source of discharge and phosphorus in the lower Boise River in October 2012 and March 2013. Model results indicate that point sources represent the largest contribution of phosphorus to the Boise River year round, but that reductions in point and nonpoint source phosphorus loads may be necessary to achieve seasonal total phosphorus concentration targets at Parma (RM 3.8) from May 1 through September 30, as set by the 2004 Snake River-Hells Canyon Total Maximum Daily Load document. (Etheridge 2013)

The report is consistent with other data collected in the lower Boise River (Appendix B) indicating upstream sampling location TP concentrations (near Veteran's Parkway at RM 50.2) between 0.01 and 0.02 mg/L. At the downstream sampling location, near Parma, TP concentrations were ≥0.29 mg/L during each of the synoptic events (Table 4).

Table 4. Results of USGS synoptic sampling on the lower Boise River in 2012 and 2013.

Sampling Week	Location	Flow (cfs)	TP Concentration (mg/L)	TP Load (lb/day)
August 20, 2012	Veteran's Parkway (RM 50.2)	759	0.015 (0.02)[a]	61.4
	Parma (RM 3.8)	624	0.30	1,010
October 29, 2012	Veteran's Parkway (RM 50.2)	234	<0.01	5.10
	Parma (RM 3.8)	924	0.29	1,450
March 4, 2013	Veteran's Parkway (RM 50.2)	243	0.01	13.1
	Parma (RM 3.8)	846	0.34	1,550

Note: Source: Etheridge (2013, Table 7).
[a] The USGS mass balance report text identifies the value as 0.015 and Table 7 of the report identifies the value as 0.02 (Etheridge 2013).

2.4.3.3 Forms of Phosphorus

TP includes particulate, nonparticulate, inorganic, and organic forms of phosphorus. OP is the bioavailable portion of TP that can be readily used by algae. Therefore, higher levels of OP in TP indicate a greater potential for algal growth.

The *Lower Boise River Nutrient Subbasin Assessment* (DEQ 2001d) identified OP levels as comprising between approximately 75–80% of the TP load, which is similar to previous findings by USGS (MacCoy 2004). The proportion of OP in the lower Boise River increases in downstream stations (e.g., Glenwood to Parma) relative to values measured at Diversion Dam.

OP, TP, and instantaneous discharge measurements collected by the USGS in the lower Boise River near Parma from 1987 to 2012 indicate that across all flows, the OP:TP ratio is approximately 0.78 (Figure 14). At flows greater than the 10th percentile flow rank (≤3,268 cubic feet per second [cfs]), the mean OP:TP ratio is 0.8, ranging from 0.5 to >1. At less than the 10th percentile flow rank (≥3,268 cfs), the mean OP:TP ratio is 0.62, ranging from 0.4 to 0.89.

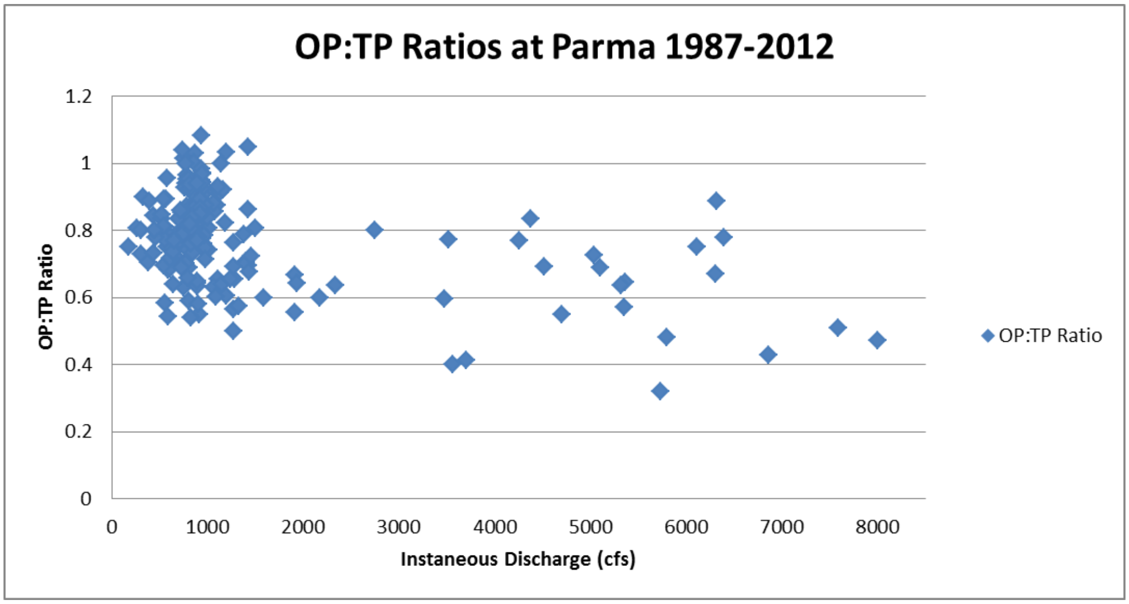
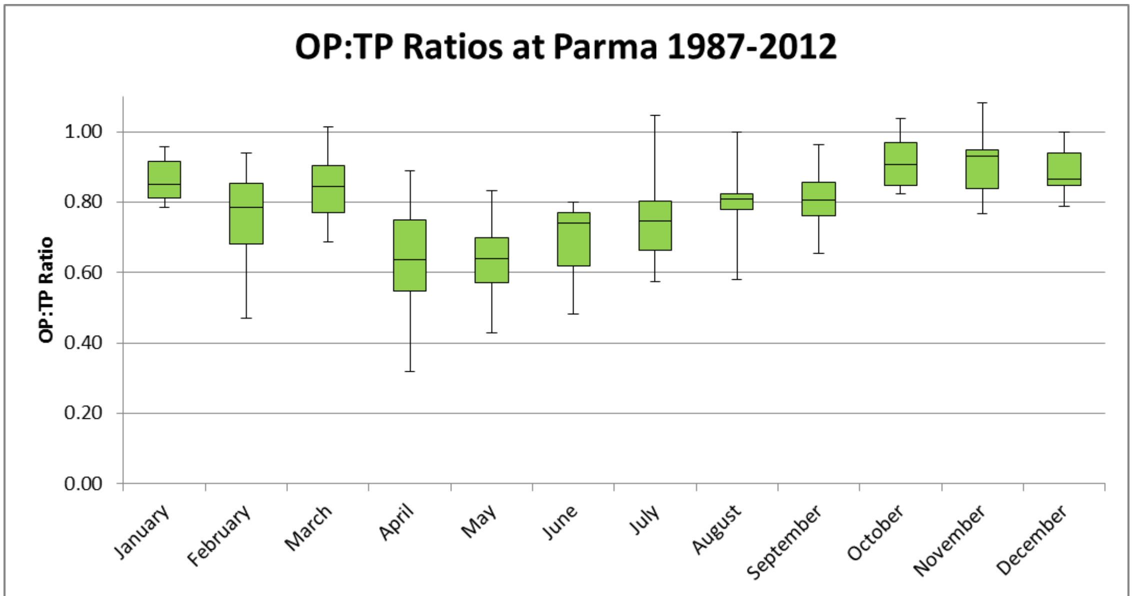


Figure 14. Orthophosphorus to TP ratios relative to instantaneous river discharge as measured by the USGS on the lower Boise River near Parma. The OP:TP ratios are presented relative to the instantaneous discharge of the Boise River measured concurrently. Note: DEQ excluded two potential outlier data points due to disproportionate influence on the analysis: (1) OP:TP ratio of 0.053 in August 2009 and (2) OP:TP ratio of 0.125 in September 1988.

Monthly median OP:TP ratios range from a low of 0.64 in April and May to a high of 0.93 in November (Figure 15). Year-round, the OP:TP ratios in the lower Boise River near Parma average 0.78. Alternatively, OP:TP ratios for the May 1–September 30 SR-HC TMDL allocation period average 0.73, and ratios for the October 1–April 30 time frame average 0.83.



	Jan n = 10	Feb n = 2	Mar n = 12	Apr n = 17	May n = 22	Jun n = 15	Jul n = 23	Aug n = 46	Sept n = 21	Oct n = 13	Nov n = 14	Dec n = 13
Average	0.86	0.76	0.84	0.63	0.64	0.69	0.74	0.80	0.81	0.92	0.91	0.89
Minimum	0.79	0.47	0.69	0.32	0.43	0.48	0.58	0.58	0.65	0.82	0.77	0.79
Q1	0.81	0.68	0.77	0.55	0.57	0.62	0.66	0.78	0.76	0.85	0.84	0.85
Median	0.85	0.79	0.84	0.64	0.64	0.74	0.75	0.81	0.81	0.91	0.93	0.87
Q3	0.92	0.85	0.90	0.75	0.70	0.77	0.80	0.82	0.86	0.97	0.95	0.94
Maximum	0.96	0.94	1.01	0.89	0.83	0.80	1.05	1.00	0.96	1.04	1.08	1.00

Figure 15. Orthophosphorus to TP ratios from USGS data on the lower Boise River near Parma. The green boxes indicate the 25th (Q1) and 75th (Q3) data percentiles and are parted by the line representing the median value. The error bars indicate the maximum and minimum observed values. Note: DEQ excluded two potential outlier data points due to disproportionate influence on the analysis: (1) a low ratio of 0.053 in August 2009 and (2) a low ratio of 0.125 in September 1988.

Recent USGS data collected for the lower Boise River mass balance models (Etheridge 2013) identify OP:TP ratios in August 2012 between Diversion Dam and Parma averaged 0.81 (n = 14; range 0.69 to 0.92). During the nonirrigation season, OP:TP ratios averaged 0.89 (n = 15; range 0.6 to 0.98) in October 2012 and 0.81 (n = 15; range 0.3 to 0.95)[3] in March 2013.

Etheridge (2013) provides detailed analyses and discussions of OP and TP in the lower Boise River, as observed during the August 2012, October 2012, and March 2013 synoptic sampling efforts in the subbasin, including the data collection, lab, and statistical methods and analyses. The USGS report states the following:

> Donato and MacCoy (2005) observed the highest orthophosphorus as phosphorus (OP)-to-TP ratios at Parma in November and December and lowest ratios in summer, which was the opposite of patterns observed in the river upstream of agricultural and urban land uses. This suggests that aquatic plants use nutrients in the lower reaches of the river in summer and that dam releases for irrigation supply dilute WWTP effluent…

[3] With the exception of the OP:TP ratio measured below Diversion Dam in March 2013 (0.3), all OP:TP ratios measured in the lower Boise River during the 2012–2013 synoptic sampling were ≥0.69.

> The evaluation of OP:TP relative to river mile and suspended sediment concentrations in the Boise River suggests that particulate phosphorus is positively correlated with suspended sediment in the downstream direction during irrigation season and that agricultural sources of particulate phosphorus constitute progressively more of the phosphorus load in a downstream direction.
>
> Agricultural runoff also can contain OP (Sharpley and others, 2002)… A study by Vadas and others (2005) indicated that OP runoff in cropped fields with soil phosphorus concentrations of 14 mg/kg, as analyzed in the 2001 study (Fox and others, 2002), could yield concentrations of 0.11–0.67 mg/L of OP in surface runoff.
>
> Despite agricultural phosphorus loading during irrigation season, some of the phosphorus in tributaries, drains, and canals likely originated from point sources that were diverted to supply irrigation water. Phyllis Canal, Indian Creek, and Riverside Canal exemplify water bodies that are used to convey point-source TP loads to irrigated land. The water-quality sample from the south channel of the Boise River immediately upstream of the Phyllis Canal diversion contained 0.18 mg/L OP and 0.21 mg/L TP in August. Phyllis Canal is outside most agricultural areas and downstream of Lander and West Boise WWTPs, indicating that non-agricultural sources of OP probably account for most of the OP in Phyllis Canal. (Etheridge 2013)

Differentiating between point and nonpoint source TP loads in the lower Boise River is difficult due to the complex hydrology management and other factors. Etheridge (2013) asserts that environmental tracers may best indicate OP sources in the subbasin because the mass balance models do not account for the fate of any particular TP load. However, the models do provide evidence that point source loads may contribute to nonpoint source loads during irrigation season. For example, the August mass balance model results suggest that biogeochemical processes may have had a limited effect on TP concentrations. Conversely, the October and March mass balance models suggest that biogeochemical processes may have occurred in the Boise River, resulting in overall net reductions of main stem TP concentrations in October 2012 and net gains in March 2013 (Etheridge 2013).

2.4.4 Data Gaps

This TMDL identifies several data gaps that, if eliminated, could help produce a more robust assessment of the effects of TP and periphyton on beneficial uses. The best available data were used to develop the current TMDL. However, DEQ acknowledges that additional questions warrant investigation (Table 5).

Additional monitoring efforts (sections 4.6 and 5.5.4) are either underway, have been planned, or are the subject of ongoing discussions among DEQ, the USGS, the LBWC, and other stakeholders. Subsequent information developed through these efforts may be used to appropriately revise portions of the TMDL and adjust implementation methods and control measures. Changes in the TMDL will be addressed through supplementary documentation or replacing sections or appendices as part of the 5-year review process. The goal will be to build upon rather than replace the original work wherever practical. The schedule and criteria for reviewing new data is more appropriately addressed in the implementation plan, due 18 months after approval of this document. The opportunity to revise the TMDL and necessary control measures is consistent with current and developing EPA TMDL guidance that emphasizes an iterative approach to TMDL development and implementation. However, any additional effort on the part of DEQ to revise the TMDL or implementation plan and control measures must be addressed on a case-by-case basis as additional funding becomes available.

Table 5. Data gaps identified while developing the lower Boise River TMDL addendum.

Pollutant or Factor	Data Gap	Potential Remedy
Phosphorus	Phosphorus concentrations and loads in the Boise River, particularly near Parma	USGS real-time water quality monitoring near Parma—initiated in 2014
	How phosphorus is diverted, used, and returned to the river (quantities, qualities, types, durations, etc.)	Additional studies using markers to track phosphorus through the subbasin
Periphyton	Spatial and temporal periphyton growth patterns and conditions in the river	More frequent and intensive periphyton sampling in the river
Ground water	Ground water behavior (rates of flow and load contributions, timing, etc.)	Additional studies examining water movement in the shallow ground water aquifer relative to lower Boise River flows
Stormwater	Points of input to stormwater system	Drainage system infrastructure and flow mapping
	Nonstormwater (dry weather) flow magnitude and duration	Nonstormwater (dry weather) survey of flow from outfalls
	Nonstormwater (dry weather) discharge water quality	Nonstormwater (dry weather) monitoring

2.4.5 Status of Beneficial Uses

Cold water aquatic life and contact recreation beneficial uses are impaired by excess nutrients, in the form of TP, within the lower Boise River as documented by the following sources: (1) available water quality data collected by DEQ, USGS, ISDA, Idaho Power, municipalities, and others; (2) the SR-HC TMDL analysis (DEQ and ODEQ 2004); and (3) written correspondence from EPA (EPA 2009b). This impairment from excess TP is evidenced by visible slime and other nuisance aquatic growths in these water bodies, impacts to other water quality and aesthetic parameters (see section 2.3.1), and contributing nutrient, algal, and other water quality impacts to the Snake River downstream. A combination of point sources (e.g., POTWs, stormwater, and industrial discharge) and nonpoint sources (e.g., agricultural return water, ground water, septic, and unmeasured flows) contribute to this TP loading in the lower Boise River.

3 Subbasin Assessment—Pollutant Source Inventory

The pollutant of concern for this TMDL is limited to excess nutrients in the form of TP, for which narrative criteria are established in the Idaho water quality standards. TP has been identified as a limiting factor for attaining beneficial uses in the subbasin (see section 2.3.1). TP load and wasteload allocations have not previously been established for the Lower Boise River subbasin; however, nonpoint and point sources in the subbasin have been addressed in the following documents:

- *Lower Boise River: TMDL Five-Year Review* (DEQ 2009b)
- *Lower Boise River Implementation Plan Total Phosphorus* (DEQ 2008)
- *Sediment and Bacteria Allocations Addendum to the Lower Boise River TMDL* (DEQ and LBWC 2008)

- *Snake River - Hells Canyon Total Maximum Daily Load (TMDL)* (DEQ and ODEQ 2004)
- *Implementation Plan for the Lower Boise River Total Maximum Daily Load* (DEQ 2003)
- *Lower Boise River TMDL: Subbasin Assessment, Total Maximum Daily Loads* (DEQ 1999)
- *Lower Boise River Nutrient & Tributary Subbasin Assessments* (DEQ 2001c)
- *Lake Lowell TMDL: Addendum to the Lower Boise River Subbasin Assessment and Total Maximum Daily Loads* (DEQ 2010b)

A new implementation plan should be drafted to incorporate this TMDL addendum for the lower Boise River.

3.1 Point Sources

Point sources addressed by this addendum include POTWs and other facilities (such as fish hatcheries) as well as certain stormwater.

3.1.1 Publicly Owned Treatment Works and Other Facilities

Major point sources within the subbasin are mostly POTWs. These POTWs treat raw sewage and discharge effluent to meet the water quality requirements of their EPA-issued National Pollutant Discharge Elimination System (NPDES) permits. While these POTWs reduce pollutants from the raw sewage, some amount of phosphorus is discharged in the effluent. EPA-permitted point source facilities discharge phosphorus into the lower Boise River, directly or indirectly, through drains, tributaries, and other hydrological connections. The phosphorus loads from these POTWs and other facilities are calculated based on discharge monitoring data flows and effluent concentrations (Table 6).

Table 6. Current annual point source discharges to the lower Boise River.

Source	NPDES Permit No.	Main Stem RM or Receiving Water[a]	Mean Discharge (mgd)	Mean TP Concentration (mg/L)[b]	Mean TP Load (lb/day)
Boise River—Main Stem					
Lander	ID-002044-3	RM 50.0	12.39	1.87	193.3
West Boise	ID-002398-1	RM 44.2	15.11	4.78	602.6
Middleton	ID-002183-1	RM 27.1	0.46	4.02	15.5
Caldwell	ID-002150-4	RM 22.6	6.45	2.26	121.6
IDFG-Eagle	Aquaculture General Permit	RM 41.8	2.62	0.02	0.4
Boise River—Tributaries					
Avimor	In application	Dry Creek	No discharge currently		
Star	ID-002359-1	Lawrence Kennedy Canal (Mill Slough/Boise River)	0.53	1.50	6.7
Meridian	ID-002019-2	Fivemile Creek (Fifteenmile Creek)	5.40	1.01	45.5
Sorrento Lactalis	ID-002803-7	Mason Creek	0.63	0.02	0.1
Nampa	ID-002206-3	Indian Creek	10.10	5.03	423.9
Kuna	ID-002835-5	Indian Creek	0.49	2.45	9.9
IDFG-Nampa	Aquaculture General Permit	Wilson Drain and Pond (Indian Creek)	20.42	0.07	11.8
Darigold	ID-002495-3	RM 22.6 (unmeasured drain)	0.25	0.23	0.5
Notus[c]	ID-002101-6	Conway Gulch	0.06	4.6	2.2
Wilder	ID-0020265	Wilder Ditch Drain	0.16	3.37	4.4
Greenleaf[c]	ID-002830-4	West End Drain (Riverside Canal to Dixie Drain)	0.06	0.06	0.03
ConAgra (XL Four Star)	ID-000078-7	Indian Creek	No discharge currently		

Note: These data represent contributions to the Boise River or tributaries and do not account for downstream diversions or uptake (e.g., agriculture, municipal, industrial, or biogeochemical).
[a] River miles (RM) identified by USGS in lower Boise River mass balance report (Etheridge 2013); IDFG-Eagle and Darigold RMs are estimated. IDFG-Eagle discharges at Eagle Island, and Darigold discharges to an unmeasured drain that discharges into the lower Boise River.
[b] Mean TP concentrations calculated from January 1, 2012, through April 30, 2013, using data provided by facilities and/or discharge monitoring report data.
[c] Values for the Notus and Greenleaf facilities are only for October 1–April 30; the facilities did not discharge from May 1–September 30. However, the new NPDES permits allow May 1–September 30 discharge.

3.1.2 Stormwater

Stormwater runoff is water from rain or snowmelt that does not immediately infiltrate into the ground and flows over or through natural or man-made storage or conveyance systems. When undeveloped areas are converted to land uses with impervious surfaces—such as buildings, parking lots, and roads—the natural hydrology of the land is altered and can result in increased surface runoff rates, volumes, and pollutant loads. Certain types of stormwater runoff are considered point source discharges for Clean Water Act purposes, including stormwater that is associated with municipal separate storm sewer systems (MS4s), industrial stormwater covered under the Multi-Sector General Permit (MSGP), and construction stormwater covered under the Construction General Permit (CGP).

The terms "municipal separate storm sewer" and "municipal separate storm sewer systems" (or MS4) are defined in 40 CFR 122.26(b)(8) and (b)(18), respectively. MS4s include any publicly owned conveyance or system of conveyances used for collecting and conveying stormwater and that discharges to waters of the United States. MS4s are designed for conveying stormwater only and are neither part of a combined sewer system nor part of a POTW. These systems may include roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains (EPA 2008a, 2008b). Polluted stormwater runoff is commonly transported through MS4s, from which it is often discharged untreated into local water bodies.

Certain MS4s are regulated under the NPDES permit program based on meeting certain definitions in federal regulations (40 CFR 122.26(b)(4), (b)(5) and/or (b)(16)). To prevent harmful pollutants from being discharged through an MS4, operators of regulated MS4s must obtain an NPDES permit from EPA, implement a comprehensive municipal stormwater management program, and use best management practices (BMPs) to control pollutants in stormwater discharges to the maximum extent practicable.

Stormwater is produced by runoff from precipitation-driven storm events. As a result, stormwater ("wet weather") discharges from MS4 systems that result from specific precipitation events will be referred to as stormwater and identified as a point source with a wasteload allocation in this TMDL. Municipal stormwater within the Lower Boise River subbasin is regulated under either a Phase I or a Phase II NPDES MS4 permit issued by EPA Region 10.

MS4 systems in the Treasure Valley also convey other inputs of water such as landscape irrigation, building cooling waters, wash waters, agricultural return flows, ground water infiltration, and construction discharges. These types of discharges are characterized as nonstormwater ("dry weather") discharges. In effect, some MS4 systems in the valley share "pipes" with nonpoint source discharges. These nonstormwater discharges can be authorized in MS4 permits if they satisfy specific conditions (see individual MS4 permits for more information). As a result, all nonprecipitation driven discharges from MS4s will be referred to as nonstormwater and identified as point sources with a wasteload allocation in this TMDL. Nonstormwater discharges originating from agricultural lands (e.g., irrigation return flows) will be identified as NPDES-exempt agricultural flows. A complete list of authorized nonstormwater discharges as defined by local MS4 permits is shown in Table 7. Within the subbasin are 9 EPA-issued MS4 stormwater permits and 12 different permittees. These entities discharge phosphorus into the lower Boise River, directly or indirectly, through drains, tributaries, and other hydrological connections (Table 8).

Table 7. NPDES MS4 permit authorized nonstormwater discharges.

Type of MS4 Authorized Nonstormwater Discharge	Point Source—Authorized Nonstormwater	Nonpoint Source—Agricultural Exempt Nonstormwater
Uncontaminated water line flushing	X	
Potable water sources	X	
Landscape irrigation	X	
Lawn watering	X	
Irrigation water		X
Flows from riparian habitats and wetlands	X	
Diverted stream flows	X	
Springs	X	
Rising ground waters	X	
Uncontaminated ground water infiltration	X	
Uncontaminated pumped ground water or spring water	X	
Foundation and footing drains	X	
Uncontaminated air conditioning or compressor condensate	X	
Water from crawlspace pumps	X	
Individual residential car washing	X	
Dechlorinated swimming pool discharges	X	
Routine external building wash down	X	
Street and pavement wash waters	X	
Fire hydrant flushing	X	
Flows from emergency firefighting activities	X	

Table 8. 2010 MS4 NPDES permit holders and nonpermitted areas with annual flows and loads (prepared by Ada County Highway District and LBWC stormwater group).

Permit Holder/Agency	NPDES Permit Number	MS4 Permit Type	Permitted Areas				Permitted Urbanized & City Limits	Non-Permitted Areas		% Impervious	Area Ratio[e,f]	Flow[g,h,i]	Load[i]
			Urbanized Area[a]		City Limits[b,c]			City Limits[b,c]		Area City Limits[d]		(CFS)	(lbs/day)
			Area (mi^2)	Acre	Area (mi^2)	Acre	Acre	Area (mi^2)	Acre				
Ada County													
Boise/Garden City	IDS027561	Phase I			87	55,773							
Boise	IDS027561	Phase I			83	53,053				28			
Garden City	IDS027561	Phase I			4	2,720				31			
Ada County Highway District	IDS027561	Phase I			87	55,773							
Boise State University	IDS027561	Phase I			0.24	153							
Ada County Drainage District 3	IDS027561	Phase I			8	4,801							
ITD, District 3	IDS027561	Phase I											
Total Area Boise/Garden City Phase I Permit					**87**	**55,773**					0.31		
Ada County Highway District	IDS028185	Phase II	62	39,376	84	54,218							
Meridian		-	24	15,178	28	18,160		4	2,982	30			
Eagle		-	12	7,518	30	19,378		18	11,860	17			
Urbanized Ada County (unincorporated)		-	26	16,680	NA	NA							
Total Area Ada County Phase II Permit			**62**	**39,376**							0.22		
Total Area Ada County Phase I and II Permits							**95,149**						
Kuna	NA	-						18	11,619	25			
Star	NA	-						4	3,288	19			
Total Ada County Incorporated Non- Permitted Area								**44**	**29,749**		**0.16**		
Canyon County													
Caldwell	IDS028118	Phase II	17.5	11,172				4.6	2,979	21			
Nampa	IDS028126	Phase II	25	16,015				6.5	4,129	25			
Middleton	IDS028100	Phase II	2.3	1,478				2.9	1,851	13			
Urbanized Canyon County (unincorporated)	-	-	24.8	15,890									
ITD, District 3	IDS028177	Phase II											
Canyon Highway District #4[a]	IDS028134	Phase II	8	5,120									
Nampa Highway District #1[a]	IDS028142	Phase II	8.5	5,440									
Notus-Parma Highway District #2[a]	IDS028151	Phase II	2	1,280									
Total Area Canyon County Phase II Permits			**70**	**44,555**							0.25		
Greenleaf	NA	-						0.8	493				
Notus	NA	-						0.4	246				
Parma	NA	-						1.1	706				
Wilder	NA	-						0.7	464				
Total Canyon County Incorporated Non- Permitted Area								**17**	**10,868**		**0.06**		
May-September Stormwater Wet Weather												**30.30**	**71.00**
May-September Non-Stormwater Dry Weather												**167.70**	**394.00**
October-April Stormwater Wet Weather												**45.30**	**107.00**
October-April Non-Stormwater Dry Weather												**18.70**	**44.00**

Notes: While average loads are used for the TMDL, actual stormwater discharge loads (flow and concentrations) can be much higher due to precipitation events with high intensity and/or duration. The Notus-Parma Highway District #2 (2 mi^2; 1,280 acres) is no longer part of a Phase II MS4 permitted area and is now a nonpermitted area.
[a] Urbanized area, based on 2010 census, which may differ from the MS4 permitted areas, which were based on 2003 decennial census data.
[b] Ada County Assessor, July 9, 2014
[c] Canyon County Assessor, May 28, 2014
[d] Data from 2011 NAIP-UTC Canopy Assessment-PlanItGeo (roads, buildings, parking lots)
[e] Area data from NPDES permit factsheets (2000 census)
[f] Area ratio = the area contribution of each MS4 permit relative to the total service area for MS4s
[g] Stormwater (wet weather) flows and loads are primarily the result of immediate precipitation.
[h] Nonstormwater (dry weather) flows are considered nonprecipitation flows that include dry weather point sources and agricultural exempt nonstormwater (Table 7).
[i] The stormwater (wet weather) and nonstormwater (dry weather) flows and load estimates are derived from data provided by the LBWC stormwater workgroup.

In the Boise and Garden City area, Ada County Highway District (ACHD), Boise, Garden City, Idaho Transportation Department District 3, Ada County Drainage District 3, and Boise State University share permittee responsibilities for implementing their NPDES MS4 permit. Information on meetings, responsibilities, budgets, stormwater management plans, and annual reports is available at *http://www.partnersforcleanwater.org*.

ACHD's annual report for the area that includes the cities of Eagle, Meridian, and urbanized unincorporated Ada County (urbanized Ada County) is published and made available through ACHD's web site at *http://www.achdidaho.org/departments/TechServices/Drainage.aspx*.

Stormwater management areas for the subbasin have been updated based on 2010 census data (US Census Bureau 2010) and current geographic information system (GIS) mapping information, which was estimated by the LBWC stormwater group. This information does not represent entities with active stormwater management programs and policies, such as stormwater retention onsite, that are currently not under the regulations of the MS4 permits. The MS4s addressed in this TMDL are located within 2010 urbanized areas and city boundaries (incorporated areas) of Ada and Canyon County based on available GIS information (Figure 16 and Figure 17). Cities in urbanized areas include Boise, Garden City, Eagle, Meridian, Middleton, Nampa, and Caldwell. Within the urbanized areas are also unincorporated areas of Ada County and Canyon County. Additionally, there are areas in each county that are incorporated but not included in the permitted urbanized areas. These areas include the Ada County cities of Kuna and Star and Canyon County cities of Greenleaf, Notus, Parma, and Wilder.

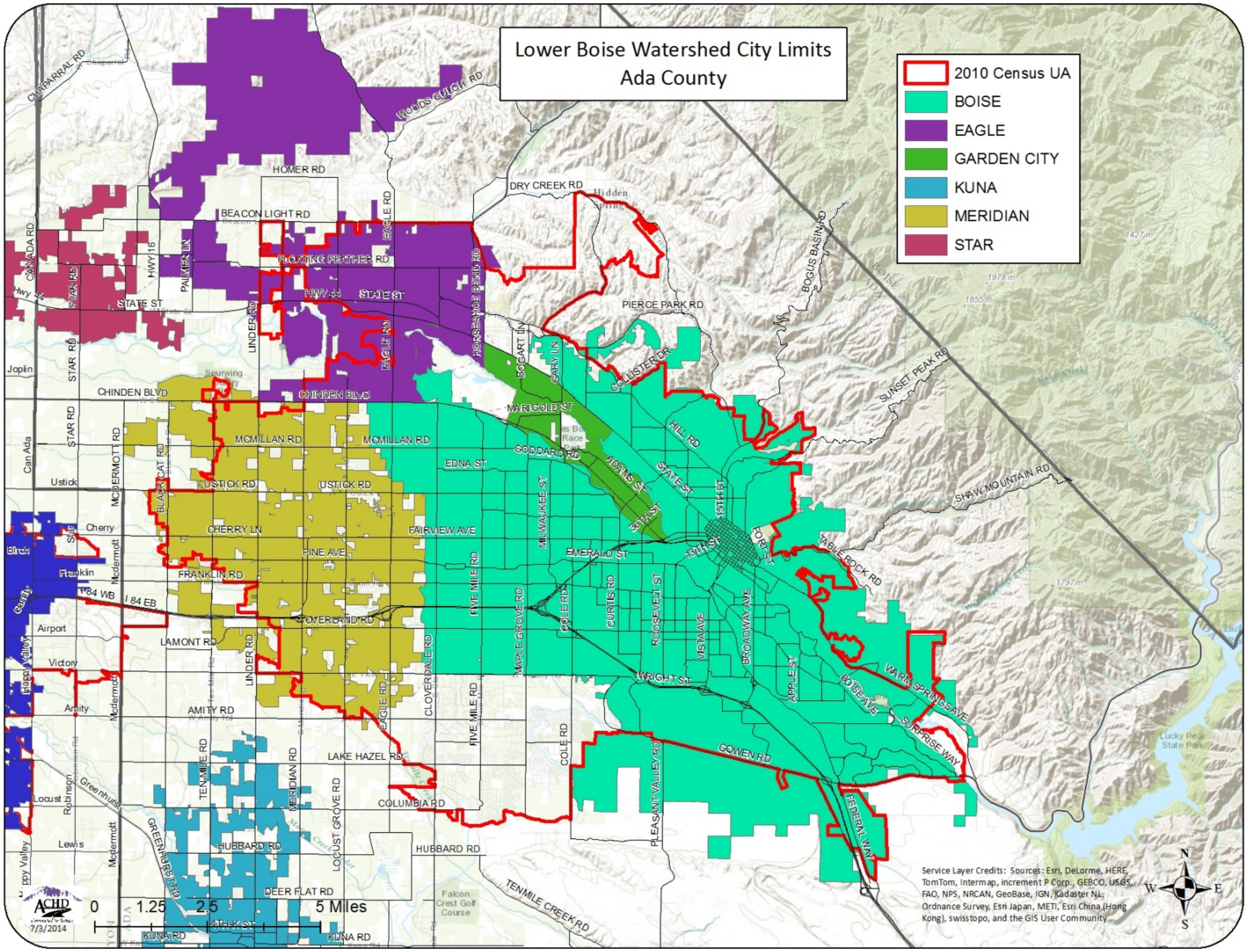


Figure 16. Boise urbanized area (UA) and other Ada County areas (prepared by ACHD) based on 2010 census.

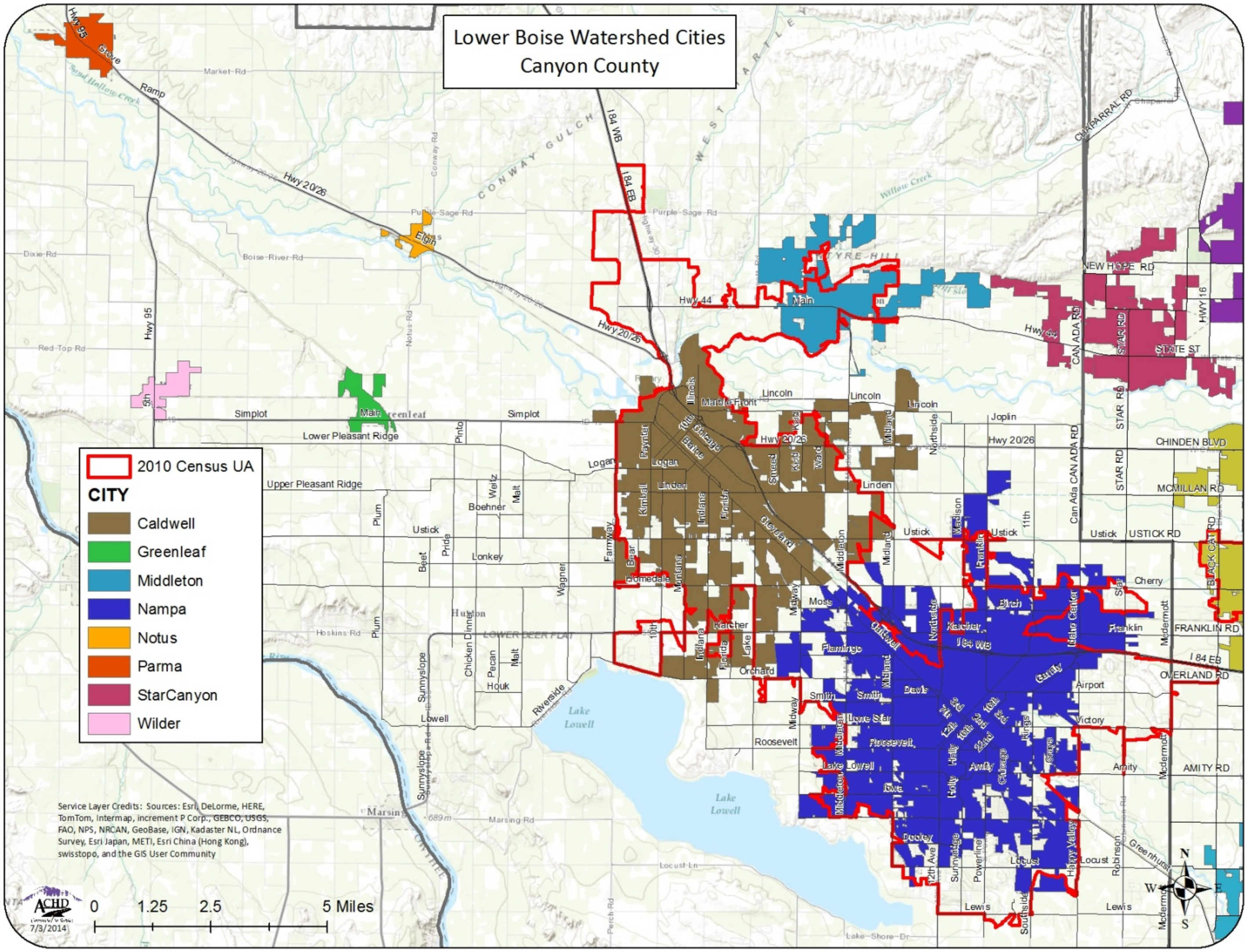


Figure 17. Map of Canyon County stormwater management areas (prepared by ACHD).

3.1.2.1 Industrial and Construction Stormwater Requirements

Stormwater runoff picks up industrial pollutants and typically discharges them into nearby water bodies directly or indirectly via storm sewer systems. When facility practices allow exposure of industrial materials to stormwater, runoff from industrial and construction areas can contain toxic pollutants (e.g., heavy metals and organic chemicals) and other pollutants such as trash, debris, and oil and grease. This increased flow and pollutant load can impair water bodies, degrade biological habitats, pollute drinking water sources, and cause flooding and hydrologic changes, such as channel erosion, to the receiving water body. Certain types of industrial activities and construction activities must manage their stormwater discharges in accordance with an NPDES permit, as defined in 40 CFR 122.26(b)(14), and (b)(15).

Multi-Sector Industrial and Construction General Permit and Stormwater Pollution Prevention Plans

In Idaho, if an NPDES-regulated industrial facility or construction activity discharges industrial stormwater into waters of the US, the facility must be permitted under EPA’s most recent MSGP or CGP. The facility must prepare a stormwater pollution prevention plan (SWPPP) before submitting a notice of intent for permit coverage. The SWPPP must document the site description, design, and installation of control measures; describe monitoring procedures; and summarize potential pollutant sources. A copy of the SWPPP must be kept on site in a format that is accessible to workers and inspectors and be updated to reflect changes in site conditions, personnel, and stormwater infrastructure.

Industrial Facilities Discharging to Impaired Water Bodies

Any facility that discharges to an impaired water body must monitor all pollutants for which the water body is impaired and for which a standard analytical method exists (see 40 CFR Part 136).

Also, because different industrial activities have sector-specific types of material that may be exposed to stormwater, EPA grouped the different regulated industries into 29 sectors, based on their typical activities. Part 8 of EPA’s MSGP details the stormwater management practices and monitoring that are required for the different industrial sectors. A new MSGP is currently in development. DEQ anticipates including specific requirements for impaired waters as a condition of the 401 certification. The new MSGP will detail the specific monitoring requirements.

Construction Activities Discharging to Impaired Water Bodies

If a construction project disturbs more than 1 acre of land (or is part of a larger common development that will disturb more than 1 acre), the operator is required to apply for a CGP from EPA after developing a site-specific SWPPP. The SWPPP must provide for the erosion, sediment, and pollution controls they intend to use; inspection of the controls periodically; and maintenance of BMPs throughout the life of the project. Operators are required to keep a current copy of their SWPPP on site or at an easily accessible location.

TMDL Industrial and Construction Stormwater Requirements

When a stream is on Idaho’s §303(d) list and has a TMDL developed, DEQ may incorporate a gross wasteload allocation for anticipated construction stormwater activities. Most loads developed in the past did not have a numeric wasteload allocation for construction stormwater activities. Construction stormwater activities are considered in compliance with provisions of the TMDL if operators obtain a CGP under the NPDES program and implement the appropriate BMPs. Typically, operators must also follow specific requirements to be consistent with any local pollutant allocations. The CGP has monitoring requirements that must be followed.

Typically, operators must also follow specific requirements to be consistent with any local pollutant allocations. Subsequent versions of the MSGP or CGP issued by EPA may have specific monitoring requirements that must be followed.

DEQ expects permittees to conduct any required monitoring under the permit and apply and maintain appropriate BMPs to prevent water quality impairment. Table 9 identifies active MSGP permits in the subbasin.

Table 9. Active MSGP facilities permitted by EPA in Ada and Canyon Counties (as of August 2014).

Number	Coverage Date	Organization	Project Name	County	City
IDR05C218	June 18, 2009	Staker Parson Companies	Idaho Concrete Eagle	Ada	Eagle
IDR05CW52	August 22, 2013	Delta Global Services	Boise Airport Terminal	Ada	Boise
IDR05C375	June 26, 2009	Idaho National Guard	Boise Air Terminal (Gowen Field)	Ada	Boise
IDR05C415	July 02, 2009	United Parcel Service, Inc.	UPS - Boise Gateway	Ada	Boise
IDR05C350	June 25, 2009	City of Boise	Boise Airport	Ada	Boise
IDR05C239	June 27, 2009	Staker Parson Companies	Idaho Sand Gravel Cole Road	Ada	Kuna
IDR05C285	June 18, 2009	Southern Foods Group, LLC	Meadow Gold Dairies	Ada	Boise
IDR05C291	June 25, 2009	Micron Technology, Inc.	Micron Technology, Inc.	Ada	Boise
IDR05C413	July 02, 2009	United Parcel Service, Inc.	UPS - Boise Hub	Ada	Boise
IDR05C220	July 18, 2009	Staker Parson Companies	Idaho Sand Gravel Federal Way	Ada	Boise
IDR05C219	June 27, 2009	Staker Parson Companies	Idaho Concrete East Boise	Ada	Boise
IDR05C231	July 27, 2009	Staker Parson Companies	Idaho Sand Gravel Tenmile	Ada	Kuna
IDR05C051	April 30, 2009	Photronics, Inc.	Photronics, Inc. nanoFab	Ada	Boise
IDR05C146	May 23, 2009	Pacific Steel and Recycling	Pacific Steel and Recycling	Ada	Boise
IDR05C234	June 27, 2009	Staker Parson Companies	Idaho Concrete Joplin	Ada	Boise
IDR05C040	June 26, 2009	Clements Concrete Co.	Joplin	Ada	Boise
IDR05C574	September 23, 2009	Basalite Concrete Products	Basalite Concrete Products	Ada	Meridian
IDR05C646	October 27, 2009	United Parcel Service, Inc.	UPS Freight Boise Terminal	Ada	Boise
IDR05C622	August 14, 2009	Plum Creek Northwest Lumber, Inc.	Plum Creek Northwest Lumber, Inc.	Ada	Meridian
IDR05CA20	May 31, 2010	MotivePower	Truck and Engine Annex	Ada	Boise
IDR05C914	December 10, 2009	FEDEX Express Corporation	FedEx Express Corp-BOIR	Ada	Boise
IDR05CC01	April 25, 2010	Greyhound Lines, Inc. #770055	Greyhound Lines, Inc. #770055	Ada	Boise
IDR05C918	February 05, 2010	Alscott Hangar, LLC	Boise Airport Alscott Hangar	Ada	Boise
IDR05CI00	November 25, 2010	Southwest Airlines Co.	SWA BOI	Ada	Boise
IDR05CI33	January 11, 2011	C A Paving Co	CA Paving Company Batch Plant	Ada	Kuna
IDR05CI85	January 24, 2011	Micron Technology, Inc.	Micron Technology, Inc.	Ada	Boise
IDR05CJ94	May 02, 2011	Idaho Sand and Gravel Co.	Southridge Gravel Source	Ada	Meridian
IDR05CF60	August 26, 2010	Idaho National Guard	Gowen Field National Guard Base	Ada	Boise
IDR05CG57	October 29, 2010	Nampa Paving Asphalt	Pleasant Valley	Ada	Boise

Number	Coverage Date	Organization	Project Name	County	City
IDR05CK24	May 25, 2011	AWS - Boise Transfer Station	AWS - Boise Transfer Station	Ada	Boise
IDR05CK25	May 25, 2011	Allied Waste Services of Boise	Allied Waste Services of Boise	Ada	Boise
IDR05CT30	July 20, 2012	Nampa Paving Asphalt	Look Lane gravel pit	Ada	Caldwell
IDR05CS39	June 10, 2012	WF Construction & Sales, LLC	BSU Athletic Football Complex	Ada	Boise
IDR05CU22	September 25, 2012	PTM of Boise, LLC	Valley Regional Transit/Orchard Street Facility	Ada	Boise
IDR05CS38	June 10, 2012	WF Construction & Sales, LLC	BSU Athletic Football Complex	Ada	Boise
IDR05CQ94	March 25, 2012	Darigold Corp.	Boise	Ada	Boise
IDR05CT84	August 16, 2012	Allied Waste Services of North America, LLC	Franklin Road Facility	Ada	Meridian
IDR05CN94	August 26, 2011	Masco dba Knife River	Knife River Eagle Pit	Ada	Eagle
IDR05CS54	May 17, 2012	Consolidated Properties of Idaho, LLC	Star Property	Ada	Star
IDR05CU26	August 19, 2012	Nampa Paving Asphalt	Nampa Paving Asphalt - Altec Property	Ada	Meridian
IDR05CV64	April 14, 2013	Knife River	Anderson Source	Ada	Eagle
IDR05CV67	April 26, 2013	C A Paving Co	Ten Mile Creek Road - Gravel Pit	Ada	Boise
IDR05CV98	June 05, 2013	Staker Parson Companies	Idaho Concrete Heron River	Ada	Star
IDR05CV34	January 28, 2013	Staker Parson Companies	Idaho Concrete Moyle	Ada	Star
IDR05CV57	March 30, 2013	Preserve LLC	Preserve Subdivision # 1	Ada	Eagle
IDR05CV62	April 08, 2013	Knife River Corporation-Northwest dba Knife River	Johnson Source	Ada	Meridian
IDR05C058	April 29, 2009	YRC, Inc.	YRC, Inc.	Ada	Boise
IDR05C145	May 23, 2009	Pacific Steel and Recycling	Pacific Steel and Recycling	Canyon	Nampa
IDR05C196	June 05, 2009	Union Pacific Railroad	UPRR Nampa Yard	Canyon	Nampa
IDR05C223	June 18, 2009	Staker Parson Companies	Idaho Concrete Keller	Canyon	Caldwell
IDR05C225	June 18, 2009	Staker Parson Companies	Idaho Concrete Look Lane	Canyon	Caldwell
IDR05C227	July 18, 2009	Staker Parson Companies	Idaho Sand Gravel Ten Lane	Canyon	Nampa
IDR05C232	June 27, 2009	Staker Parson Companies	Idaho Concrete Middleton	Canyon	Caldwell
IDR05C236	July 27, 2009	Staker Parson Companies	Idaho Sand Gravel Greenleaf	Canyon	Caldwell
IDR05C243	June 27, 2009	Staker Parson Companies	Idaho Concrete Caldwell	Canyon	Caldwell
IDR05C279	June 22, 2009	Masco dba Knife River	Notus	Canyon	Caldwell
IDR05C321	June 21, 2009	Central Paving Co., Inc.	Middleton Gravel Pit	Canyon	Middleton

Number	Coverage Date	Organization	Project Name	County	City
IDR05C405	July 01, 2009	J.R. Simplot Company	Nampa Potato Plant	Canyon	Nampa
IDR05C414	July 02, 2009	United Parcel Service, Inc.	UPS - Nampa	Canyon	Nampa
IDR05C417	July 29, 2009	Simplot Transportation	Simplot Transportation	Canyon	Caldwell
IDR05C425	July 15, 2009	Darigold Corp.	Darigold-Caldwell	Canyon	Caldwell
IDR05C509	July 19, 2009	Woodgrain Millwork, Inc.	Nampa	Canyon	Nampa
IDR05C865	December 14, 2009	Deerflat Sand Gravel, Inc.	Deerflat Sand Gravel, Inc., Pit #2	Canyon	Nampa
IDR05C908	December 05, 2009	Americrete Ready Mix Concrete Inc. dba. GB Redi-mix	GB Redi-Mix Nampa	Canyon	Nampa
IDR05C938	December 19, 2009	Fleetwood Homes, Inc.	Fleetwood Homes, Inc., Plant #230	Canyon	Nampa
IDR05CA31	March 14, 2010	City of Caldwell	Caldwell Industrial Airport	Canyon	Caldwell
IDR05CD07	June 05, 2010	Rambo Sand and Gravel, Inc.	Rambo Sand and Gravel	Canyon	Caldwell
IDR05CJ61	April 15, 2011	Lows Ready Mix, Inc.	Notus Pit	Canyon	Caldwell
IDR05CK01	April 06, 2011	Nampa Paving Asphalt	Deward Gravel Pit	Canyon	Caldwell
IDR05CK27	May 25, 2011	AWS - Nampa Hauling	AWS - Nampa Hauling	Canyon	Nampa
IDR05CL39	July 03, 2011	Nampa Paving Asphalt	Nampa Paving Asphalt	Canyon	Nampa
IDR05CO66	November 04, 2011	Syngenta Seeds, Inc.	Madison Avenue Facility	Canyon	Nampa
IDR05CQ04	April 03, 2012	City of Nampa	Nampa Municipal Airport	Canyon	Nampa
IDR05CQ53	April 16, 2012	Lehigh Hanson, Inc.	Caldwell Plant	Canyon	Caldwell
IDR05CR34	March 11, 2012	Deerflat Sand Gravel, Inc.	Deerflat Sand Gravel Pit #3	Canyon	Nampa
IDR05CS15	May 21, 2012	Rambo Crushing Co.	Rambo Sand Gravel, Inc.	Canyon	Nampa
IDR05CW59	October 04, 2013	Western Stockmen	Western Stockmen	Canyon	Caldwell
IDR05CW60	October 03, 2013	IBI, LLC	IBI, LLC	Canyon	Caldwell

3.2 Nonpoint Sources

Although the actions of agricultural diversions, dams, drains, and return flows can sometimes be identified as specific points on the landscape, the Clean Water Act designates these as nonpoint sources due to the impact that widespread land use activities have on the water channeled through agricultural irrigation systems. Septic systems, runoff from paved and unpaved road surfaces, and other unquantified sources contribute TP, directly and indirectly, to surface water in the lower Boise River. Specific contributions from these nonpoint sources are acknowledged data gaps, and implementation plans could include details regarding future data collection from these sources. Further, nonstormwater (dry weather) discharge is an inherent component of the tributary and ground water/unmeasured flows and loads within the USGS synoptic samples and mass balance models, as well as the long-term flow and load duration.

3.2.1 Tributary and Drain Discharges

Of the approximately 475,000 acres that drain to the lower Boise River below Diversion Dam, approximately 162,000 of those acres are irrigated cropland (as defined by ISDA as encompassing agricultural parcels greater than 20 acres). These acres are located along the water conveyance system and contribute nonpoint loading of phosphorus. Within the watershed, TP is delivered by various pathways to the lower Boise River from irrigated cropland and animal-related phosphorus sources (e.g., grazing and dairies/feedlots). For example, tributaries, including agricultural drains, and predictive ground water contributed approximately 880 pounds per day (lb/day) and 562 lb/day of TP, respectively, relative to approximately 1,440 lb/day attributed to point sources during the USGS August 2012 synoptic sampling (Etheridge 2013). Although less in October 2012, TP contributions from tributaries and ground water were approximately 483 lb/day, compared to point source contributions of approximately 1,050 lb/day. March 2013 data were similar, when TP contributions from tributaries and ground water were approximately 378 lb/day and point source contributions were approximately 1,220 lb/day. Table 10 provides estimated annual discharges and loads to the lower Boise River from major tributaries and drains based on long-term USGS and ISDA data.

Table 10. Annual tributary discharge to the lower Boise River.

Source Name	Lower Boise River Receiving River Mile (RM)[a]	Mean Discharge (cfs)[b]	Mean TP Concentration (mg/L)[b]	Mean TP Load (lb/day)[b]
Eagle Drain	42.7	22.0	0.14	16.3
Dry Creek	42.5	11.2	0.14	8.5
Thurman Drain	41.9	11.1	0.12	7.4
Fifteenmile Creek	30.3	88.9	0.33	156.3
Mill Slough	27.2	76.5	0.20	84.0
Willow Creek	27.0	27.6	0.28	42.1
Mason Slough	25.6	8.8	0.30	14.2
Mason Creek	25.0	101.2	0.32	173.0
Hartley Gulch	24.4	22.7	0.29	35.9
Indian Creek	22.4	139.5	0.54	407.8
Conway Gulch	14.2	31.6	0.28	48.3
Dixie Drain	10.5	164.0	0.34	300.2
Total		**705.0**	**Mean = 0.34**	**1,294.1**

Note: These data represent contributions to the Boise River, including flows and TP from agriculture, municipal, and industrial contributions.
[a] As identified by USGS in Etheridge (2013)
[b] Values calculated from USGS and ISDA data available from 1983–2013.

3.2.2 Background Contributions

Inflows at the upstream boundary of the lower Boise River (Diversion Dam) originate from Lucky Peak Dam releases (operated by the US Army Corps of Engineers). Lucky Peak Reservoir inflows are controlled by two other upstream storage projects: Arrowrock Reservoir and Anderson Ranch Dam (operated by the US Bureau of Reclamation). During synoptic sampling on the lower Boise River in 2012 and 2013, USGS identified current background TP concentrations as ≤0.02 mg/L during all three sample periods. This value is consistent with historical data collected near Diversion Dam and is comparable to background values of 0.02 mg/L used in the SR-HC TMDL (DEQ and ODEQ 2004). While there are human-caused changes in the upstream watershed (due to three reservoirs), DEQ has determined a background TP concentration of 0.018 mg/L as appropriate for this TMDL (Table 11). This value is based on the 2005–2013 USGS TP data at Diversion Dam, with detection levels of 0.01 mg/L. This level is similar to long-term data based on the median TP concentration (n = 119) in the Boise River below Diversion Dam (RM 61.1), including a statistical analysis of nondetect results using the Kaplan-Mier method (Helsel 2005) and the USGS 2012–2013 synoptic samples (Etheridge 2013), which indicate background concentrations of 0.02 and 0.015 mg/L, respectively.

Table 11. Background concentrations for the lower Boise River near Parma.

Sampling Date	Parma Flow (cfs)[a]	Background TP Concentration at Diversion Dam (mg/L)[b]	Potential TP Background Load at Parma (lb/day)[c]	TP Load at Parma (lb/day)[a]	Max Potential Background TP Contribution at Parma (%)[d]
August 2012	624	0.018	61	1,010	6.0
October 2012	924	0.018	90	1,450	6.2
March 2013	846	0.018	82	1,550	5.3

Note: These data represent contributions to the Boise River, and they do not account for downstream diversions or uptake (e.g., agriculture, municipal, industrial, or biogeochemical).
[a] As identified by USGS in the lower Boise River mass balance model (Etheridge 2013).
[b] Background is calculated as the TP load at Diversion Dam, based on 2005–2013 USGS data, indicating concentrations of 0.018 mg/L with detection levels of 0.01 mg/L.
[c] Calculated as Parma flow (cfs) x TP concentration (mg/L) x 5.39 standard conversion factor (Hammer 1986)
[d] Estimated as the potential TP background load at Parma / TP load at Parma. This assumes that 100% of the TP background load reaches Parma.

Conservatively assuming 100% of background TP load reaches Parma, estimates range from approximately 61 to 90 lb/day at Parma, which represents approximately 5.3–6.2% of the load. Although the actual percentage of background TP loads reaching Parma from Diversion Dam is less due to the diversions and returns, this estimation identifies the maximum potential background TP loads reaching Parma at 0.018 mg/L.

3.2.3 Ground Water and Unmeasured Sources

The gaining and losing reaches of the main stem lower Boise River vary spatially and temporally. In addition to work that has been conducted previously, the USGS synoptic sampling and mass balance model have provided additional information to better understand ground water and other unmeasured sources of water and TP in the lower Boise River. These ground water and unmeasured sources described above do not include the shallow ground water that drains into and discharges with the tributaries and drains, particularly during October–April when most of the flow in the tributaries and drains is the shallow ground water draining the agricultural lands (see section 3.2.1).

The questions of ground water and other unmeasured flows contributing to loads observed in the main stem and tributaries are complex due to the numerous water uses and plumbing conveyances in the subbasin. Given the complexity, it is important to note that ground water and unmeasured sources are estimated in the mass balance model as sources not directly attributed to point source or nonpoint source tributary and drain additions. As a result, it is understood and explicitly assumed that shallow subsurface ground water and unmeasured nonpoint source flows may come from a variety of known and unknown sources that were not measured as surface water, including but not limited to, agricultural irrigation; ground seepage; unidentified small drains; urban, suburban, and rural diffuse returns; nonstormwater (dry weather) returns; septic systems; and bank recharge.

During the USGS August 2012 synoptic sample, ground water and unmeasured flows (485 cfs at 0.22 mg/L TP) accounted for approximately 78% of the 624 cfs discharge measured at the Boise River near Parma and accounted for approximately 576 lb/day of TP (Etheridge 2013). Conversely, in October, the Boise River ground water gains of 91.4 cfs accounted for approximately 9.9% of the 924 cfs flow measured at Parma, with a TP concentration estimated at

0.16 mg/L, resulting in 79 lb/day of TP. The March discharge balance resulted in a 174 cfs gain from ground water, or 21% of the 846 cfs discharge observed at the Boise River near Parma, corresponding with TP concentrations of approximately 0.12 mg/L and loads of 113 lb/day (Etheridge 2013; Alex Etheridge, pers. comm., 2014).

3.3 Pollutant Transport

Phosphorus is discharged into the river from both point and nonpoint sources. It is difficult to determine pollutant delivery potential in such a complex watershed with a modified surface hydrology system because water is diverted and often reused downstream from its original source. In the Lower Boise River subbasin, wastewater and agricultural return flow is often subsequently diverted and used again for irrigation, industrial, or municipal purposes. Even through complex modeling efforts, the accuracy in determining exactly where particular pollutants originate decreases as distance from original diversion/return increases.

In this TMDL, the potential relative contribution of each source sector is discussed throughout section 5. The relative contribution from each source sector is calculated as the ratio of total measured TP inputs from the various sources relative to the measured TP loads at Parma. A major assumption in these calculations is that TP from each source sector has a similar potential to reach Parma. A strength of this simplified assumption is that it facilitates using straightforward calculations to quantify potential loading relationships without requiring additional complex assumptions about TP use and reuse throughout the watershed. Conversely, a limitation of this assumption is that the subbasin is much more dynamic than potentially represented by simplified ratios. However, trying to further refine calculations to estimate individual TP sources relative to loads measured at Parma would add additional layers of complexity, assumptions, and speculation about how TP moves and is reused through the system. And although measured data are readily available regarding the TP inputs from various point and nonpoint sources throughout the watershed, as well as the TP loads measured at Parma, the movement of TP through the watershed and the interrelationships among the complex plumbing, water reuse, agricultural drains and tributaries, ground water, and other biogeochemical process are not well understood.

Additional discussions of pollutant transport in the subbasin are provided in the *Lower Boise River Nutrient Subbasin Assessment* (DEQ 2001d) and *Lower Boise River Implementation Plan Total Phosphorus* (DEQ 2008).

4 Subbasin Assessment—Summary of Past and Present Pollution Control Efforts

Multiple pollution control efforts have been implemented for both point sources and nonpoint sources in the lower Boise River watershed. Although not targeted for TP specifically, many of the pollution control efforts address the pathways for TP entering the system. Information concerning pollution control efforts for POTWs, urban and suburban storm drainage, and agricultural and other nonpoint sources (including rural roads, septic systems, and sewer lines) can be found in the current NPDES permits. These permits document the requirements of the permittees. Additionally, the status of implementing permits is included in stormwater management plans and annual reports that are included on permittee websites as required by the permits. Permits can be found through EPA's NOI Application Search: *http://yosemite.epa.gov/r10/water.nsf/NPDES+Permits/Current+ID1319http://cfpub.epa.gov/npdes/stormwater/noi/noihitlist_new.cfm?CFID=25634902&CFTOKEN=40772253&jsessionid=cc30914e297abd18ec942e14c3173776a264%20*.

Additionally, pollution control efforts can be found in the implementation plan for the lower Boise River TMDL (DEQ 2003).While the 2003 plan was developed for sediment and bacteria TMDLs, many of the BMP practices used by nonpoint sources would be similar for TP. Additional information pertaining to point sources is also available in the *Lower Boise River Implementation Plan Total Phosphorus* (DEQ 2008).

In 2013 and 2014, DEQ solicited information from the LBWC, Technical Advisory Committee (TAC), and other stakeholders to help describe past and present pollution control efforts in the subbasin. The following descriptions in this section represent the information provided to DEQ (DEQ, 2009b).

4.1 Section 319 Grant Projects

In 1987, Congress established the Nonpoint Source Management Program under §319 of the Clean Water Act to help states address nonpoint source pollution by identifying waters affected by such pollution and adopting and implementing management programs to control this pollution. In the §319 grant selection process, proposals are required to link project benefits to pollutant load reductions identified in an approved TMDL. Preference is given to projects where priority has been identified in a water quality improvement plan. To keep the focus on improving water quality, load reduction estimates must be calculated for each pollutant being addressed by the nonpoint source project.

These §319 programs recommend where and how to use BMPs to prevent runoff from becoming polluted, and where it is polluted, to reduce the amount that reaches surface waters. For example, Ferguson (1999) estimates that an average range of 40 to 60% of irrigation water applied to cropland in the south-central and southwest areas of Idaho flows off of surface-irrigated fields. And Carter (2002) and Ferguson (1999) also identify BMPs that can be implemented to reduce subsequent pollutant delivery from fields.

Since 1997, DEQ has allocated approximately $1.4 million toward §319 grants in the Lower Boise River subbasin for implementing BMPs to reduce and prevent pollutant runoff (e.g., sediment and nutrients) from reaching surface waters (Table 12). Currently, subgrant S521 is being implemented by the LBWC. The project includes implementing projects using sprinkler and drip irrigations systems to reduce water use and pollutant delivery relative to traditional surface irrigation practices.

Table 12. Section 319 project subgrants in the Lower Boise River subbasin.

Subgrant	Grant Year	Year Closed	Project Name	Sponsor	Budget[a]
QC037900	1997	1999	LBRWQP T and E	Lower Boise River WQ Plan	$32,000.00
QC051900	1999	2001	LBRWQP DNA Fingerprinting	Lower Boise River WQ Plan	$46,839.00
QC061100	2000	2000	Dixie Surge System	Canyon SWCD	$18,000.00
S104	2004	2006	Boise River Side Channel Reconstruction	Trout Unlimited	$159,525.00
S120	2000	2005	Jerrell Glenn Wetland Restoration	Jerrell Glenn	$22,250.00
S130/Ph1	2002	2008	Indian Creek LID Demonstration Caldwell	City of Caldwell	$28,668.00
S130/Ph2	2002	2007	Indian Creek LID Demonstration Caldwell	City of Caldwell	$73,332.00
S131	2001	2006	Downtown Boise Graywater Recycling	The Christensen Group	$50,000.00
S132	2002	2006	Barber Park Living Roof Demonstration	Ada County	$150,703.00
S195	2002	2007	Indian Creek Stormwater Runoff Phase 2	City of Caldwell	$79,383.00
S231	2006	2008	Dry Creek Streambed Protection Patterson Property	Ada Soil and Water Conservation District	$58,365.67
S232	2004	2009	Boise River Side Channel Formerly S104	Trout Unlimited	$34,525.00
S323	2009	2013	Canyon Co. BMPs for WQ Improvement	Lower Boise Watershed Council	$250,000.00
S356[b]	2009	2014	Ada County BMPs Four Corners[b]	Ada Soil and Water Conservation District[b]	$48,000.00
S443	2011	2015	Canyon County BMPs	Lower Boise Watershed Council	$250,000.00
S521	2014	Open	Canyon County BMP Program	Lower Boise Watershed Council	$250,000.00

Note: Because the §319 grant program did not require load reduction estimates until recently, estimates are only available for subgrants S120, S231, and S323.
[a] Total subgrant amount allocated for each project, but not necessarily the amount spent.
[b] Ada Soil and Water Conservation District revised the application to purchase a John Deere 1590 No-Till Drill - 15 ft. (model year 2013) that would be made available, at a reasonable cost, for use by producers within the subbasin. The drill has been purchased and sediment and phosphorus losses are expected to be reduced by up to 95%.

4.2 Soil and Water Conservations Districts

In addition to §319 grants, numerous projects have been completed within the subbasin through federal programs such as the Conservation Stewardship Program, Environmental Quality Incentives Program, and Wildlife Habitat Incentives Program. The conservation partnership (Ada Soil and Water Conservation District, Canyon Soil Conservation District, Idaho Association of Soil Conservation Districts, Natural Resources Conservation Service, Idaho Soil and Water Conservation Commission (ISWCC), and landowners) addresses agricultural nonpoint source pollution through voluntary BMPs. Table 13 provides a list of BMPs installed in the subbasin from 2008 through 2013.

Table 13. Best management practices (BMPs) installed in the Lower Boise River subbasin between October 2008 and December 2013.

Subwatershed and Activity	Sum of Land Unit (acres)	Sum of Applied Amount	Units
Willow Creek			
Canyon County			
Livestock Pipeline	1,150.4	15,340.0	feet
Watering Facility	1,118.1	3.0	each
Gem County			
Cover Crop	24.5	10.0	acres
Integrated Pest Management (IPM)	32.7	32.7	acres
Nutrient Management	32.7	32.7	acres
Tenmile Creek			
Ada County			
Channel Bed Stabilization	2.2	1,400.0	acres
Conservation Cover	2.2	2.2	acres
Riparian Forest Buffer	2.2	2.2	acres
Riparian Herbaceous Cover	2.2	1.0	acres
Stream Habitat Improvement and Management	2.2	2.2	acres
Streambank and Shoreline Protection	2.2	1,400.0	acres
Structure for Water Control	2.2	3.0	no.
Tree/Shrub Establishment	2.2	2.2	acres
Upland Wildlife Habitat Management	2.2	2.2	acres
Wetland Enhancement	2.2	1.0	acres
Wetland Wildlife Habitat Management	2.2	2.2	acres
Canyon County			
Agricultural Energy Management Plan, Headquarters - Written	5.9	1.0	no.
Conservation Crop Rotation	37.0	37.0	acres
Cover Crop	18.2	0.1	acres
Forage Harvest Management	35.6	35.6	acres
Integrated Pest Management (IPM)	36.9	36.9	acres
Irrigation System, Microirrigation	37.4	37.4	acres
Irrigation System, Surface and Subsurface	35.6	35.6	acres
Irrigation Water Conveyance, Corrugated Metal Pipeline	30.6	67.0	feet
Irrigation Water Conveyance, Ditch and Canal Lining, Plain Concrete	30.6	755.0	feet
Irrigation Water Management	92.8	92.8	acres
Nutrient Management	91.6	73.5	acres
Nutrient Management Plan - Written	37.4	1.0	no.
Prescribed Grazing	7.9	7.9	acres
Seasonal High Tunnel System for Crops	18.2	2,178.0	square feet
Elmore County			
Conservation Crop Rotation	109.2	109.2	acres
Prescribed Grazing	995.2	770.4	acres
Residue and Tillage Management, Reduced Till	4.2	4.2	acres

Subwatershed and Activity	Sum of Land Unit (acres)	Sum of Applied Amount	Units
Sand Hollow Creek			
Canyon County			
Above Ground, Multi-Outlet Pipeline	62.4	760.0	feet
Anionic Polyacrylamide (PAM) Application	58.4	58.4	acres
Comprehensive Nutrient Management Plan	10.0	1.0	no.
Conservation Crop Rotation	522.1	516.7	acres
Cover Crop	57.1	57.1	acres
Forage Harvest Management	64.0	47.6	acres
Integrated Pest Management (IPM)	459.0	459.0	acres
Irrigation Pipeline	163.1	12,956.0	feet
Irrigation Reservoir	4.7	0.4	feet
Irrigation System, Microirrigation	329.6	304.1	acres
Irrigation Water Conveyance, Corrugated Metal Pipeline	45.7	20.0	feet
Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic	162.3	9,025.0	feet
Irrigation Water Conveyance, Pipeline, Steel	112.8	348.0	feet
Irrigation Water Management	588.7	579.6	acres
Nutrient Management	814.3	848.7	acres
Prescribed Grazing	31.3	31.3	acres
Pumping Plant	158.4	7.0	no.
Sprinkler System	353.5	295.3	acres
Structure for Water Control	230.4	13.0	no.
Subsurface Drain	18.8	720.0	feet
Underground Outlet	93.7	2,206.0	feet
Upland Wildlife Habitat Management	25.0	25.0	acres
Gem County			
Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic	74.5	1,300.0	feet
Irrigation Water Conveyance, Pipeline, Low-Pressure, Underground, Plastic	74.5	780.0	feet
Irrigation Water Management	74.5	74.5	acres
Nutrient Management	74.5	74.5	acres
Pumping Plant	74.5	1.0	no.
Sprinkler System	74.5	63.0	acres
Structure for Water Control	74.5	1.0	no.
Payette County			
Conservation Crop Rotation	40.1	40.6	acres
Integrated Pest Management (IPM)	40.1	40.6	acres
Irrigation Pipeline	112.8	5,135.0	feet
Irrigation Regulating Reservoir	56.3	1.0	acre-feet
Irrigation Water Management	196.6	163.7	acres
Nutrient Management	131.7	110.0	acres
Pumping Plant	31.4	1.0	no.
Sprinkler System	140.1	140.1	acres
Structure for Water Control	31.4	1.0	no.

Subwatershed and Activity	Sum of Land Unit (acres)	Sum of Applied Amount	Units
Upland Wildlife Habitat Management	40.1	40.6	acres
Mason Creek			
Ada County			
Conservation Crop Rotation	63.3	63.3	acres
Surface Roughening	63.3	63.3	acres
Canyon County			
Conservation Crop Rotation	0.8	0.8	acres
Cover Crop	0.8	0.2	acres
Fence	80.0	6,193.0	feet
Forage and Biomass Planting	109.2	97.3	acres
Integrated Pest Management (IPM)	5.8	5.8	acres
Irrigation Pipeline	55.0	3,333.0	feet
Irrigation System, Microirrigation	13.8	13.8	acres
Irrigation System, Surface and Subsurface	4.2	4.2	acre-feet
Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic	5.7	1,030.0	feet
Irrigation Water Management	150.3	149.1	acres
Livestock Pipeline	54.2	1,101.0	feet
Nutrient Management	36.7	36.7	acres
Prescribed Grazing	8.6	8.6	acres
Pumping Plant	51.2	4.0	no.
Seasonal High Tunnel System for Crops	1.6	4,674.0	square feet
Sprinkler System	71.1	52.9	acres
Structure for Water Control	52.7	7.0	no.
Upland Wildlife Habitat Management	3.4	2.2	acres
Watering Facility	8.6	1.0	no.
Windbreak/Shelterbelt Establishment	14.5	3,860.0	feet
Indian Creek			
Canyon County			
Forage and Biomass Planting	6.8	6.8	acres
Irrigation System, Microirrigation	1.6	1.6	acres
Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic	14.5	930.0	feet
Irrigation Water Management	23.4	23.4	acres
Nutrient Management	70.7	70.7	acres
Pumping Plant	1.1	1.0	no.
Seasonal High Tunnel System for Crops	1.6	1.0	square feet
Sprinkler System	13.4	12.6	acres
Structure for Water Control	1.1	1.0	no.
Elmore County			
Conservation Crop Rotation	163.4	163.4	acres
Prescribed Grazing	10,857.8	6,749.7	acres
Range Planting	220.9	98.3	acres
Dry Creek			

Subwatershed and Activity	Sum of Land Unit (acres)	Sum of Applied Amount	Units
Ada County			
Channel Bank Vegetation	12.8	2.0	acres
Channel Bed Stabilization	12.8	600.0	feet
Conservation Cover	12.8	2.0	acres
Dam, Diversion	12.8	1.0	no.
Livestock Pipeline	12.8	1,800.0	feet
Riparian Forest Buffer	12.8	2.0	acres
Structure for Water Control	12.8	1.0	no.
Tree/Shrub Establishment	12.8	2.0	acres
Tree/Shrub Site Preparation	12.8	2.0	acres
Wetland Enhancement	12.8	2.0	acres
Canyon County			
Field Border	18.1	7.6	acres
Forage and Biomass Planting	14.9	14.9	acres
Forage Harvest Management	14.9	15.2	acres
Integrated Pest Management (IPM)	60.2	60.2	acres
Irrigation System, Microirrigation	18.1	2.3	acres
Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic	14.9	615.0	feet
Irrigation Water Management	14.9	12.6	acres
Windbreak/Shelterbelt Establishment	18.1	6,160.0	feet
Boise River–Snake River			
Canyon County			
Conservation Cover	34.5	13.0	acres
Conservation Crop Rotation	317.8	317.8	acres
Fence	71.4	2,550.0	feet
Forage and Biomass Planting	5.0	7.6	acres
Irrigation Pipeline	324.4	25,415.0	feet
Irrigation Regulating Reservoir	16.2	1.0	acres
Irrigation System, Microirrigation	274.7	234.0	acres
Irrigation Water Conveyance, Corrugated Metal Pipeline	4.3	85.0	feet
Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic	96.4	4,255.0	feet
Irrigation Water Management	701.0	693.0	acres
Mulching	1.7	0.5	acres
Nonforested Riparian Zone Enhancement for Fish and Wildlife	71.4	1,247.7	linear feet/year
Nutrient Management	435.8	435.8	acres
Prescribed Grazing	18.6	25.6	acres
Pumping Plant	300.0	13.0	no.
Retrofit Watering Facility for Wildlife Escape	404.7	27.0	no.
Seasonal High Tunnel System for Crops	0.3	160.0	square feet
Sediment Basin	182.1	10.0	no.
Solar Powered Electric Fence Charging Systems	127.4	6.0	no.

Subwatershed and Activity	Sum of Land Unit (acres)	Sum of Applied Amount	Units
Sprinkler System	347.4	337.1	acres
Structure for Water Control	323.1	20.0	no.
Tree/Shrub Establishment	40.5	0.3	acres
Upland Wildlife Habitat Management	82.0	10.8	acres
Wetland Enhancement	34.5	5.7	acres
Wetland Wildlife Habitat Management	53.8	19.5	acres

Note: The life expectancy of each practice depends on the individual circumstances and contract periods. Construction specifications guide the installation of practices, along with operation and maintenance guidelines.

4.3 Simplot Caldwell Potato Processing Plant

The Simplot potato processing plant and land application site is adjacent to the lower Boise River, west of Caldwell. This plant has been applying industrial wastewater on this site since the late 1960s. Since first obtaining a land application permit at the site in the 1980s, the site has been operating under a zero surface water discharge requirement. In 1998, upgrades at the Simplot site included the following (H. Haminishi, pers. comm., 2013):

- Flood-irrigated fields were converted to sprinkler irrigation, including an extensive pumping system and piping infrastructure. In 2012, this system was upgraded to include more pivot irrigation and to irrigate corners that were previously not farmed.
- The land application system was doubled in land size to its current acreage (approximately 2,000 acres).
- The cattle feedlot on site was shut down.
- An anaerobic digester was installed for further digestion of organics and conversion of nutrients to a more “plant available” form.
- A 28 million gallon holding pond was built that allowed winter water storage (during very severe weather) and storage during summer harvest of crops.
- A silt recovery system was installed to remove significantly more silt during potato washing, thus reducing silt discharges to the land application system.
- A centrifuge building and system was installed for dewatering primary clarifier underflow.
- In 2008, the ethanol plant was permanently shut down, thus eliminating a source of flow and nutrients.

Even though Simplot upgraded the site over the years, there was still concern that the canals and drains going through the site, along with the high ground water, were possibly impacting surface water quality, even without direct discharge. As a result, DEQ required a study that was completed in 2008, specifically looking at many source impacts of phosphorus for the site, that resulted in several recommendations: (1) reducing phosphorus loadings to the site, (2) evaluating a couple of unnamed drains at the site for reduction or elimination of phosphorus impacts, and (3) eliminating the Simplot domestic drainfield on site as a source of phosphorus. Associated implementation measures have included the following:

- Wastewater flow has been reduced from 1,474 million gallons per year in 1995 to 637 million gallons per year in 2012 to 551 million gallons per year in 2013.
- In 2009, a double cropping system was installed that has nearly doubled the nutrient uptake (both nitrogen and phosphorus) as well as significantly increased ash (total dissolved solids) uptake.
- In 2009, zero discharge evaporation ponds were installed to replace the domestic drainfield, thus eliminating domestic wastewater as a source of phosphorus.

In addition, Simplot is currently completing construction and startup of a new treatment system that will support the new potato processing plant at this site. This treatment system will do the following:

- Reduce overall hydraulic flow to the land application site
- Reduce nitrogen loading to less than half of the current loading rates and reduce phosphorus loading rates by 90–95%
- Return more than half of the treated process water to the new process plant for reuse in the industrial process
- Use mechanical reverse osmosis to evaporate the concentrate from the treatment plant

The plant currently has one MSGP and two CGPs open, with a third requested. With the new potato plant on line and the old plant now shut down, Simplot will be updating the SWPPP for the MSGP but does not plan to request a new MSGP.

4.4 City of Meridian

Meridian operates a POTW that was constructed in 1978. Numerous capacity upgrades and treatment improvements have occurred since the original construction. Flow through the plant has increased from about 3.2 to 5.6 million gallons per day (mgd) (annual averages from 2001 and 2013, respectively), representing nearly a 5% annual increase in response to population growth within the city. Discharge is permitted to two outfalls, one to Fivemile Creek and the other to the Boise River. Upgrades and improvements have included the following:

- Biological treatment process improvements to provide both biological phosphorus removal and nitrification and denitrification for ammonia and TN reduction
- Tertiary filtration
- Return activated sludge denitrification
- Primary sludge fermentation (under construction)
- Investment in Class A recycled water program

4.5 Additional Water Quality Information

Additional information regarding past, present, and future management actions affecting water quality in the lower Boise River were previously identified and are available in the 2008 *Lower Boise River Implementation Plan Total Phosphorus* (DEQ 2008), including submissions by the following:

- City of Boise
- City of Caldwell

- City of Nampa
- City of Star
- City of Wilder
- Darigold

4.6 Water Quality Monitoring

A combination of one-time, ongoing, regularly scheduled, and event-specific water quality monitoring occurs in the lower Boise River (Appendix B). These monitoring efforts include, but are not limited to, DEQ BURP sampling; ISDA monitoring (ISDA 2008); synoptic sampling in 2012 and 2013 (Etheridge 2013); other long-term USGS data collection; ongoing City of Boise data collection throughout the river (unpublished data); discharge monitoring reports (DMRs) and other data collected by municipal, stormwater, and industrial dischargers; and §319 grant and other nonpoint source monitoring efforts.

Since 1994, the USGS has monitored water quality and biological communities in the Boise River in cooperation with DEQ and the LBWC. Early efforts were designed to assess ongoing status and trends in water quality and biological communities on the Boise River and use synoptic studies to identify the tributaries contributing the most significant loads of selected constituents to the river. The program evolved over the years to accommodate data needs to formulate TMDLs in the Lower Boise River subbasin. Included were several short-term studies to evaluate continuous water temperatures, ground water nutrient loads, nutrient and sediment loads discharged to the Snake River, resident fish communities, cost-effective methods to more frequently monitor nutrients and sediment, and potential applications of isotopic tracers for understanding nutrient sources and cycling (USGS 2012, 2013a, 2013b).

Additionally, the USGS, in cooperation with DEQ and the LBWC, has collected and published other biological data throughout the subbasin, including aquatic growth (periphyton and phytoplankton). Some of the monitoring results are available in the subsequent documents:

- *Evaluation of Total Phosphorus Mass Balance in the Lower Boise River, Southwestern Idaho* (Etheridge 2013)
- *Water-Quality Conditions near the Confluence of the Snake and Boise Rivers, Canyon County, Idaho* (Wood and Etheridge 2011)
- *Water-Quality and Biological Conditions in the Lower Boise River, Ada and Canyon Counties, Idaho, 1994–2002* (MacCoy 2004)
- *Water-Quality Conditions of the Lower Boise River, Ada and Canyon Counties, Idaho, May 1994 through February 1997* (Mullins 1998)
- *Biological Assessment of the Lower Boise River, October 1995 through January 1998, Ada and Canyon Counties, Idaho* (Mullins 1999)

5 Total Maximum Daily Load

A TMDL prescribes an upper limit (i.e., load capacity) on discharge of a pollutant from all sources to ensure water quality standards are met. It further allocates this load capacity among the various sources of the pollutant. Pollutant sources fall into two broad classes: point sources, each of which receives a wasteload allocation, and nonpoint sources, each of which receives a load allocation. Natural background contributions, when present, are considered part of the load allocation but are often treated separately because they represent a part of the load not subject to control. Because of uncertainties about quantifying loads and the relation of specific loads to attaining water quality standards, the rules regarding TMDLs (40 CFR Part 130) require a margin of safety be included in the TMDL. Practically, the margin of safety and natural background are both reductions in the load capacity available for allocation to pollutant sources.

Load capacity can be summarized by the following equation:

$$LC = MOS + NB + LA + WLA = TMDL$$

Where:

LC = load capacity
MOS = margin of safety
NB = natural background
LA = load allocation
WLA = wasteload allocation

The equation is written in this order because it represents the logical order in which a load analysis is conducted. First, the load capacity is determined. Then the load capacity is broken down into its components. After the necessary margin of safety and natural background, if relevant, are quantified, the remainder is allocated among pollutant sources (i.e., the load allocation and wasteload allocation). When the breakdown and allocation are complete, the result is a TMDL, which must equal the load capacity.

The load capacity must be based on critical conditions—the conditions when water quality standards are most likely to be violated. If protective under critical conditions, a TMDL will be more than protective under other conditions. Because both load capacity and pollutant source loads vary, and not necessarily in concert, determining critical conditions can be more complicated than it may initially appear.

Another step in a load analysis is quantifying current pollutant loads by source. This step allows for the specification of load reductions as percentages from current conditions, considers equities in load reduction responsibility, and is necessary for water quality trading to occur. A load is fundamentally a quantity of pollutant discharged over some period of time and is the product of concentration and flow. Due to the diverse nature of various pollutants, and the difficulty of strictly dealing with loads, the federal rules allow for “other appropriate measures” to be used when necessary (40 CFR 130.2). These other measures must still be quantifiable and relate to water quality standards, but they allow flexibility to deal with pollutant loading in more practical and tangible ways. The rules also recognize the particular difficulty of quantifying nonpoint loads and allow “gross allotment” as a load allocation where available data or appropriate predictive techniques limit more accurate estimates. For certain pollutants whose effects are long term, such as sediment and nutrients, EPA allows for seasonal or annual loads; however, under a federal court decision, daily loads must also be expressed.

5.1 Instream Water Quality Targets

Instream water quality targets are selected for the purpose of restoring "full support of designated beneficial uses" (Idaho Code §§39-3611, 39-3615). The state's water quality standards for nutrients and nuisance aquatic growth are narrative rather than numerical. In this TMDL addendum, DEQ selected two surrogate targets for attaining this narrative standard in the lower Boise River: (1) a target concentration of ≤0.07 mg/L TP to specifically achieve the SR-HC TMDL allocation target for the lower Boise River (which is set at different levels for two distinct seasonal periods) and (2) a more stringent nuisance aquatic growth target of <150 mg/m^2 specific to supporting beneficial uses in the lower Boise River. These targets are discussed in more detail below.

5.1.1 Projected Conditions

The TMDL targets are designed to achieve full support of beneficial uses in the lower Boise River. Because identifying the impairment or beneficial use support is based on multiple lines of evidence, it is difficult to directly measure or compare to the narrative water quality standards. The daily TP concentration limits were set in accordance with the SR-HC TMDL. Additional water quality targets were selected based on scientific literature for river conditions representing a variety of water quality systems, including levels of phosphorus and benthic chlorophyll *a* representative of unimpaired and impaired streams and rivers. This information was then used to help determine load capacity, existing pollutant loads, wasteload allocations, and load allocations.

The projected conditions are anticipated to improve water quality by reducing periphyton growth, phytoplankton and sestonic algae delivery, and other potential impacts such as low dissolved oxygen in order to support the beneficial uses of contact recreation, aesthetics, aquatic life, and wildlife habitats. Targets are structured to support existing beneficial uses of domestic, agricultural, and industrial water supply, which are significant economic and sociopolitical drivers in the watershed.

The water quality targets take into account multiple factors within the watershed:

- The lower Boise River has some finite ability to process and transport TP at concentrations greater than background values without impairing beneficial uses but will respond positively to TP target concentrations.
- Watershed hydrology dynamics are not simple (e.g., upstream reservoirs, irrigation diversions, return flows, and drains).
  - Flow is highly managed throughout the watershed.
  - Water quality conditions vary seasonally and spatially (i.e., location in the watershed).
- Phosphorus sources have different locational impacts.
- Phosphorus is moving through the watershed; it may take years before nonpoint source phosphorus load reductions are observed downstream.
- Phosphorus and benthic algae are not toxics and should not be managed as such.
- Limited exceedances (depending on magnitude, duration, and frequency) may be acceptable so long as they do not impair beneficial uses.

- TP has multiple components, including labile and refractory, and may not be equally bioavailable for algal growth.
- Algal biomass may be influenced by human and environmental factors other than TP alone (e.g., flow, water temperature, other nutrients).
- Algal species composition is variable.
- Supporting water reuse, offsets, pollutant trading, and other innovative approaches may further improve water quality over meeting the targets.
- A balanced approach is necessary. Using simple assumptions about the fate and transport of TP throughout the watershed may be too conservative; whereas, developing a detailed approach to track phosphorus as it moves through the intricate maze of channels for irrigation may be currently unattainable.
- The concepts of seasonal conditions and limited exceedances are supported by a number of references including EPA guidance, other TMDLs including the SR-HC TMDL, the fact that phosphorus and periphyton are not toxic, and the fact that responses vary with conditions and time.

5.1.2 Target Selection

These surrogate targets are intended to protect beneficial uses and are translated into other forms for setting allocations and permit limits. The TMDL strives to be clear in how allocations were developed and in how NPDES permits should interpret the allocations. However, it is important to be clear that the surrogate target selection informs analyses but is a site-specific interpretation of a narrative standard and is not a standard itself that is necessarily applicable to any other watershed.

5.1.2.1 Snake River-Hells Canyon TMDL TP Target Compliance

For compliance with the SR-HC TMDL, May 1–September 30 TP target concentrations (or TP load equivalents) were set at ≤0.07 mg/L (instantaneous maximum, not to be exceeded) in the lower Boise River near Parma.[4]

The final SR-HC TMDL was approved by EPA in September 2004 (DEQ and ODEQ 2004). The TMDL addressed point and nonpoint sources that discharge or drain directly to that reach of the Snake River. Five major tributaries received gross phosphorus allocations at their mouths, including the lower Boise River. Load allocations in the SR-HC TMDL were developed to achieve TP concentrations of ≤0.07 mg/L in the Snake River and Brownlee Reservoir from May 1 through September 30:

> Site-specific chlorophyll a and total phosphorus targets (less than 14 µg/L and less than or equal to ≤0.07 mg/L respectively) were identified by the TMDL. These targets are seasonal in nature and apply from May through September. … Inflowing tributaries have been assigned load allocations to meet the ≤0.07 mg/L total phosphorus target at their inflow to the Snake River. (DEQ and ODEQ 2004, p. ii)

[4] TP load equivalent, for purposes of this TMDL, is defined as the mass of TP (e.g., pounds per day) that corresponds with an identified TP concentration (in milligrams per liter).

Therefore, consistency with the SR-HC TMDL requires achieving the seasonal ≤0.07 mg/L TP target at the mouth of the lower Boise River near Parma (although not explicitly stated; Figure 18).

Snake River - Hells Canyon TMDL Load Allocations

June 2004

Table 4.0.9. Calculated total phosphorus load allocations for tributary, point and nonpoint sources to the Snake River - Hells Canyon TMDL reach based on calculated average flows (May through September).

Segment	Load Allocation[a,b] (kg/day)	Percent Reduction
Snake River Inflow	1,379	28
Owyhee River	71	73
Boise River	242	78
Malheur River	58	88
Payette River	469	34
Weiser River	136	65
Drains	91	86
Ungaged flows	137	64
Total Upstream Snake River Load Allocations	2582	54
Total Upstream Snake River Waste Load Allocations	153	
Total Upstream Snake River Segment Load and Waste Load Allocations	2,735[c]	
Burnt River	21	60
Powder River	33	74
Unmeasured Tributaries to Brownlee	40	50
Total Brownlee Reservoir Segment	2,829[d]	
Unmeasured Tributaries to Oxbow	10	50
Total Oxbow Reservoir Segment	2,839	

[a] The SR-HC TMDL target for total phosphorus for each tributary is a concentration of less than or equal to 0.07 mg/L total phosphorus as measured at the mouth of the tributary and applies from May through September. Because the total phosphorus target is concentration-based, actual allowable tributary load allocations under the TMDL are dependant on actual tributary flow and will fluctuate year to year. The total phosphorus load allocations listed in this table are based on averaged tributary flows measured in 1979, 1995 and 2000, which were average Snake River flow years, not necessarily average tributary flow years. Therefore they do not necessarily represent the calculated load allocations for any specific year or different series of years.

Figure 18. Table 4.0.9 from the 2004 SR-HC TMDL (DEQ and ODEQ 2004). The TP load allocation of 242 kg/day converts to approximately 533.5 lb/day.

Achieving this concentration target at the mouth of the lower Boise River near Parma is expected to be protective of cold water aquatic life and contact recreation in the Snake River. Reducing the phosphorus load is anticipated to reduce the phytoplankton, measured as chlorophyll *a*, in the Snake River and reservoirs. Therefore, load and wasteload allocations in this TMDL will support the SR-HC TMDL target of ≤ 0.07 mg/L TP (instantaneous maximum, not to be exceeded). This target at the mouth of the of the lower Boise River should in turn should support the mean growing season limit of <14 micrograms per liter (μg/L) chlorophyll *a* with a nuisance threshold of 30 µg/L and exceedance threshold of no greater than 25% that was identified in the TMDL for the Snake River.

Also, the load analysis for this TP TMDL results in TP concentrations and loads that achieve the mean monthly periphyton (nuisance algae) target in the lower Boise River (discussed in the following section). The May 1–September 30 TP concentration and load equivalent targets correspond to the 90th percentile low flows in the lower Boise River near Parma. Achieving the TP target near Parma will help reduce the frequency, magnitude, and duration of algal blooms and their associated aesthetic, ecological, and physical impacts on contact recreation and cold water aquatic life in the Snake River and lower Boise River.

5.1.2.2 Nuisance Algae Target

Through the TMDL process, DEQ, in consultation with the LBWC, identified a further set of surrogate metrics that relate nuisance algae growth with the impairment of beneficial uses in the lower Boise River (see section 2.3.1) and for remaining consistent with the concentration limits in the SR-HC TMDL. The following metrics and rationale were selected as appropriate for the lower Boise River:

- **Magnitude**—mean monthly benthic chlorophyll *a* of $\leq$150 mg/m^2
- **Location—**within impaired AUs of the main stem lower Boise River
- **Duration—**year round
    - May 1–September 30—This period aligns with the SR-HC TMDL target dates and can include primary growing periods for benthic algae within the river given favorable conditions such as light, temperature, and hydrology.
    - October 1–April 30—This period incorporates the early fall period that historically appears to coincide with elevated periphyton, but also when a majority of the historical periphyton data has been collected in the lower Boise River. It also incorporates the winter and spring conditions during which very little historical periphyton data have been collected in the lower Boise River. Nonetheless, the limited data illustrate that periphyton has exceeded 200 mg/m^2 during this time period at multiple sampling locations.
- **Frequency**—For TMDL implementation, DEQ recommends that continued monitoring and reassessment during the 5-year review will determine an allowable exceedance frequency that is sufficient to maintain full support of beneficial uses.

These target parameters are similar to those developed and implemented for waters in Montana (MDEQ 2008), Minnesota (MPCA 2013), and Colorado (CDPHE 2013) and correspond with scientific literature values that support contact recreation and cold water aquatic life (see section 2.3.1).

5.1.3 Water Quality Monitoring Points

USGS efforts are now underway to track trends in water quality that might result from management of water resources. These efforts require an emphasis on gathering information within tributary basins in addition to continued monitoring on the Boise River for ongoing trend detection. This work includes maintaining and evaluating the long-term water quality data set on the lower Boise River near Parma. Monitoring results from this location incorporate contributions and impacts from basin activities and represent the quality of Boise River water discharging to the Snake River. The USGS measures continuous streamflow near Parma as funded by the USGS National Streamflow Information Program.

Additionally, monitoring activities that began in fiscal year 2014 include sample collection and continuous monitoring of water quality parameters at the gage near Parma. In addition to collecting at least 8 water quality samples during the fiscal year, a continuous water-quality monitor will be installed and operated at the Parma stream gage. The continuous monitor will collect temperature, specific conductance, dissolved oxygen, and turbidity every 15 minutes and will be updated in real time on the stream gage web page (USGS 2013b).

A previously published statistical regression model provides the ability to estimate TP and suspended sediment in real time at Parma given continuously monitored turbidity and specific conductance (Wood and Etheridge 2011). Event-based sample collection efforts will be used to verify and/or calibrate model estimates of the TP and suspended sediment. Real-time estimates of TP and suspended sediment will be provided online and can be used to evaluate TP and suspended sediment loading and concentrations on time scales consistent with storm events, diurnal variation, and anomalous fluctuations in stream pollutants (USGS 2013b). The statistical regression model will provide useful information for scheduling event-based samples, but only event-based samples will be used for water quality evaluations and compliance purposes.

Through development of the subsequent implementation plan, DEQ, LBWC, USGS, and other stakeholders will continue to develop and refine the water quality monitoring points and strategies in the subbasin. This effort will help determine the effectiveness and impacts of TP load reductions on achieving both the May–September ≤0.07 mg/L TP target near Parma and the ≤150 mg/m^2 mean monthly benthic chlorophyll *a* target in the impaired AUs.

5.2 Load Capacity

Load capacity is the calculated TP load in the lower Boise River at Parma that complies with the SR-HC TMDL and fully supports beneficial uses in the lower Boise River. In other words, it is the amount of TP these water bodies can receive and still meet water quality standards. The amount of this pollutant must achieve a sufficient level to meet "...water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge..." (Clean Water Act §303(d)(C)). The margin of safety accounts for uncertainty about assimilative capacity, the relationship between the selected target and support of beneficial uses, and variability in target measurement.

The TP load capacities for the lower Boise River §303(d)-listed AUs are based on the expectation that the TP allocations in this TMDL will support beneficial uses, while acknowledging that adaptive management adjustments may be necessary as additional information is obtained through monitoring. The LBWC has suggested it submit an adaptive management plan to DEQ to provide guidance for both allocation and implementation approaches to this TMDL. TP concentrations that support beneficial uses in western watersheds and values identified in scientific literature are assumed to be useful reference points. However, TP concentrations that fully support cold water aquatic life and recreation beneficial uses in the lower Boise River and its tributaries have not been previously established.

5.2.1 TP Load Capacity to Achieve SR-HC TMDL Target

The TP load capacities developed for the lower Boise River near Parma are based on the following:

- TP concentration and TP load equivalent of ≤0.07 mg/L maintained at the mouth of the lower Boise River throughout the critical season (May 1–September 30)
- Instream loads support beneficial uses in the lower Boise River

A load duration approach and a simplified mass balance excel spreadsheet model were used to assess existing May–September TP loads relative to the ≤0.07 mg/L TP target (see tables and figures in section 5.3.1 and Table 14).

Additionally, May–September TP loading into the lower Boise River was estimated using available data for each of the various point and nonpoint sectors. The results indicated that under 90th percentile low flow conditions, only approximately 23% of the total TP loading into the lower Boise River actually makes it to Parma during that time frame due to reuse, uptake, infiltration, etc. The extent of these processes and the long-term persistence of TP in the watershed is currently unclear.

The TP loading scenario that achieves both targets in the lower Boise River corresponds to the 90th percentile low flow conditions (Table 14, Figure 19 through Figure 21) and maintains the same TP concentrations and loads under higher flows for all point and nonpoint sources, except natural background and ground water/unmeasured, which adjusts with river flow. These load capacities comply with the target TP allocations identified in the SR-HC TMDL and with the lower Boise River mean monthly periphyton target (section 5.1.2).

Table 14. TP existing loads and load capacities for May 1–September 30 presented as daily averages for the Boise River near Parma (AU ID17050114SW001_06).

Flow[a] (cfs)	Flow Rank (%)	Current Load		Load Capacity[b]		
		TP Conc. (mg/L)	TP Load (lb/day)	Target TP Conc. (mg/L)	Target TP Load (lb/day as a monthly average)	Target TP Load Reductions (lb/day as a monthly average [%])
3,268	10th	0.21	3,747	≤0.07	1,233	-2,514 (67%)
912	40th	0.31	1,531	≤0.07	344	-1,187 (78%)
705	60th	0.31	1,190	≤0.07	266	-924 (78%)
624	69th	0.30	1,010	≤0.07	235	-775 (77%)
383	90th	0.36	738	≤0.07	145	-593 (80%)

Note: Flows, TP concentrations, and loads highlighted in green are derived from the USGS August 2012 synoptic sample (Etheridge 2013). These USGS-derived values are only for comparing the USGS mass balance data with long-term flow and load duration data and are not for TP allocation purposes.
[a] Based on data from May 1–September 30, 1987 through 2012, and duration curves with water quality targets
[b] Load capacities are calculated and applied near Parma, using duration curves.

The allocations for the lower Boise River from May 1 through September 30 are designed to achieve the SR-HC TMDL ≤0.07 mg/L TP target by using a combination of the USGS mass balance models (Etheridge 2013) and duration curves. The duration curves are developed in reference to *An Approach for Using Load Duration Curves in the Development of the TMDLs* (EPA 2007), which states the following:

> The duration curve approach is particularly applicable because stream flow is an important factor in the determination of loading capacities…An underlying premise of the duration curve approach is correlation of water quality impairments to flow conditions. The duration curve alone does not consider specific fate and transport mechanisms, which may vary depending on watershed or pollutant characteristics…Practitioners, should consider using a separate analytical tool to develop a TMDL when factors other than flow significantly affect a water body's loading capacity. (EPA 2007)

The load duration curve approach recognizes that the assimilative capacity of the lower Boise River and the maximum allowable loading varies with flow conditions. Therefore, existing loads and load reductions required to achieve the SR-HC TMDL TP water quality target are calculated under different flow conditions. The difference between existing loads and the TP target of ≤0.07 mg/L is used to calculate the load reductions required.

Based on the following reasons, DEQ has determined that using the duration approach, along with the USGS mass balance models and other information, is appropriate for this TMDL:

- The May 1–September 30 SR-HC TMDL TP allocation identified for the lower Boise River is concentration-based. Therefore, flow is directly related to the water quality target and load capacity.
- The May 1–September 30 R^2 correlation values between TP loads and concentrations, relative to flows at Parma, were 0.84 and 0.57.
- The USGS mass balance model results suggest that biogeochemical processes, including uptake by plants, may have had a limited effect on main stem TP concentrations in August 2012 (Etheridge 2013).

However, it is important to note that under all flow conditions except the 90th percentile low flows, the TP load and wasteload allocations are more stringent than necessary to achieve ≤0.07 mg/L TP near Parma. These extra reductions were required to also achieve the mean monthly benthic chlorophyll *a* target of ≤150 mg/m^2 within the TP-impaired AUs of the lower Boise River (see sections 5.1.2 and 5.2.2).

According to 40 CFR 130.7(c)(1), TMDLs must consider seasonal variation in watershed conditions and pollutant loading. Seasonal variation is accounted for in this TMDL by using long-term USGS flow records and water quality data to develop flow and load curves and the reductions and allocations needed to achieve the SR-HC TMDL TP target for the lower Boise River.

Daily mean flows based on USGS gage 13213000 as recorded at the Boise River near Parma for the period 1987 through 2012 are shown in Figure 4. This period was selected because it incorporates long-term daily mean flows as measured by USGS, while only including river management practices and conditions that are still largely relevant to current conditions, and includes the initiation of long-term TP data collection by the USGS in the lower Boise River near Parma.

Daily flows from 1987 through 2012 were used to develop a May 1–September 30 flow duration curve for the lower Boise River at Parma (Figure 19). The lowest daily flow was 108 cfs in 1992 and the highest was 8,040 cfs in 2012. The flow duration curve shows the percentage of time that an average flow for May 1–September 30 occurs at Parma. Four tiers were selected for calculations: the 10th, 40th, 60th, and 90th percentiles.

The flows for the four tiers and the TP target concentration of ≤0.07 mg/L were used along with a standard conversion factor to calculate the load capacity for phosphorus (load capacity = concentration × flow × 5.39; Hammer 1986) (Table 14). Additionally, the load capacity for phosphorus was also calculated for the flow that occurred during the USGS August 2012 synoptic sample (Table 14), which was equivalent to the 69th percentile. The estimation of load capacity relative to the sources upstream in the watershed is described in section 5.4.2.4.

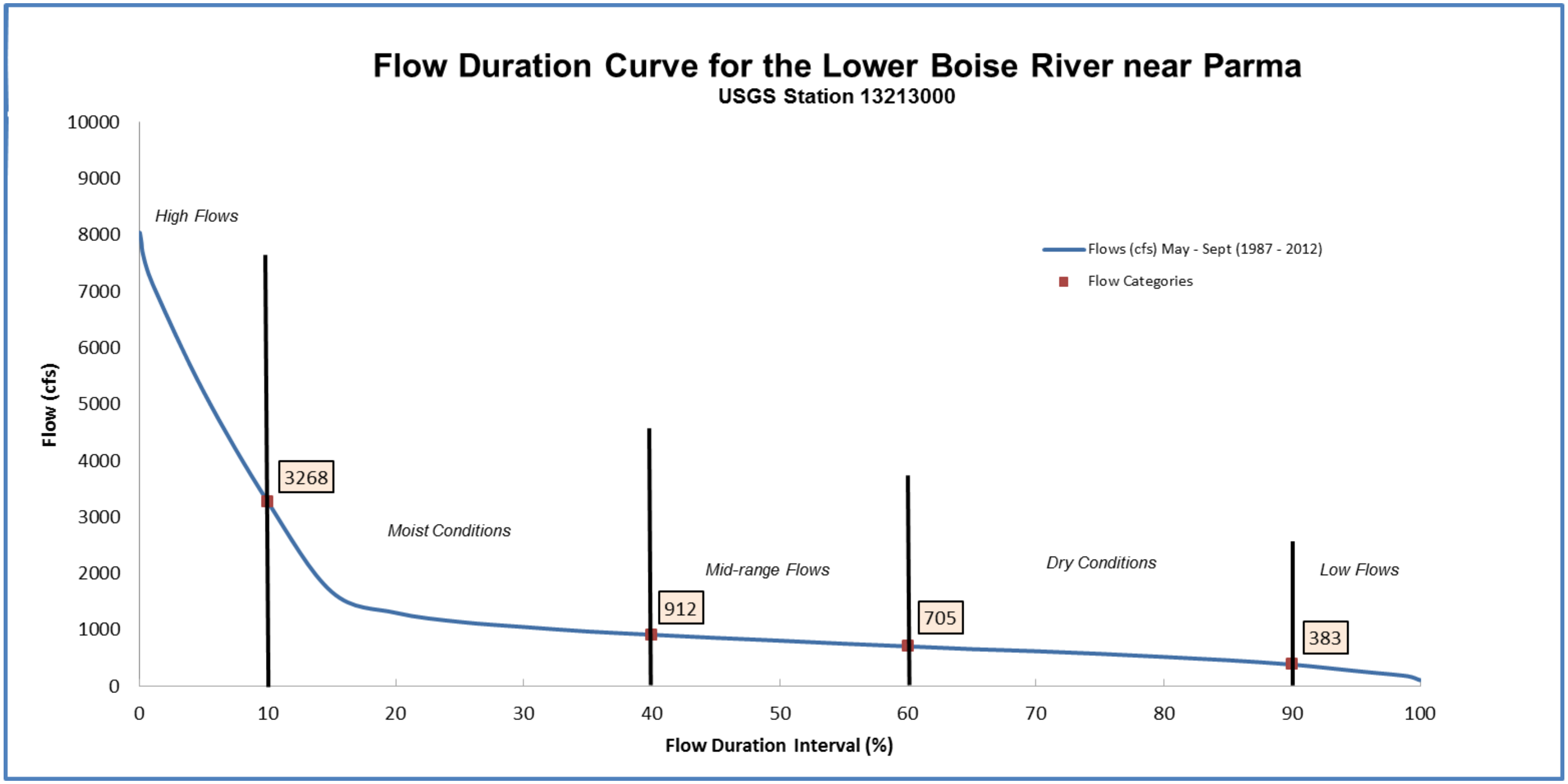


Figure 19. Flow duration curve for the lower Boise River near Parma—May 1–September 30, 1987–2012.

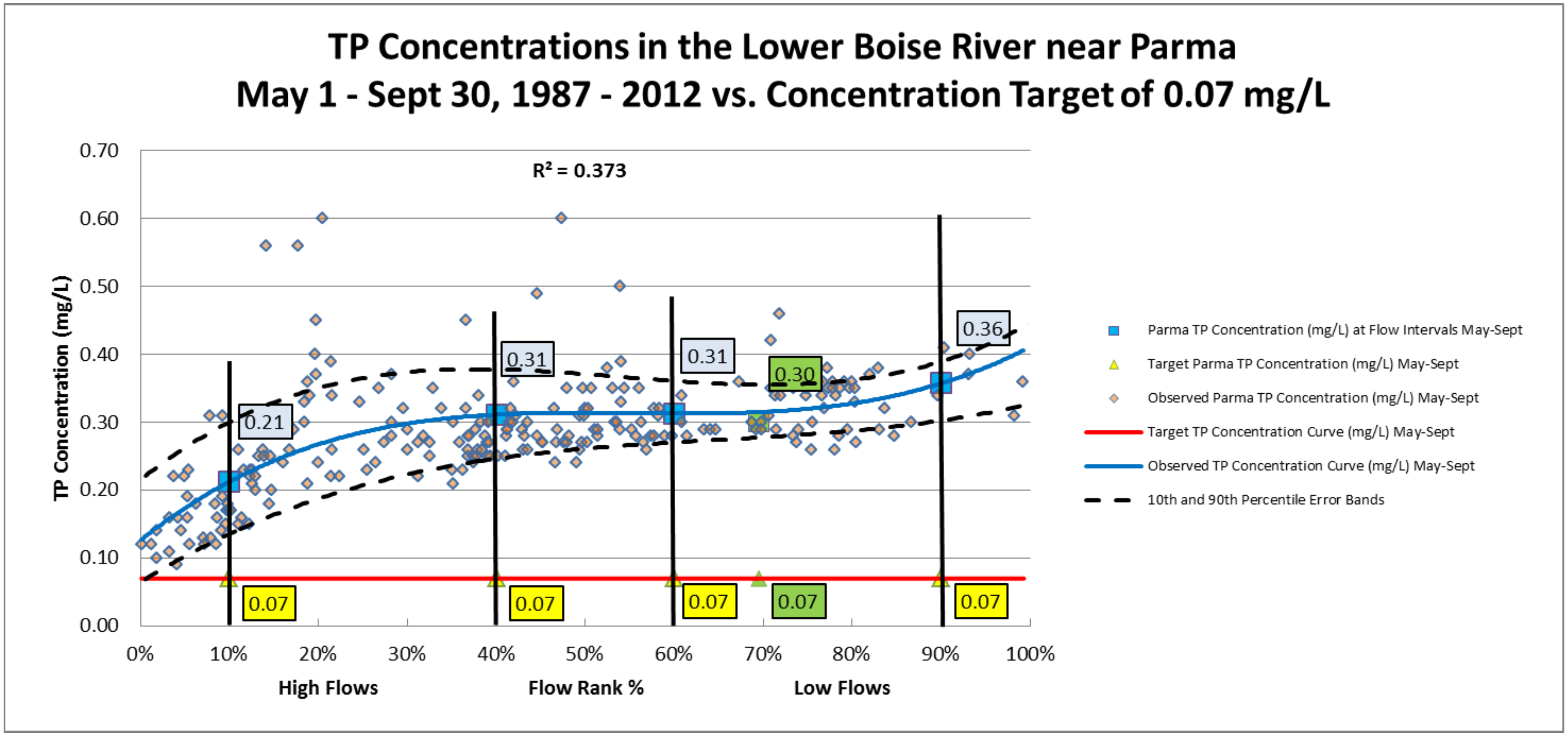


Figure 20. Long-term existing TP concentrations for the lower Boise River compared to the concentration target of ≤0.07 mg/L May 1–September 30. Note: DEQ excluded a potential outlier data point from the figure and analyses due to disproportionate influence—a TP concentration of 2 mg/L associated with an 80th percentile flow on September 21, 1988.

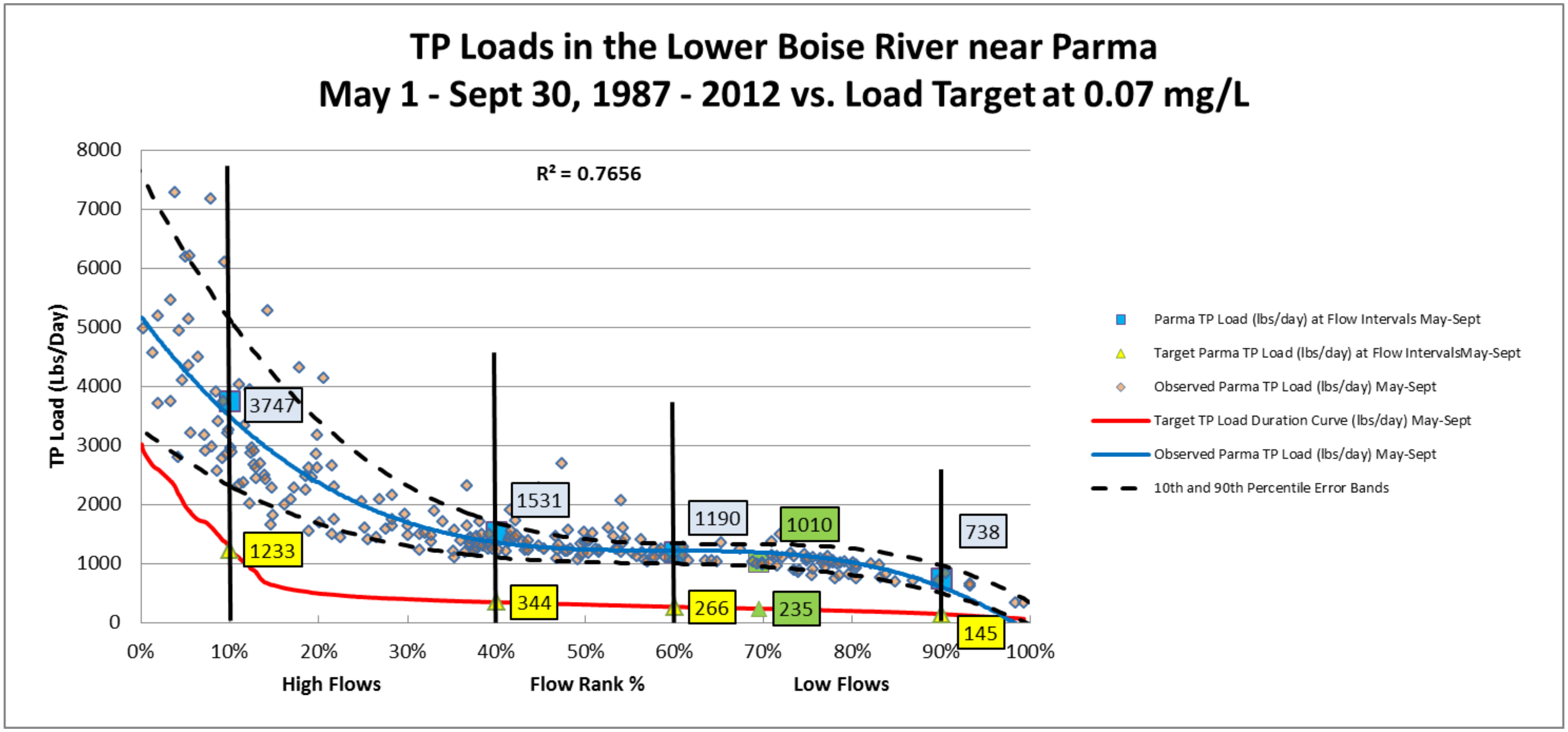


Figure 21. Long-term existing TP loads for the lower Boise River in relation to the TP load equivalent target of ≤0.07 mg/L May 1–September 30. Note: DEQ excluded a potential outlier data point from the figure and analyses due to disproportionate influence—a TP load of 5,544 lb/day associated with an 80th percentile flow on September 21, 1988.

5.2.2 TP Load Capacity to Achieve Chlorophyll *a* Target

The AQUATOX model was used to assess the load capacity for TP and benthic algae for the lower Boise River as a function of multiple parameters included within the model. Further analyses are described in the model report (DEQ 2014a).

The load capacity is the summation of TP inputs to the AQUATOX model under which simulation results achieve the mean monthly periphyton target. Multiple combinations of TP inputs from sources may mathematically achieve the selected target. The division of the load capacity to the sources upstream in the watershed is described in section 5.4. The particular combination of pollutants chosen for the TMDL is based on a number of factors including the characteristics of the watershed; the results of the USGS August 2012, October 2012, and March 2013 mass balance models (Etheridge 2013); and previous studies of the watershed.

Figure 22 shows the results of USGS benthic chlorophyll *a* sampling between 1995 and 2013. These results reflect a range of elevated periphyton at several locations in October, November, and January–March. However, these results also demonstrate that the majority of data have historically been collected during October and November, with relatively fewer data collected the remainder of the year.

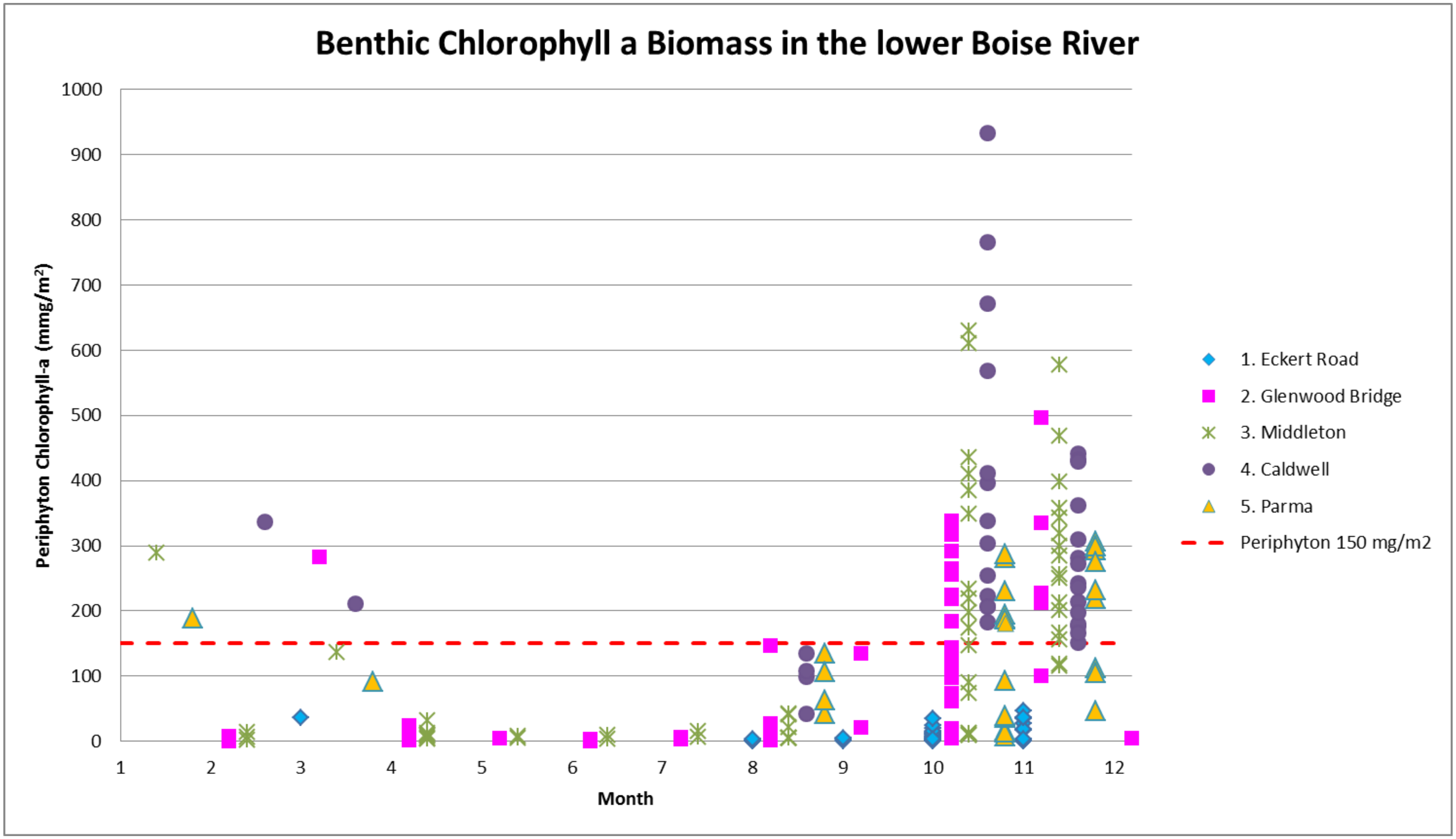


Figure 22. USGS benthic chlorophyll *a* samples in the lower Boise River between 1995 and 2013. Note, some value differences may reflect different sampling methodologies.

5.3 Estimates of Existing Pollutant Loads

Regulations allow that loadings "...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading" (40 CFR 130.2(g)). An estimate must be made for each point source. Nonpoint sources are typically estimated based on the type of source or land area. To the extent possible, background loads should be distinguished from human-caused increases in nonpoint loads.

5.3.1 TP Loads: May 1–September 30

5.3.1.1 Background

A background TP concentration of 0.018 mg/L is based on the 2005–2013 USGS TP data at Diversion Dam with detection levels of 0.01 mg/L (see section 3.2.2).

5.3.1.2 NPDES-Permitted Wastewater, Industrial, and Fish Hatchery Facilities

Point source contributions were calculated from facility-supplied data and/or DMRs from May 1–September 30, 2012, as available (Table 15). This time period was chosen to utilize the most recent data available and accurately capture the current conditions. It is assumed that point source loadings remain relatively independent of various Boise River flow scenarios and are more dependent on factors such as population and service area.

5.3.1.3 NPDES-Permitted Municipal Stormwater and Nonstormwater

Existing stormwater (wet weather) TP contributions were derived from data provided by the LBWC stormwater workgroup (Appendix C) through several workgroup meetings and correspondence (Table 16; Figure 23). These data were developed for May 1–September 30 for MS4-permitted and nonpermitted areas. Stormwater (wet weather) flows represent specific precipitation (storm) events that are not represented as part of the USGS August 2012 synoptic sample and may be underrepresented in other long-term river monitoring data not specifically focusing on these short-term flows and loads. Although stormwater loading was included in the TMDL, a large degree of uncertainty remains in the assumed loading. This known uncertainty will be addressed during implementation planning through additional monitoring, and or further characterization of stormwater, which may include additional modeling.

Few nonstormwater (dry weather) data have been collected in the subbasin (Appendix C). Nonstormwater flows and loads can originate from a variety of sources, including agricultural water supply returns, shallow ground water, urban/suburban sources (e.g., lawn watering), and other unmeasured sources. Further, nonstormwater discharge is an inherent component of the tributary and ground water/unmeasured flows and loads within the USGS synoptic samples and mass balance models, as well as the long-term flow and load duration analyses.

For stormwater (wet weather) and nonstormwater (dry weather), it is assumed that loadings remain relatively independent of various Boise River flow conditions and are more dependent on factors such as population, service area, specific storm events, etc.

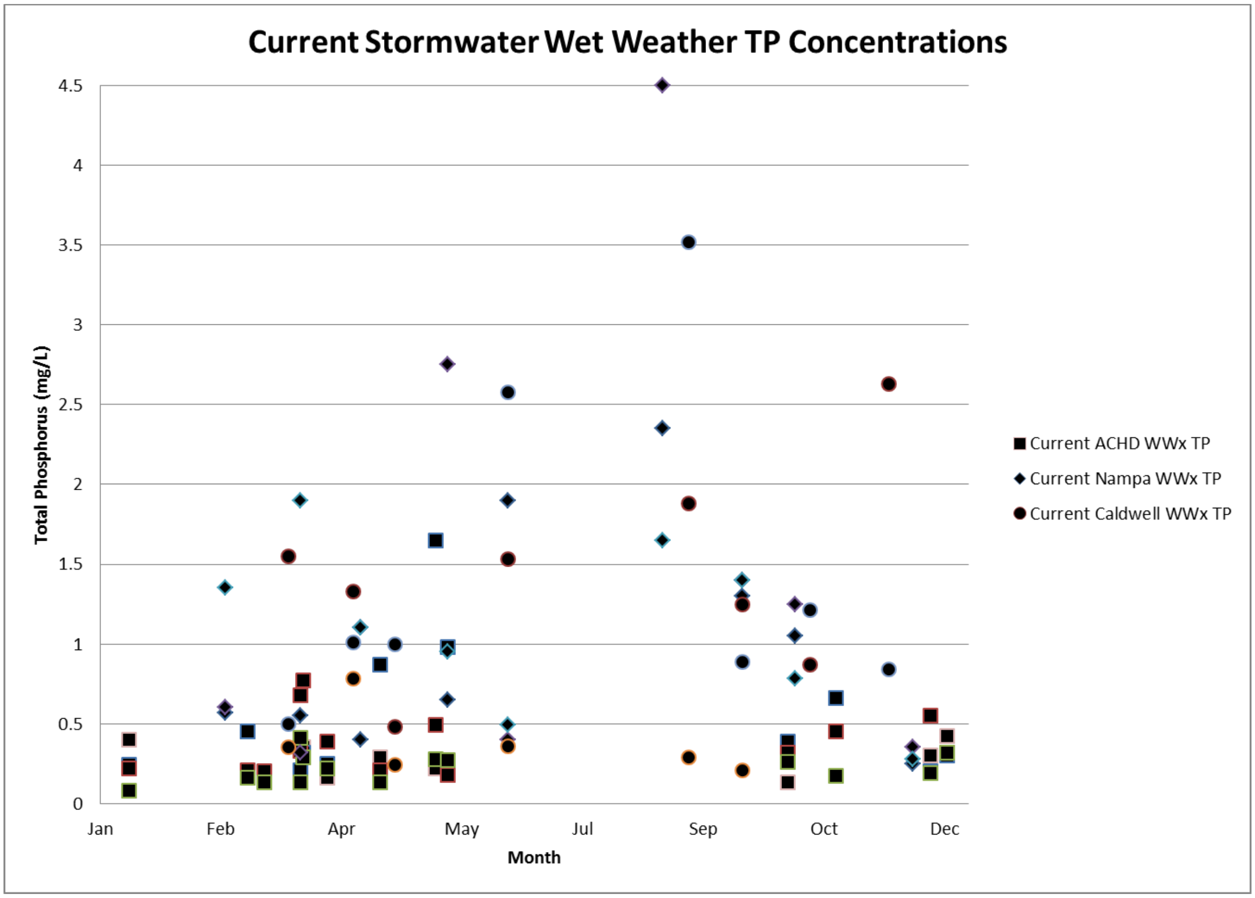


Figure 23. Current stormwater (wet weather) TP concentrations.

5.3.1.4 Nonpoint Source Tributary, Ground Water, and Unmeasured Contributions

Agricultural and other nonpoint source tributary contributions were calculated from available USGS and ISDA data for May 1–September 30 from 1983 through 2013, as available (Table 17). These long-term data were selected due to temporal and spatial paucity of data and in order to moderate the intra- and inter-annual variation that can result from varying precipitation, runoff, temperature, and water use regimes. Flow, TP concentrations, and loads are also presented by removing the flows and TP loads attributed to NPDES-permitted facilities.

Ground water and unmeasured contributions were calculated from the August 2012 synoptic sampling effort in the Lower Boise River subbasin (Etheridge 2013) and further derived from professional judgment to adjust ground water interactions under various flow scenarios (Alex Etheridge, pers. comm., 2014). These calculations represent the best and most current ground water and unmeasured flow data for the lower Boise River (Table 18).

Shallow ground water that drains into and discharges with the tributaries and drains is not included in ground water and unmeasured sources. This situation occurs most during the October to April time period when most of the flow in the tributaries and drains is the shallow ground water draining the agricultural fields.

5.3.1.5 Additional Assumptions

Lower Boise River TP inputs do not translate directly into TP loads at Parma. Instead, TP inputs relative to TP loads at Parma were calculated over various flow scenarios to develop delivery ratios. An assumption of this approach is that TP from each source has similar potential to reach Parma. This simplified assumption facilitates the use of calculations to quantify potential loading without requiring complex assumptions about TP use and reuse throughout the watershed. Conversely, a limitation of this assumption is that the lower Boise River watershed is much more dynamic than potentially represented by simple ratios. However, trying to further refine calculations to estimate individual TP sources relative to loads measured at Parma would add additional layers of complexity, assumptions, and speculation about how TP moves through the system. And although measured data are readily available regarding the TP inputs from various point and nonpoint sources throughout the watershed, as well as the TP loads measured at Parma, the movement of TP through the watershed and the interrelationships among the complex plumbing, water reuse, agricultural drains and tributaries, ground water, and other biogeochemical processes are not well understood.

The USGS August 2012 mass balance model (Etheridge 2013) was used to identify contributing source flows and loads for the time period measured (i.e., August 2012 with Boise River flows near Parma at 624 cfs) and to help derive approximate ground water flows associated with the various flow scenarios in the lower Boise River near Parma. However, upon recommendation from the USGS model developer (Alex Etheridge, pers. comm., 2014), the mass balance model was not used to estimate lower Boise River TP concentrations or loads near Parma under adjusted flow scenarios. This recommendation was made because altering river flows in the mass balance model also requires altering ground water, tributary, background, and POTW flows throughout the system to maintain the balance. The complex relationships among the various sources under changing flow conditions are not well understood and would require additional speculation. Further, although the mass balance model clearly illustrates the flow and TP relationships throughout the river during one week in August 2012 when flows near Parma were 624 cfs, it does not account for varying flow and TP relationships in the subbasin.

Table 15. Current permitted May 1–September 30 point source TP discharge to the lower Boise River and its tributaries.

Source	NPDES Permit No.	Main Stem RM[a] or Receiving Water	Mean Discharge (mgd)[b]	Design Flow (mgd)	Mean TP Conc. (mg/L)[b]	Permitted TP Conc. (mg/L)	Mean TP Load (lb/day)[b]	Permitted TP Load (lb/day)
Boise River—Main Stem								
Lander	ID-002044-3	RM 50.0	12.71	15.0	2.10	0.07/monthly avg 0.0931/weekly avg	222.7	8.7/monthly avg 11.6/weekly avg
West Boise	ID-002398-1	RM 44.2	16.10	24.0	4.47	0.07/monthly avg 0.084/weekly avg	600.5	14/monthly avg 16.8/weekly avg
Middleton	ID-002183-1	RM 27.1	0.57	1.83	3.23	No limit	15.4	No limit
Caldwell	ID-002150-4	RM 22.6	7.90	8.50	2.37	No limit	156.2	No limit
IDFG-Eagle[c]	NPDES Aquaculture Permit	RM 41.8	2.95	4.25	0.02	No limit	0.6	No limit
Boise River—Tributaries								
Avimor[d]	In application	Dry Creek	In application	0.42		No discharge currently		
Star	ID-002359-1	Lawrence Kennedy Canal (Mill Slough/Boise River)	0.63	1.85	1.85	No limit	9.7	No limit
Meridian[e]	ID-002019-2	Fivemile Creek (Fifteenmile Creek)	5.87	10.2	1.26	No limit	61.6	No limit
Sorrento Lactalis	ID-002803-7	Mason Creek	0.7	1.52	0.03	0.07/monthly avg 0.14/daily max	0.2	0.29/monthly avg 0.58/daily max
Nampa	ID-002206-3	Indian Creek	10.51	18.0	4.97	No Limit	435.8	No Limit
Kuna	ID-002835-5	Indian Creek	0.47	3.5	0.04	0.07/monthly avg 0.105/weekly avg	0.2	1.1/monthly avg 1.65/weekly avg
IDFG-Nampa[c]	IDG-130042 NPDES Aquaculture Permit	Wilson Drain and Pond (Indian Creek)	17.85	19.38	0.06	No limit	8.8	No limit
Darigold	ID-002495-3	RM 22.6 (unmeasured drain)	0.22	1.70	0.31	No limit	0.6	No limit
Notus[d]	ID-002101-6	Conway Gulch	n/a	0.11	n/a	0.07/monthly avg 0.14/weekly avg	n/a	0.064/monthly avg 0.128/weekly avg

Source	NPDES Permit No.	Main Stem RM[a] or Receiving Water	Mean Discharge (mgd)[b]	Design Flow (mgd)	Mean TP Conc. (mg/L)[b]	Permitted TP Conc. (mg/L)	Mean TP Load (lb/day)[b]	Permitted TP Load (lb/day)
Wilder	ID-0020265	Wilder Ditch Drain	0.07	0.25	6.02	No limit	3.3	No limit
Greenleaf[d]	ID-002830-4	West End Drain	n/a	0.24	n/a	0.07/monthly avg 0.105/weekly avg	n/a	0.14/monthly avg 0.21/weekly avg
ConAgra (XL4Star)[d]	ID-000078-7	Indian Creek	n/a	0.48	n/a	No limit	n/a	No limit
Total			**76.54**	**111.23**	**2.37**		**1515.48**	

Note: n/a indicates facility currently has no May–September discharge.
[a] River miles (RM) as identified by USGS in Etheridge (2013).
[b] Calculated from May 1–September 30, 2012, using data provided by facilities and/or DMR data.
[c] Eagle and Nampa IDFG facility outputs were calculated using 2011 and 2012 data due a single concentration/load May 1–September 30 data point in 2012.
[d] The Avimor, Notus, Greenleaf, and ConAgra facilities did not discharge from May 1–September 30. However, new NPDES permits allow May 1–September 30 discharge.
[e] Permitted flow was 7 mgd when the NPDES permit was issued in 1999. The receiving water was commonly Fivemile Creek; however, the city is permitted to discharge to the south channel of the Boise River. Meridian's current design flow is 10.2 mgd and is used for allocations.

Table 16. Current sector TP loads for the lower Boise River, May 1–September 30, presented per day as monthly averages. The green highlight represents data derived from the USGS August 2012 mass balance model for the lower Boise River (Etheridge 2013).

Parma Flow	Current Background TP Inputs[a]		Current NPDES WWTF and Industry TP Inputs[b]			Current Fish Hatchery TP Inputs[c]			Current Tributary TP Inputs w/o NPDES Flows and Loads[d]			Current Ground Water TP Inputs[e]			Current Dry Weather Nontormwater TP Inputs (Accounted for in Tribs)[f]			Current Wet Weather Stormwater TP Inputs[g]			Current Total TP Inputs	TP Inputs Reaching Parma	Current Parma TP Load	Parma TP Load Reduction Needed
(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(lbs/day)	(%)	(lbs/day)	(%)
3268	0.018	317	85.3	3.27	1506	32	0.05	9	853	0.25	1144	-1390	0.21	-1573	168	0.44	394	30	0.44	71	1474	254%	3747	67%
912	0.018	88	85.3	3.27	1506	32	0.05	9	853	0.25	1144	164	0.21	186	168	0.44	394	30	0.44	71	3005	51%	1531	78%
705	0.018	68	85.3	3.27	1506	32	0.05	9	853	0.25	1144	300	0.21	340	168	0.44	394	30	0.44	71	3139	38%	1190	78%
624	0.015	50	84.0	3.18	1440	NA	0.06	9	888	0.18	880	485	0.21	562	168	0.44	394	No Storm Event			2942	34%	1010	77%
383	0.018	37	85.3	3.27	1506	32	0.05	9	853	0.25	1144	398	0.21	450	168	0.44	394	30	0.44	71	3218	23%	738	80%

Note: The USGS-derived values highlighted in green are only for comparing the USGS mass balance data with long-term flow and load duration data and not for allocation purposes. The USGS August 2012 mass balance model estimated the total diversions as -1,590 cfs at 0.22 mg/L TP, resulting in 1,890 lb/day.

[a] Background TP concentration of 0.018 mg/L was utilized based on 2005–2013 USGS Diversion Dam data, with detection levels of 0.01 mg/L. Long-term median data and the USGS 2012–2013 synoptic data (Etheridge 2013) indicate background concentrations of 0.02 and 0.015 mg/L.

[b] POTW and industrial discharge data are calculated for May 1–September 30, 2012, and represented in Table 15. The USGS August 2012 synoptic sample data represent only POTW contributions from Lander, West Boise, Meridian, Middleton, Nampa, and Caldwell facilities (Etheridge 2013).

[c] Fish hatchery data represent the Idaho Department of Fish and Game Eagle and Nampa facilities identified in Table 15.

[d] Tributary data were calculated by removing POTW, industrial, and aquaculture flows, concentrations, and loads that discharge into tributaries. The USGS August 2012 synoptic sample calculated tributaries by removing the contributions from only the Meridian and Nampa facilities (Etheridge 2013).

[e] The USGS August 2012 mass balance model was used to adjust ground water flows, including ground water loss (-1,315) under various river flow scenarios (Alex Etheridge, pers. comm., 2014). The USGS August 2012 synoptic sampling identified ground water flows as 485 cfs with 0.21 mg/L TP concentration (Etheridge 2013).

[f] Nonstormwater (dry weather) contributions were derived from data provided by the LBWC stormwater workgroup (Appendix C). Current nonstormwater flows and loads are a subcomponent of, and not summed separately from, tributary and ground water/unmeasured discharge.

[g] Stormwater (wet weather) contributions were derived from data provided by the LBWC stormwater workgroup (Appendix C). These flows and loads represent specific precipitation (storm) events and were not captured as part of the USGS August 2012 synoptic sample (Etheridge 2013).

Table 17. Current May 1–September 30 tributary TP discharge to the lower Boise River.

Tributary	Lower Boise River Receiving River Mile[a]	Mean Discharge (cfs)[b]	Mean TP Concentration (mg/L)[b]	Mean TP Load (lb/day)[b]
Eagle Drain	42.7	36.3	0.11	22.3
Dry Creek	42.5	6.5	0.16	5.6
Thurman Drain	41.9	15.0	0.11	8.6
Fifteenmile Creek	30.3	131.7	0.31	222.2
Mill Slough	27.2	104.9	0.21	118.2
Willow Creek	27.0	36.1	0.23	44.0
Mason Slough	25.6	13.0	0.22	15.4
Mason Creek	25.0	147.6	0.41	322.1
Hartley Gulch	24.4	39.2	0.27	57.4
Indian Creek	22.4	100.6	0.50	271.6
Conway Gulch	14.2	44.8	0.41	99.7
Dixie Drain	10.5	232.6	0.38	477.2
Total		**908.4**	**Mean = 0.34**	**1,664.4**
Tributary loads excluding POTW TP loads[c]		853.5	Mean = 0.25	1,144.3

[a] River miles as identified by USGS in Etheridge (2013).
[b] Values calculated from USGS and ISDA data available from 1983–2013.
[c] Tributary flows and loads were calculated by subtracting POTW flows, loads, and concentrations.

Table 18. Current May 1–September 30 ground water/unmeasured contributions and background TP discharge to the lower Boise River.

	Mean Flow (cfs)	Mean TP Conc. (mg/L)	Mean TP Load (lb/day as a monthly average)
Ground water and unmeasured [a]	164 to-1,390	0.21	-1,573 to 562
Background [b]	383 to 3,268	0.018	37 to 317

[a] Ground water and unmeasured flows are estimated from the August 2012 USGS synoptic sampling and mass balance and professional judgment (Alex Etheridge, pers. comm., 2014). These flows and loads are estimated as negative under 10th percentile high flow conditions, as the flows and loads are absorbed into near-river terrestrial zones.
[b] Background TP concentration of 0.018 mg/L was utilized based on 2005–2013 USGS Diversion Dam data (see section 3.2.2).

Based on available information for each source, current loads by sector are presented in Table 16 and Figure 24.

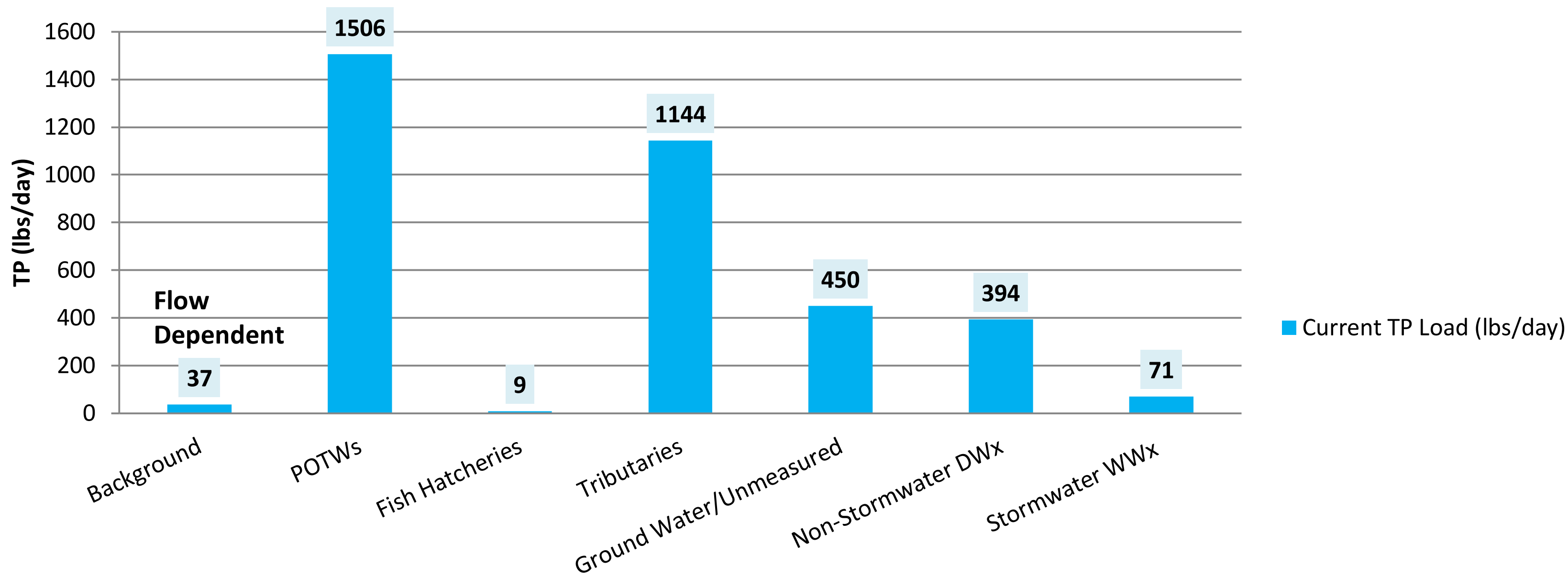


Figure 24. Current TP loads in the lower Boise River from May 1–September 30, based on average 90th percentile low flow conditions.

Notes: Stormwater (wet weather; WWx) flows and loads are associated with precipitation (storm) events conveyed through permitted and nonpermitted MS4s. Nonstormwater (dry weather; DWx) flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.

5.3.2 TP Loads: October 1–April 30

The following (Table 19) represent the TP reductions necessary to achieve the following:

- Mean monthly periphyton target of ≤ 150 mg/m^2 within the impaired AUs of the lower Boise River
- Average TP load reductions in the lower Boise River fully supporting beneficial uses and TP concentrations are at or near the EPA Gold Book recommended value of 0.1 mg/L (EPA 1986)

Table 19. Total phosphorus loads and water quality targets for October 1–April 30, expressed per day as monthly averages. These are calculated for the lower Boise River near Parma (AU ID17050114SW001_06).

Flow[a] (cfs)	Flow Rank (%)	Current Load[a]		Water Quality Targets[b]			
		TP Conc. (mg/L)	TP Load (lb/day)	TP Allocations (lb/day as a monthly average)	TP Load Reductions (lb/day as a monthly average)	TP Conc. (mg/L)	TP Load Reductions(%)
1,293	Mean	0.3	2,302	815	-1,487	0.11	65%

[a] Based on a data from October 1–April 30, 1987 through 2012.
[b] Mean load capacities and water quality targets calculated and applied as instream conditions.

5.3.2.1 Background

A background TP concentration of 0.018 mg/L is based on the 2005–2013 USGS TP data (see section 3.2.2).

5.3.2.2 NPDES-Permitted Wastewater, Industrial, and Fish Hatchery Facilities

Point source contributions were calculated from facility-supplied data and/or DMRs from October 1 through April 30, 2012–2013 (Table 20). This time period was chosen to utilize the most recent data available and accurately capture the current conditions. It is assumed that point source loadings remain relatively independent of various Boise River flow scenarios and are more dependent on factors such as population and service area.

5.3.2.3 NPDES-Permitted Municipal Stormwater and Nonstormwater

Existing stormwater (wet weather) TP contributions were derived from data provided by the LBWC stormwater workgroup (Appendix C) through several workgroup meetings and correspondence. These data were developed for October 1–April 30 for MS4-permitted and nonpermitted areas. Stormwater (wet weather) flows represent specific precipitation (storm) events that are not represented as part of the USGS October 2012 or March 2013 synoptic samples and may be underrepresented in other long-term river monitoring data not specifically focusing on these short-term flows and loads (Figure 25).

Few nonstormwater (dry weather) data have been collected in the subbasin (Appendix C). During the October 1 through April 30 time period, nonstormwater flows and loads can come from a variety of sources, including shallow ground water, urban/suburban sources (e.g., construction discharges), and other unmeasured sources. Agricultural returns and lawn watering typically begin in April. Further, nonstormwater discharge is an inherent component of the tributary and ground water/unmeasured flows and loads within the USGS synoptic samples and mass balance models, as well as the long-term flow and load duration analyses.

For stormwater (wet weather) and nonstormwater (dry weather), it is assumed that loadings remain relatively independent of various Boise River flow conditions and are more dependent on factors such as population, service area, specific storm events, etc.

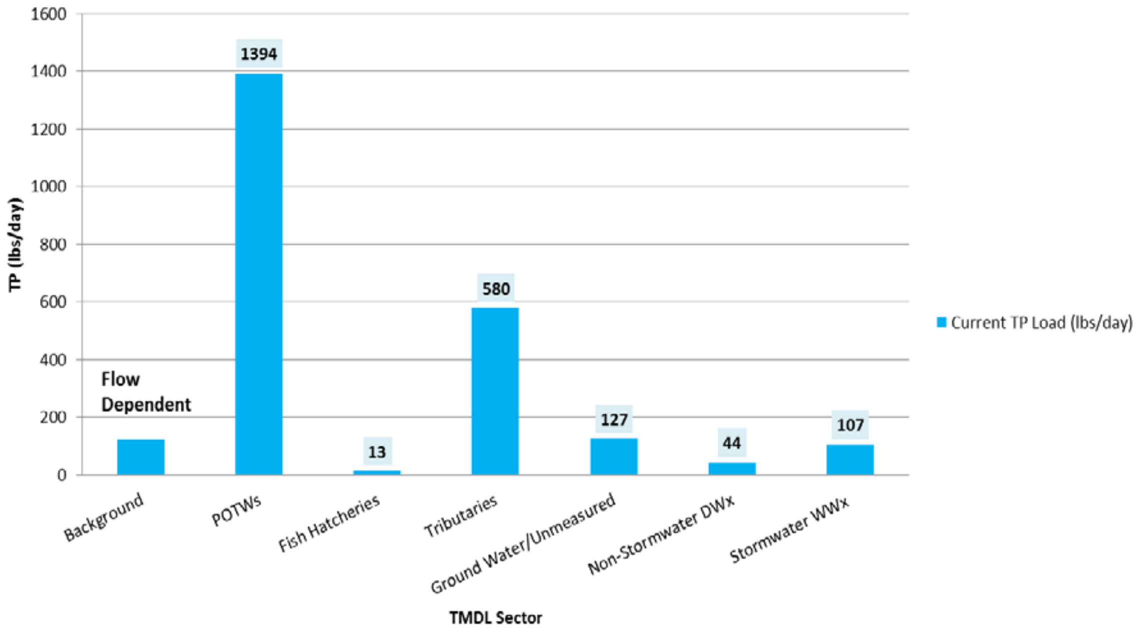


Figure 25. Current TP loads in the lower Boise River from October 1–April 30, based on January 2012 through April 2013 modeling.

Notes: Stormwater (wet weather; WWx) flows and loads are associated with precipitation (storm) events conveyed through permitted and nonpermitted MS4s. Nonstormwater (dry weather; DWx) flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.

5.3.2.4 Nonpoint Source Tributary, Ground Water, and Unmeasured Contributions

Agricultural drains and other nonpoint source tributary contributions were calculated from available USGS and ISDA data for October 1–April 30 from 1983 through 2013 (Table 21). These long-term data were selected due to temporal and spatial paucity of data and to moderate the intra- and inter-annual variation that can result from varying precipitation, runoff, temperature, and water use regimes. Flow, TP concentrations, and loads are also presented by removing the flows and TP loads attributed to NPDES-permitted facilities.

Ground water, unmeasured, and background contributions were calculated using data from the October 2012 and March 2013 synoptic sampling effort in the Lower Boise River subbasin (Etheridge 2013) and professional judgment using the October 2012 and March 2013 lower Boise River mass balance model to adjust ground water interactions in the lower Boise River under various flow scenarios (Alex Etheridge, pers. comm., 2014). These calculations represent the best and most current ground water and unmeasured flow data for the lower Boise River (Table 22).

Table 20. Current permitted October 1–April 30 point source TP discharge to the lower Boise River.

Source	NPDES Permit No.	Main Stem RM[a] or Receiving Water	Current Flow (mgd)[b]	Design Flow (mgd)	Mean TP Conc. (mg/L)[b]	Permitted TP Conc. (mg/L)	Mean TP Load (lb/day)[b]	Permitted TP Load (lb/day)
Boise River—Main Stem								
Lander	ID-002044-3	RM 50.0	12.24	15.0	1.77	No limit	180.8	No limit
West Boise	ID-002398-1	RM 44.2	14.65	24.0	4.94	No limit	603.3	No limit
Middleton	ID-002183-1	RM 27.1	0.41	1.83	4.37	No limit	14.9	No limit
Caldwell	ID-002150-4	RM 22.6	5.78	8.5	2.21	No limit	106.6	No limit
IDFG-Eagle	NPDES Aquaculture Permit	RM 41.8	2.20	4.25	0.02	No limit	0.4	No limit
Boise River—Tributaries								
Avimor [c]	In application	Dry Creek	In application	0.42	No discharge currently			
Star	ID-002359-1	Lawrence Kennedy Canal (Mill Slough/Boise River)	0.49	1.85	1.34	No limit	5.5	No limit
Meridian [d]	ID-002019-2	Fivemile Creek (Fifteenmile Creek)	5.18	10.2	0.90	No limit	38.7	No limit
Sorrento Lactalis	ID-002803-7	Mason Creek	0.60	1.52	0.02	0.07/monthly avg 0.14/daily max	0.1	0.29/monthly avg 0.58/daily max
Nampa	ID-002206-3	Indian Creek	9.91	18.0	5.13	No limit	424.1	No limit
Kuna	ID-002835-5	Indian Creek	0.49	3.5	3.34	No limit	13.8	No limit
IDFG-Nampa[d]	IDG-130042 NPDES Aquaculture Permit	Wilson Drain and Pond (Indian Creek)	21.52	19.38	0.07	No limit	12.7	No limit
Darigold	ID-002495-3	RM 22.6 (unmeasured drain)	0.27	1.7	0.20	No limit	0.4	No limit
Notus	ID-002101-6	Conway Gulch	0.06	0.11	4.60	No limit	2.2	No limit
Wilder	ID-0020265	Wilder Ditch Drain	0.19	0.25	2.23	No limit	3.6	No limit

Source	NPDES Permit No.	Main Stem RM[a] or Receiving Water	Current Flow (mgd)[b]	Design Flow (mgd)	Mean TP Conc. (mg/L)[b]	Permitted TP Conc. (mg/L)	Mean TP Load (lb/day)[b]	Permitted TP Load (lb/day)
Greenleaf	ID-002830-4	West End Drain	0.06	0.24	0.06	No limit	0.03	No limit
ConAgra (XL4Star)[c]	ID-000078-7	Indian Creek	n/a	0.48	n/a	No limit	n/a	No limit
Total			**74.04**	**111.23**	**2.28**		**1407.14**	

Note: n/a indicates no current discharge in October–April.
[a] River miles (RM) as identified by USGS in Etheridge 2013).
[b] Calculated from October 1–April 30, 2012–2013, using data provided by facilities and/or DMR data.
[c] The Avimor and ConAgra facilities did not discharge from October 1–April 30. However, new NPDES permits allow October 1–April 30 discharge.
[d] Permitted flow was 7 mgd when the NPDES permit was issued in 1999. The receiving water was commonly Fivemile Creek; however, the city is permitted to discharge to the south channel of the Boise River. Meridian's current design flow is 10.2 mgd and is used for allocations.

Table 21. Current October 1–April 30 tributary TP discharge to the lower Boise River.

Tributary	Lower Boise River Receiving River Mile[a]	Mean Discharge (cfs)[b]	Mean TP Conc. (mg/L)[b]	Mean TP Load (lb/day)[b]
Eagle Drain	42.7	11.7	0.16	9.8
Dry Creek	42.5	14.6	0.13	9.9
Thurman Drain	41.9	8.2	0.14	6.1
Fifteenmile Creek	30.3	58.0	0.34	104.9
Mill Slough	27.2	56.0	0.20	60.3
Willow Creek	27.0	21.4	0.33	37.5
Mason Slough	25.6	5.8	0.36	11.1
Mason Creek	25.0	67.7	0.25	92.6
Hartley Gulch	24.4	10.7	0.31	17.9
Indian Creek	22.4	167.7	0.57	516.9
Conway Gulch	14.2	22.1	0.19	22.6
Dixie Drain	10.5	114.5	0.31	191.3
Total		**558.2**	**Mean = 0.36**	**1081.0**
Tributary loads excluding POTW TP Loads[c]		498.6	Mean = 0.22	579.9

[a] River miles as identified by USGS in Etheridge (2013).
[b] Values calculated from USGS and ISDA data available from 1983–2013.
[c] Tributary flows and loads were calculated by subtracting POTW flows, loads, and concentrations.

Table 22. Current October 1–April 30 ground water/unmeasured contributions and background TP discharge to the lower Boise River.

	Mean Flow (cfs)	Mean TP Conc. (mg/L)	Mean TP Load (lb/day)
Ground water and unmeasured [a]	133 to 180	0.15	108 to 146
Background [b]	1,293	0.018	125

[a] Ground water and unmeasured mean flows are estimated from the October 2012 and March 2013 USGS synoptic sampling and mass balance (Etheridge 2013) and the water balance used for the AQUATOX model.
[b] Background TP concentration of 0.018 mg/L was used based on 2005–2013 USGS Diversion Dam data (see section 3.2.2). The actual background loading (in pounds) is variable depending on the river inflow from upstream, ground water, and tributary/drain sources.

5.4 Load and Wasteload Allocations

A detailed approach was used for analyzing and selecting the allocations, which include implicit and explicit margins of safety and take into account seasonal variability and uncertainty with the conservative assumptions built into the methodology (section 5.4.4).[5] Uncertainty arises in selecting water quality targets, determining load capacity, and estimating existing loads and may be attributed to incomplete knowledge or understanding of the lower Boise River managed system, such as assimilation, data gaps, or variability. Considerations included equitable cost, cost effectiveness, and credit for prior efforts, but all within the ceiling of remaining available

[5] Given the complexity of the lower Boise River managed watershed, through the implementation process and the TMDL 5-year review, wasteload allocations and load allocations established in this TMDL may be reevaluated as additional data become available.

load to fully support existing beneficial uses. Each point source receives a wasteload allocation, whereas nonpoint source load allocation responsibilities are often varied (e.g., tributaries versus ground water and unmeasured). The projected implementation time frames are identified in section 5.5.1 and will be further evaluated in the subsequent implementation plan.

In the case of the lower Boise River TP TMDL, the May–September TP allocations are based on achieving a TP concentration of ≤0.07 mg/L near Parma, which also contributes to achieving the mean monthly periphyton target of ≤150 mg/m^2 in the two impaired AUs. Alternatively, the October–April TP allocations correspond only with achieving the mean monthly periphyton target.

5.4.1 TP Allocations to Achieve the SR-HC TMDL Target

For May 1–September 30, the load allocation is set at a TP concentration and TP load equivalent ≤0.07 mg/L in the lower Boise River near Parma to comply with the 2004 Snake River-Hells Canyon TMDL (and achieve the mean monthly periphyton target in the lower Boise River).

The following analysis and allocations indicate that lower Boise River TP loadings near Parma must be reduced between approximately 81% to 83% from May 1–September 30 to achieve the TP load equivalent target of ≤0.07 mg/L and comply with the mean monthly benthic chlorophyll *a* (periphyton) target of ≤150 mg/m^2 in the lower Boise River impaired AUs. Table 23 through Table 25 and Figure 26 outline sector-wide and specific allocations that achieve both targets. As with the current load estimates, there are several assumptions identified in the load and wasteload analyses to help achieve the May 1–September 30 TP and periphyton targets.

Table 23. Current TP loads, load capacities, and water quality targets for May 1–September 30, presented as daily averages. These are calculated for the Boise River near Parma (AU ID17050114SW001_06).

Flow[a] (cfs)	Flow Rank (%)	Current Load[a]		Load Capacity[b]			Water Quality Targets[b]			
		TP Conc. (mg/L)	TP Load (lb/day)	Target TP Conc. (mg/L)	Target TP Load (lb/day)	Target TP Load Reductions (lb/day [%])	TP Allocations (lb/day as a monthly average)	TP Load Reductions(lb/day as a monthly average)	TP Conc. (mg/L)	TP Load Reductions (%)
3,268	10th	0.21	3,747	≤0.07	1,233	-2,514 (67%)	601	-3,146	0.034	84%
912	40th	0.31	1,531	≤0.07	344	-1,187 (78%)	303	-1,228	0.062	80%
705	60th	0.31	1,190	≤0.07	266	-924 (78%)	237	-953	0.062	80%
624	69th	0.30	1,010	≤0.07	235	-775 (77%)	224	-786	0.067	78%
383	90th	0.36	738	≤0.07	145	-593 (80%)	145	-593	0.070	80%

Note: Lower Boise River flows, TP concentrations, and loads highlighted in green are derived from the USGS August 2012 synoptic sample (Etheridge 2013). These USGS-derived values are only for comparing the USGS mass balance data with long-term flow and load duration data and not for TP allocation purposes.
[a] Based on data from May 1–September 30, 1987 through 2012, and duration curves with water quality targets.
[b] Load capacities and water quality targets are applied near Parma using duration curves.

Table 24. Gross load and wasteload allocations by sector for the lower Boise River, May 1–September 30, presented per day as monthly averages. DEQ intends that wasteload allocations are to be expressed as average monthly limits.

Parma Flow	Background TP Allocations[a] (per day as monthly average)		NPDES POTW and Industry TP Allocations[b] (per day as monthly average)			Fish Hatchery TP Allocations[c] (per day as monthly average)			Tributary TP Allocations w/o NPDES Flows and TP Loads[d] (per day as monthly average)			Ground Water TP Allocations[e] (per day as monthly average)			Dry Weather Nonstormwater TP Allocations (Accounted for in Tribs)[f] (per day as monthly average)			Wet Weather Stormwater TP Allocations[g] (per day as monthly average)			TP Input Allocations (per day as monthly average)	TP Inputs Reaching Parma	Parma TP Load w/ Allocations (per day as monthly average)	Parma TP Load Reduction
(cfs)	(mg/L)	(lb/day)	(cfs)	(mg/L)	(lb/day)	(cfs)	(mg/L)	(lb/day)	(cfs)	(mg/L)	(lb/day)	(cfs)	(mg/L)	(lb/day)	(cfs)	(mg/L)	(lb/day)	(cfs)	(mg/L)	(lb/day)	(lb/day)	(%)	(lb/day)	(%)
3268	0.018	317	135.6	0.10	73	37	0.10	20	822	0.07	310	-1390	0.07	-524	168	n/a	63	30	n/a	41	237	254%	601	84%
912	0.018	88	135.6	0.10	73	37	0.10	20	822	0.07	310	164	0.07	62	168	n/a	63	30	n/a	41	594	51%	303	80%
705	0.018	68	135.6	0.10	73	37	0.10	20	822	0.07	310	300	0.07	113	168	n/a	63	30	n/a	41	625	38%	237	80%
624	0.015	50	120.0	0.10	65	34	0.10	18	888	0.07	335	485	0.07	183	168	n/a	63	No Storm Event			651	34%	224	78%
383	0.018	37	135.6	0.10	73	37	0.10	20	822	0.07	310	398	0.07	150	168	n/a	63	30	n/a	41	631	23%	145	80%

Note: The green highlight represents data derived from the USGS August 2012 mass balance model for the lower Boise River (Etheridge 2013). The USGS-derived values are only for comparing the USGS mass balance data with long-term flow and load duration data and not for TP allocation purposes.

[a] Background TP concentration of 0.018 mg/L was used based on 2005–2013 USGS Diversion Dam data, with detection levels of 0.01 mg/L (see section 3.2.2). Long-term median data and the USGS 2012–2013 synoptic data (Etheridge 2013) indicate background concentrations of 0.02 and 0.015 mg/L.
[b] POTW and industrial discharge data are based on facility design flows, represented in Table 15. The USGS August 2012 synoptic sample data represent only POTW contributions from Lander, West Boise, Meridian, Middleton, Nampa, and Caldwell facilities (Etheridge 2013).
[c] Fish hatchery data represent the Idaho Department of Fish and Game Eagle and Nampa facilities identified in Table 15.
[d] Tributary data were calculated by removing all POTW, industrial, and aquaculture design flows, concentrations, and loads that discharge into tributaries. The USGS August 2012 synoptic sample calculated tributaries by removing the contributions from only the Meridian and Nampa facilities (Etheridge 2013).
[e] The USGS August 2012 mass balance model was used to adjust ground water flows, including ground water loss (-1,315 cfs) under various river flow scenarios (Alex Etheridge, pers. comm., 2014). The USGS August 2012 synoptic sample identified ground water flows as 485 cfs with a 0.21 mg/L TP concentration (Etheridge 2013).
[f] Nonstormwater (dry weather) allocations were derived from data provided by the LBWC stormwater workgroup (Appendix C) and represent an 84% TP load reduction on average across all MS4s in order to achieve a 0.07 mg/L TP load equivalent under current flows. Nonstormwater flows and loads are largely unmeasured throughout the subbasin and are a subcomponent of, and not summed separately from, tributary and ground water load allocations.
[g] Stormwater (wet weather) allocations were derived from the data provided by the LBWC stormwater workgroup (Appendix C) and represent a 42% TP load reduction on average across all MS4s. These flows and loads represent specific precipitation (storm) events and were not captured as part of the USGS August 2012 synoptic sample (Etheridge 2013).

Table 25. Percent reductions by sector for the lower Boise River, May 1–September 30, presented per day as monthly averages. DEQ intends that wasteload allocations are to be expressed as average monthly limits.

Sector	Current TP Conc. (mg/L)	Current TP Load (lb/day)	Target TP Conc. (mg/L)	TP Allocation (lb/day as a monthly average)	Percent Reduction	Notes
Average Daily Background	0.018	37	0.018	37	**0%**	Background TP concentration of 0.018 mg/L was utilized based on 2005–2013 USGS Diversion Dam data, with detection levels of 0.01 mg/L (see section 3.2.2). Background was based on the quantity of water reaching Parma under the 90th percentile low flow conditions.
Average Daily NPDES POTW and Industry	3.27	1,506	0.1	73	**-95%**	Publicly owned treatment works (POTW) and industrial discharge data are based on facility design flows, represented in Table 15.
Average Fish Hatchery	0.05	9	0.1	20	**110%**	Fish hatchery data represent the Idaho Department of Fish and Game Eagle and Nampa facilities identified in Table 15
Average Tributary (w/o NPDES Flows and Loads)	0.25	1,144	0.07	310	**-73%**	Tributary data (Table 17) were calculated by removing all POTW, industrial, and aquaculture design flows, concentrations, and loads that discharge into tributaries.
Average Ground Water and Unmeasured	0.21	450	0.07	150	**-67%**	The USGS August 2012 mass balance model was used to estimate average ground water flows. Ground water was based on the 90th percentile low flow conditions.
Average Nonstormwater Dry Weather	0.44	394	n/a	63	**-84%**	Nonstormwater (dry weather) allocations were derived from the data provided by the LBWC stormwater workgroup (Table 8 and Appendix C). Nonstormwater flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.
Average Stormwater Wet Weather	n/a	71	n/a	41	**-42%**	Stormwater (wet weather) allocations were derived from the data provided by the LBWC stormwater workgroup (Table 8 and Appendix C). These flows and loads represent specific precipitation (storm) events.

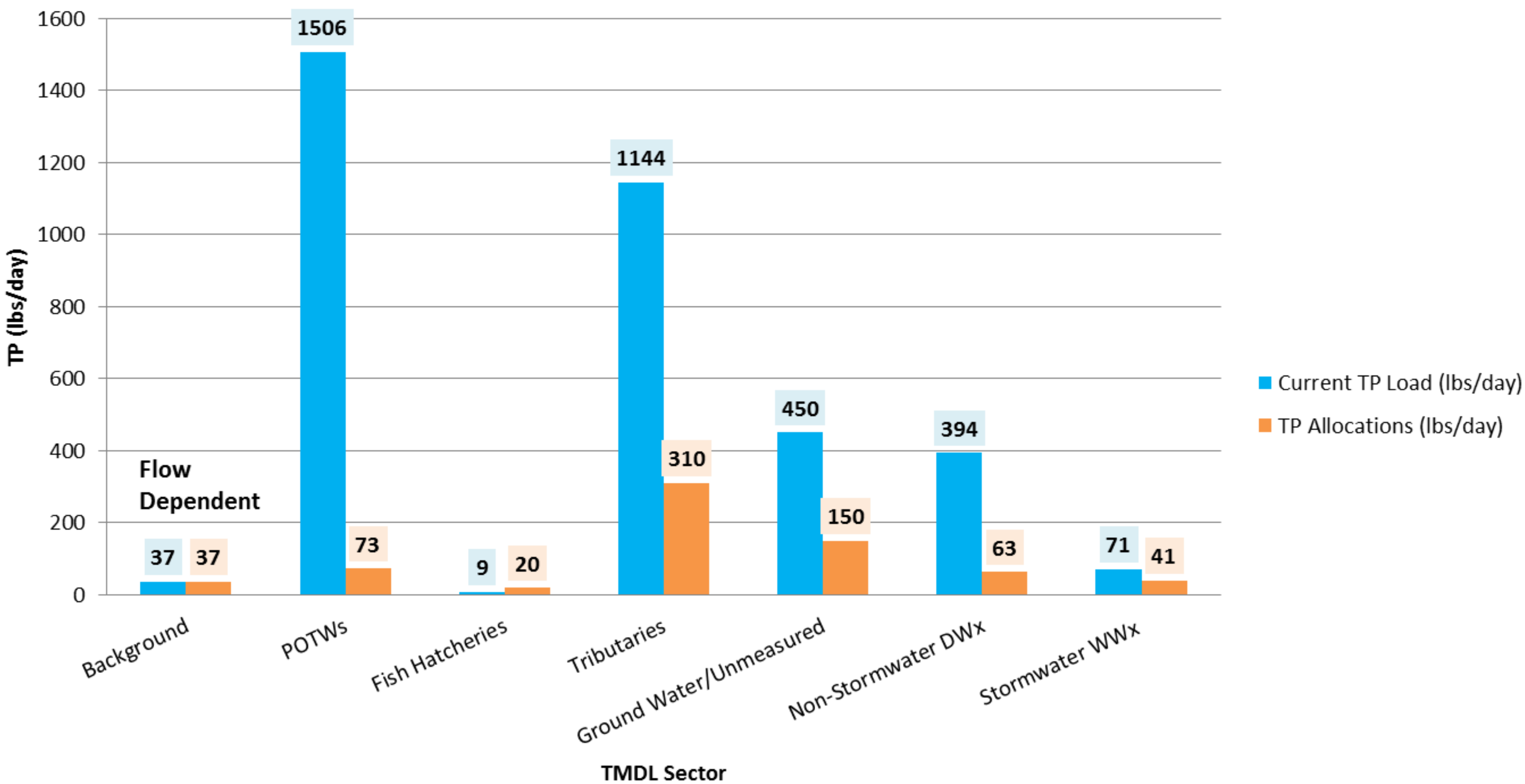


Figure 26. Current TP loads versus load allocations for the lower Boise River, May 1–September 30.

Notes: Stormwater (wet weather; WWx) flows and loads are associated with precipitation (storm) events conveyed through permitted and nonpermitted MS4s. Stormwater (wet weather) allocations represent a 42% TP load reduction on average across all MS4s.
Nonstormwater (dry weather; DWx) allocations represent an 84% TP load reduction on average across all MS4s in order to achieve a 0.07 mg/L TP load equivalent under current flows. Nonstormwater flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.

5.4.1.1 Background

The background TP concentration of 0.018 mg/L is based on the 2005–2013 USGS TP data at Diversion Dam, with detection levels of 0.01 mg/L (see section 3.2.2).

To achieve the May 1–September 30 TP target of ≤0.07 mg/L near Parma and the ≤150 mg/m^2 mean monthly periphyton target, background contributions received load allocations of 37 to 317 lb/day (0.018 mg/L) TP for various flow conditions (0% reduction) (Table 26).

Table 26. Agricultural and other nonpoint source ground water, unmeasured, and background load allocations for the lower Boise River, May 1–September 30. Load allocations are presented per day as monthly averages. DEQ intends that load allocations are to be expressed as monthly averages.

	Mean Flows (cfs)	Current TP Conc. (mg/L)	Current TP Load (lb/day)	Target TP Conc. (mg/L)	Average TP Allocation (lb/day as a monthly average)[a]	Average TP Load Reduction (%)
Ground water and unmeasured[b]	-1390 to 164	0.21	-1573 to 562	0.07	-524 to 150	-67%
Background[c]	383 to 3268	0.018	37 to 317	0.018	37 to 317	0%

[a] Because the TP target is concentration-based, actual allowable ground water, unmeasured, and background load allocations under the TMDL are dependent on actual flow and will fluctuate year to year.
[b] Ground water and unmeasured flows are derived from the August 2012 USGS synoptic sampling and mass balance (Alex Etheridge, pers. comm., 2014). Ground water/unmeasured TP concentrations were reduced to 0.07 mg/L for all flows.
[c] Background TP concentration of 0.018 mg/L was used based on 2005–2013 USGS Diversion Dam data (see section 3.2.2).

5.4.1.2 NPDES-Permitted Wastewater, Industrial, and Fish Hatchery Facilities

Point source allocations are calculated for facility design flows from May 1–September 30. It is assumed that point source loadings remain relatively independent of various Boise River flow scenarios and are more dependent on factors such as population and service area.

To achieve the TP target near Parma and the monthly periphyton target, this sector received wasteload allocations of 73 lb/day (0.1 mg/L) TP for all flow conditions (95% reduction) (Table 27).

Table 27. Point source wasteload allocations for the lower Boise River, May 1–September 30. Wasteload allocations at TP concentrations of 0.1 mg/L are presented per day as monthly averages. DEQ intends that wasteload allocations are to be expressed as average monthly limits.

Point Source	Current Flow (mgd)	Design Flow (mgd)	Current May–Sept TP Conc. (mg/L)	Current May–Sept TP Load (lb/day)	Average May–Sept TP Allocation[a,b] (lb/day as a monthly average)	Average May–Sept TP Load Reduction[a] (%)
Boise River—Main Stem						
Lander Street POTW	12.71	15	2.10	222.7	12.5	-94%
West Boise POTW	16.10	24	4.47	600.5	20.0	-97%
Middleton	0.57	1.83	3.23	15.4	1.5	-90%
Caldwell	7.90	8.5	2.37	156.2	7.1	-96%
IDFG Eagle	2.95	4.25	0.02	0.6	3.6	+500%
Boise River—Tributary						
Avimor—Dry Creek	n/a	0.42	n/a	n/a	0.35	n/a
Star—Lawrence-Kennedy Canal	0.63	1.85	1.85	9.7	1.5	-84%
Meridian—Fivemile Creek and Boise River	5.87	10.2	1.26	61.6	8.5	-86%
Sorrento Lactalis—Purdham Drain	0.7	1.52	0.03	0.2	1.3	+738%
Nampa—Indian Creek	10.51	18.0	4.97	435.8	15.0	-97%
Kuna—Indian Creek	0.47	3.5	0.04	0.2	2.9	+1766%
IDFG Nampa—Indian Creek	17.85	19.38	0.06	8.8	16.2	+84%
Darigold—unmeasured drain	0.22	1.7	0.31	0.6	1.4	+149%
Notus—Conway Gulch	n/a	0.11	n/a	n/a	0.09	n/a
Wilder—Wilder Ditch Drain	0.07	0.25	6.02	3.3	0.21	-94%
Greenleaf—West End Drain	n/a	0.24	n/a	n/a	0.20	n/a
ConAgra (XL Four Star)—Indian Creek	n/a	0.48	n/a	n/a	0.40	n/a
Total	**76.5**	**111.2**	**2.37**	**1,515.5**	**92.8**	**-95%**

Note: n/a indicates no current discharge.
Point source allocations can be met through trading or offset as detailed in regulations and guidance documents, such as the DEQ *Water Quality Trading Guidance* (DEQ 2010a) and the Lower Boise Trading Framework that is being developed.
[a] The wasteload allocations and load reductions are estimates that achieve the ≤0.07 mg/L TP target in the lower Boise River for the 90th percentile low flow conditions for May 1–September 30, 1987 through 2012, near Parma and are applied to all flows in order to also achieve the monthly periphyton target (see section 5.4.1).
[b] It is expected that all NPDES point source facilities will achieve the wasteload allocation targets within compliance schedules granted by DEQ and approved by EPA. Achieving the wasteload allocation targets is expected to occur through enhanced technology and/or water quality trading. This TMDL provides opportunity for potentially re-opening NPDES permits by providing new water quality information.

5.4.1.3 NPDES-Permitted Municipal Stormwater and Nonstormwater

Stormwater (wet weather) allocations were derived from data provided by the LBWC stormwater workgroup (Appendix C) through several meetings and correspondence. The stormwater load estimates were not derived from the AQUATOX or mass balance models; therefore, refinements should be made as additional characterization information becomes available. For example, analytical methods for separating stormwater baseflow would allow for the refinement of dry weather flow estimates. Further, these TP wasteload and load allocations may need to be adjusted to reflect MS4 boundary and land use changes in the subbasin.

Nonstormwater (dry weather) allocations are derived as a subcomponent of the tributary and ground water/unmeasured discharge, which must achieve a ≤0.07mg/L TP load equivalent to help achieve the May 1–September 30 TP target of ≤0.07 mg/L near Parma. Stormwater and nonstormwater allocations are for MS4-permitted and nonpermitted areas. It is assumed that these loads remain relatively independent of various Boise River flow scenarios and are more dependent on factors such as population, service area, storm events, etc.

To achieve the May 1–September 30 TP target of ≤0.07 mg/L near Parma and the mean monthly periphyton target of ≤ 150 mg/m^2, stormwater (wet weather) load and wasteload allocations require a 42% load reduction from currently estimated baseline loads (Figure 27). Nonstormwater (dry weather) allocations require an 84% load reduction, which is the percent load reduction needed to achieve a TP load equivalent of ≤0.07 mg/L under current flow conditions for each MS4 (Table 28). These allocations are further broken down into the following subcategories:

- **Stormwater (wet weather) in MS4-permitted areas**: average daily *wasteload allocations* as a 42% TP load reduction
- **Stormwater (wet weather) in non-MS4 permitted areas**: average daily *load allocations* as a 42% TP load reduction
- **Nonstormwater (dry weather) in MS4-permitted areas**: average daily *wasteload allocations*[6] as an 84% TP load reduction equivalent to 0.07 mg/L under current flow conditions
- **Nonstormwater (dry weather) in non-MS4 permitted areas**: average daily *load allocations* as an 84% TP load reduction equivalent to 0.07 mg/L under current flow conditions

[6] To the extent that nonstormwater (dry weather) discharges are the result of exempt nonpoint source activities (i.e., irrigation flows and pass-through) they are assigned a load allocation.

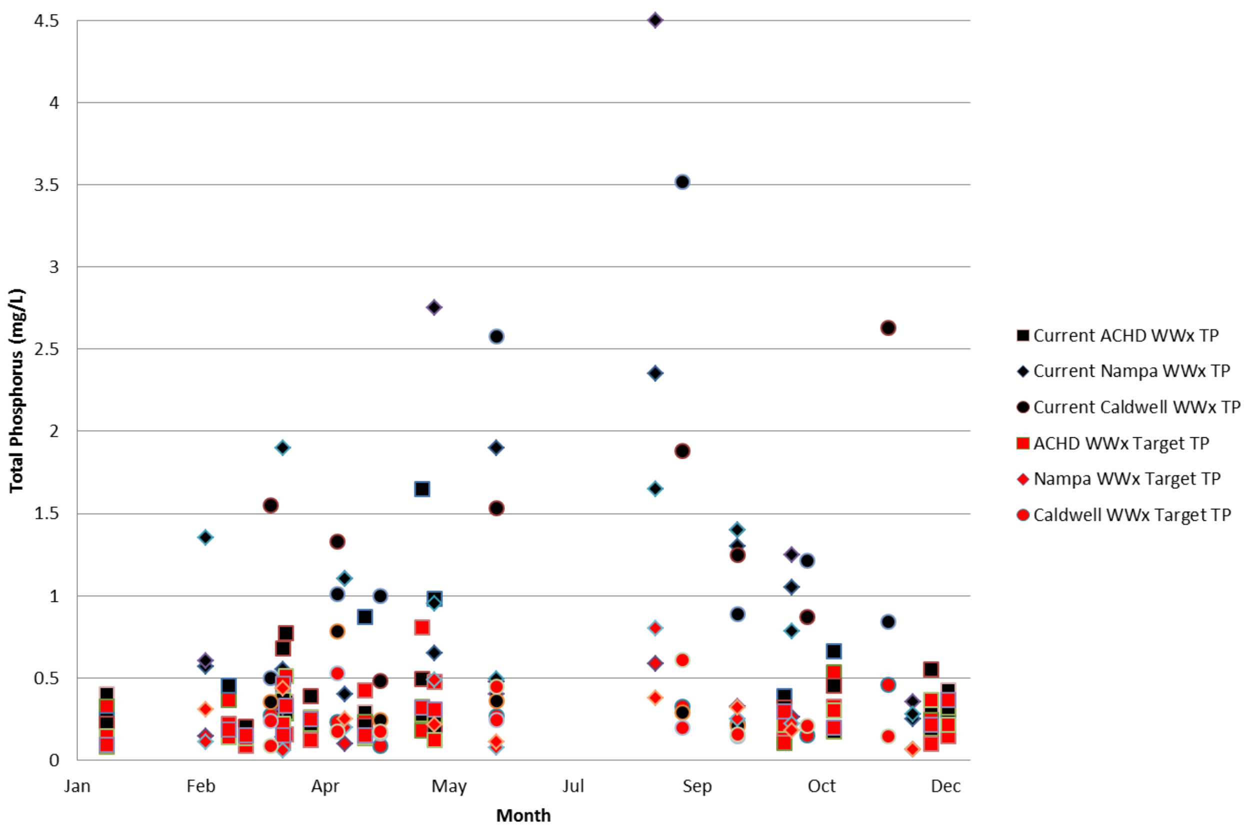


Figure 27. Current versus target stormwater (wet weather) TP concentrations (year-round).

Table 28. Point source stormwater (wet weather) and nonstormwater (dry weather) TP allocations for MS4-permitted and nonpermitted areas of the lower Boise River, May 1–September 30. Wasteload and load allocations are presented as per day monthly averages. DEQ intends that wasteload allocations are to be expressed as percent load reductions for average monthly limits in NPDES permits.

Permit Holder/Jurisdiction	NPDES Permit Number	MS4 Permit Type	Permitted Areas: Urbanized Area[a] Area (mi^2)	Permitted Areas: City Limits[b,c] Area (mi^2)	Non-Permitted Areas: City Limits[b,c] Area (mi^2)	Area Ratio[d,e]	May-Sept Current stormwater Wet Weather Avg TP Load[f] (lbs/day as a monthly average)	May-Sept stormwater Wet Weather Avg TP Allocation[f,g] (% Reduction)	May-Sept Current Non-stormwater Dry Weather Avg TP Load[h](lbs/day as a monthly average)	May-Sept Non-stormwater Dry Weather Avg TP Allocation[h,i,j] (% Reduction)
							Current Load = Qcurrent (CFS) x **C**current (mg/L) x 5.39	**42% Load Reduction = Q**current (CFS) x **C**current (mg/L) x 5.39 X 0.57	**Current Load = Q**current (CFS) x **C**current (mg/L) x 5.39	**84% Load Reduction = Q**current (CFS) x Ccurrent (mg/L) x 5.39 x 0.16
Ada County										
Boise/Garden City	IDS027561	Phase I		87						
Boise	IDS027561	Phase I		83						
Garden City	IDS027561	Phase I		4						
Ada County Highway District	IDS027561	Phase I		87						
Boise State University	IDS027561	Phase I		0.24						
Ada County Drainage District 3	IDS027561	Phase I		8						
ITD, District 3	IDS027561	Phase I								
Total Area Boise/Garden City Phase I Permit				**87**		0.31				
Ada County Highway District	IDS028185	Phase II	62	84						
Meridian		-	24	28	4					
Eagle		-	12	30	18					
Urbanized Ada County (unincorporated)		-	26	NA						
Total Area Ada County Phase II Permit			**62**			0.22				
Kuna	NA	-			18					
Star	NA	-			4					
Total Ada County Incorporated Non- Permitted Area					**44**	**0.16**				
Canyon County										
Caldwell	IDS028118	Phase II	17.5		4.6					
Nampa	IDS028126	Phase II	25		6.5					
Middleton	IDS028100	Phase II	2.3		2.9					
Urbanized Canyon County (unincorporated)	-	-	24.8							
ITD, District 3	IDS028177	Phase II								
Canyon Highway District #4[a]	IDS028134	Phase II	8							
Nampa Highway District #1[a]	IDS028142	Phase II	8.5							
Notus-Parma Highway District #2[a]	IDS028151	Phase II	2							
Total Area Canyon County Phase II Permits			**70**			0.25				
Greenleaf	NA	-			0.8					
Notus	NA	-			0.4					
Parma	NA	-			1.1					
Wilder	NA	-			0.7					
Total Canyon County Incorporated Non- Permitted Area					**17**	**0.06**		**-42%**		**-84%**

Note: Stormwater (wet weather) and nonstormwater (dry weather) allocations were derived from data provided by the LBWC stormwater workgroup (Appendix C). DEQ intends that wasteload allocations are to be expressed as percent load reductions for monthly average limits in NPDES permits.

The nonpermitted areas receive load allocations because they are currently not permitted under the NPDES program. As permitting areas change, load and wasteload allocations may be adjusted.

[a] Urbanized area based on 2010 census, which may differ from the MS4 permitted areas that are based on 2003 decennial census data.

[b] Ada County Assessor, July 9, 2014

[c] Canyon County Assessor, May 28, 2014

[d] Area data from NPDES permit factsheets (2000 census)

[e] Area ratio = the area contribution of each MS4 permit relative to the total service area for MS4s

[f] Stormwater (wet weather) allocations represent a 42% average TP load reduction on average across all permitted and nonpermitted MS4 areas. The gross current TP load estimate is 71 lb/day, with a necessary reduction of 41 lb/day. In the wasteload allocation equation, Qcurrent (cfs) is current baseline discharge, Ccurrent (mg/L) is current baseline TP concentration, and 5.39 is standard conversion factor (Hammer 1986).

[g] Higher maximum daily stormwater (wet weather) target loads may exceed average daily loads and still allow MS4s to comply with the load and wasteload reductions.

[h] Nonstormwater (dry weather) allocations represent an 84% TP load reduction on average across all permitted and nonpermitted MS4 areas in order to achieve a 0.07 mg/L TP load equivalent under current flows. The gross current TP load estimate is 394 lb/day, with a reduction of 63 lb/day. Nonstormwater flows and loads are largely unmeasured throughout the subbasin and are a subcomponent of, and not summed separately from, tributary and ground water load allocations). In the wasteload allocation equation, Qcurrent (cfs) is current baseline discharge, Ccurrent (mg/L) is current baseline TP concentration, and 5.39 is a standard conversion factor (Hammer 1986).

[i] It is DEQ's intent to include in the MS4 wasteload allocation only nonstormwater that is categorized as allowable under the MS4 NPDES permit and to treat other nonstormwater flow as a nonpoint source. If the other nonstormwater flow can be identified and quantified by the MS4, it will be treated under this TMDL as a nonpoint source (see Table 8). Further, this TMDL does not excuse the responsibility of the MS4 owner or operator to comply with the terms of the applicable NPDES permit.

[j] The May–September 84% reduction for nonstormwater dry weather is an estimated average across all MS4s. The actual percent reduction would be based on the current loading for each individual MS4.

Stormwater and nonstormwater estimates and allocations are based on limited data and conservative assumptions. Further, these TP wasteload and load allocations and/or their use in NPDES permits may need to be adjusted as MS4/urban/agriculture boundaries and land uses change in the subbasin.

The plumbing of MS4 systems is intricate, and the exact quantity of the nonstormwater inputs is presently unknown. However, MS4 permittees have provided initial estimates for the percentage of their nonstormwater discharge that originates from nonpoint sources (Table 29). These estimates should be refined through monitoring and mapping in future permit cycles and as part of TMDL implementation.

The following issues and concerns are identified and discussed to provide a better understanding of how loads are represented and allocations are applied within the TMDL.

Concentration versus Load

Attempting to achieve a concentration target at point of discharge for stormwater is difficult and costly. For this reason, most stormwater management BMPs are designed and implemented to reduce loads (not concentrations) for each MS4. To facilitate implementation, allocations are expressed as a percent load reduction from the existing conditions that can then be translated into management activities.

Many BMPs remove only 10–45% of influent phosphorus loads; therefore, it may be technically or economically difficult to treat all stormwater runoff from a locality or achieve large loading reductions through the use of BMPs alone (DEQ 2005). For these reasons, TMDL-related activities should be determined on a watershed basis such that all regulated MS4 entities should be conducting the same or similar types of actions to identify all existing MS4 outfalls discharging during dry weather and to sufficiently characterize such flows to identify the type and source of such flows, including to confirm whether such ground water and/or irrigation water flows are indeed uncontaminated.Trading with other sectors and sources should be allowed and encouraged to facilitate cost effective load reductions.

The stormwater (wet weather) wasteload allocations are based on existing loads, recognizing that retrofitting the existing infrastructure may require considerable time and resources. Runoff from new urban development will need to be managed carefully, using appropriate BMPs and consistent with the overall TP reduction goals.

Stormwater Management

Many entities in the subbasin have active stormwater management programs and policies, such as on-site retention and other low impact development or area-wide green infrastructure practices. When fully implemented across the watershed, these are the primary mechanisms for managing stormwater and reducing pollutant loads from both commercial and residential developments.

Low Frequency of Storms

Because stormwater (wet weather) loads are precipitation driven and can vary by orders of magnitude depending on the location and/or event, one number will often not represent an adequate daily load value. To better account for allowable differences in loading due to flow-related conditions, stormwater wasteload allocations in this TMDL represent average daily TP load reductions but acknowledge that higher maximum daily loads can occur and still achieve the per day monthly average target discharge.

The area of interest has a relatively low frequency of storms, with only about 40 annual events causing runoff-producing volumes. While the lowest occurrence is during the summer, precipitation and runoff rates can exceed average.

Stormwater (wet weather) flows and loads were not captured as part of USGS August 2012 synoptic sampling. Because of the lack of long-term stormwater data, it is unclear how the loads from these discrete events impact periphytic growth.

Permittees and Other Municipal Entities

In situations where a stormwater or nonstormwater source is not currently regulated by a permit but may become part of a permitted area in the future, the allocation is currently expressed as a load allocation. The load allocation could later be deemed a wasteload allocation if the stormwater or nonstormwater discharge for the source were required to obtain NPDES permit coverage or become annexed into an existing MS4.

Therefore, discharges occurring in areas within Ada County that do not meet the federal MS4 definition (i.e., portions of Meridian, Eagle, and unincorporated urbanized Ada County) are authorized under existing NPDES permits and managed by the owner/operator of the MS4 in the urbanized area. These areas are included as load allocations in the TMDL because BMPs including education activities, construction site runoff control, on-site detention of runoff, and others are in place for urban and suburban stormwater management. Municipalities have existing regulatory authority over private and municipal properties to require on-site retention and other low impact development or area-wide green infrastructure practices to mitigate potential sources of stormwater runoff.

Nonstormwater (Dry Weather)

In this TMDL analysis, the nonstormwater (dry weather) flows and loads are implicitly measured as a subcomponent of the tributary and ground water/unmeasured discharge. Nonstormwater can originate from a variety of sources, including, but not limited to, agricultural returns, shallow ground water, urban/suburban sources (e.g., lawn watering), and other unmeasured sources. Due to nonstormwater being estimated as an inherent component of tributaries and ground water/unmeasured flows in this TMDL analysis, the sector received an allocation equivalent of 0.07 mg/L TP for current flow conditions, which is the same allocation for the tributaries and ground water/unmeasured flows.

The nonstormwater (dry weather) TP reductions could be achieved through load reductions, offsets/trading, reuse, and other BMPs targeting phosphorus reductions; increased attention to on-site stormwater inspection; maintenance; dry weather inspections; and public education.

Table 29. Estimates for the percentage of nonstormwater (dry weather) MS4 discharge attributable to NPDES-exempt agricultural flows. These estimates are approximate and based on professional judgment, rather than hard data. See Table 7 for a list of all authorized nonstormwater discharges.

Facility	NPDES Permit No.	Nonstormwater (Dry Weather) Discharge Attributable to NPDES-Exempt Agricultural Flows
ACHD Phase II	IDS-028185	50%
ACHD Phase I	IDS 027561	50%
Boise City	IDS 027561	0%
Garden City	IDS 027561	0%
Ada County Drainage #3	IDS 027561	[a]
ITD #3	IDS 027561	100%
Boise State University	IDS 027561	0%
City of Caldwell	IDS-028118	98%
Canyon Highway District #4	IDS-028134	100%
ITD #3	IDS-028177	100%
Nampa Highway District MS4	IDS-028142	0%
City of Nampa	IDS-028126	99%
City of Middleton	IDS-028100	[a]
Industrial Facilities	Multi-Sector General Permit	0%
Construction Activities	Construction General Permit	0%
Confined animal feeding operations	IDG010000	0%

[a] Estimates have not been received for these MS4 systems at the time of release for this draft TMDL.
[b] The nonpermitted areas receive 100% load allocations because they are currently not permitted under the NPDES program. As permitting areas change, load and wasteload allocations may be adjusted.

5.4.1.4 Nonpoint Source Tributary, Ground Water, and Unmeasured Flows

Agricultural and other nonpoint source tributary allocations were calculated from available USGS and ISDA data for May 1–September 30 from 1983 through 2013 and removing the design flows and TP loads attributed to NPDES-permitted facilities. To achieve the May 1–September 30 TP target and monthly periphyton target, this sector received allocations of 310 lb/day (0.07 mg/L) TP for all flow conditions (requiring a 73% reduction) (Table 30).

Ground water and unmeasured flows were calculated from the 2012 August synoptic sampling effort in the subbasin (Etheridge 2013) and professional judgment using the August 2012 lower Boise River mass balance model to adjust ground water interactions in the lower Boise River under various flow scenarios (Alex Etheridge, pers. comm., 2014). To achieve the May 1–September 30 TP target and monthly periphyton target, this sector received allocations of -524 to 183 lb/day (0.07 mg/L) TP for various flow conditions (requiring a 67% reduction) (Table 26).

Table 30. Agricultural and other nonpoint source tributary load allocations for the lower Boise River, May 1–September 30. Load allocations are presented per day as monthly averages. DEQ intends that load allocations are to be expressed as monthly averages.

Tributary	Boise River Receiving River Mile	Flow (cfs)	Current TP Conc. (mg/L)	Current TP Load (lb/day)	Target TP Conc. (mg/L)	Average TP Allocation[a] (lb/day as a monthly average)	Average TP Load Reduction (%)	Notes
Eagle Drain	42.7	36.3	0.11	22.3	0.070	13.7	-39%	
Dry Creek	42.5	6.5	0.16	5.6	0.073	2.6	-54%	Load allocation includes the design flow and TP contributions from Avimor POTW: 0.1 mg/L May 1–September 30.
Thurman Drain	41.9	15.0	0.11	8.6	0.070	5.7	-34%	
Fifteenmile Creek	30.3	131.7	0.31	222.2	0.074	52.3	-76%	Load allocation includes the design flow and TP contributions from Meridian POTW: 0.1 mg/L May 1–September 30.
Mill Slough	27.2	104.9	0.21	118.2	0.071	40.1	-66%	Load allocation includes the design flow and TP contributions from Star POTW: 0.1 mg/L May 1–September 30.
Willow Creek	27.0	36.1	0.23	44.0	0.070	13.6	-69%	
Mason Slough	25.6	13.0	0.22	15.4	0.070	4.9	-68%	
Mason Creek	25.0	147.6	0.41	322.1	0.070	56.1	-83%	Load allocation includes the design flow and TP contributions from Sorrento Lactalis: 0.1 mg/L May 1–September 30.
Hartley Gulch	24.4	39.2	0.27	57.4	0.070	14.8	-74%	
Indian Creek	22.4	100.6	0.50	271.6	0.089	48.3	-82%	Load allocation includes the design flow and TP contributions from Kuna and Nampa POTWs, IDFG Nampa facility, and ConAgra: 0.1 mg/L May 1–September 30.
Conway Gulch	14.2	44.8	0.41	99.7	0.070	16.9	-83%	Load allocation includes the design flow and TP contributions from Notus POTW: 0.1 mg/L May 1–September 30.
Dixie Drain	10.5	232.6	0.38	477.2	0.070	87.9	-82%	Load allocation includes the design flow and TP contributions from Wilder and Greenleaf POTWs: 0.1 mg/L May 1–September 30.
Total		**908.4**	**0.34**	**1664.4**	**0.073**	**356.7**	**-79%**	

[a] Because the TP target is concentration-based, actual allowable tributary load allocations under the TMDL are dependent on actual tributary flow and will fluctuate year to year.

5.4.1.5 Additional Assumptions

Because the USGS mass balance model does not account for varying flow and TP relationships in the subbasin, the USGS mass balance model was not utilized to set TP allocations near Parma under adjusted flows scenarios on the recommendation from the USGS model developer (Alex Etheridge, pers. comm., 2014). However, the USGS mass balance model was used for initial sensitivity analysis of TP concentration inputs under twelve scenarios. The analysis narrowed the range of potential load and wasteload allocations under current conditions (Etheridge et al. 2014), indicating that nonpoint and unmeasured discharges may need to be reduced to concentrations of 0.07 mg/L due to the magnitude of the loadings, whereas point sources may need to be reduced to concentrations of 0.30 mg/L. These findings are useful starting points for the subsequent load duration and AQUATOX modeling and demonstrate the significance of reducing nonpoint and unmeasured discharges to achieve the targets during the May 1–September 30 time frame.

As such, the load duration approach and simplified mass balance excel spreadsheet model was used to assess May–September TP load allocations relative to the ≤0.07 mg/L TP target (see Table 23, Figure 28, and Figure 29). Because it was estimated that 23% of the total TP loading into the lower Boise River reaches Parma from May through September (see section 5.2.1), it was assumed that the hydrologic processes would be similar under TP reduction scenarios and allocations. As such, the TP allocations used the same 23% multiplier to estimate the proportion of total TP loading expected to reach Parma from May through September. This simplified approach allows one to approximate the necessary TP load reductions and allocations from each sector that will achieve the ≤0.07 mg/L target on average under the 90th percentile low flows.

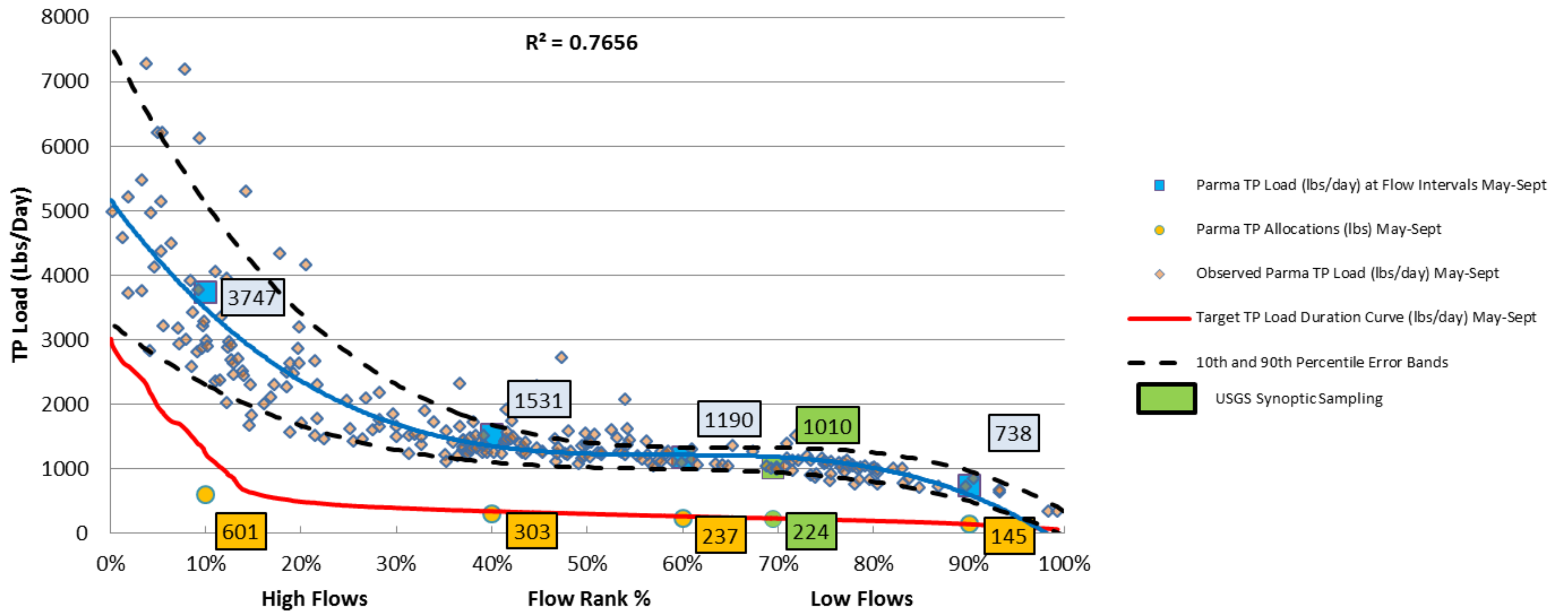


Figure 28. TP allocation targets (orange circles and labels) for the lower Boise River near Parma, relative to current TP loads (blue squares and labels) and the TP target load equivalent of ≤0.07 mg/L (red line). The green circles and labels represent the loads derived from the USGS August 2012 synoptic sampling event (Etheridge 2013).

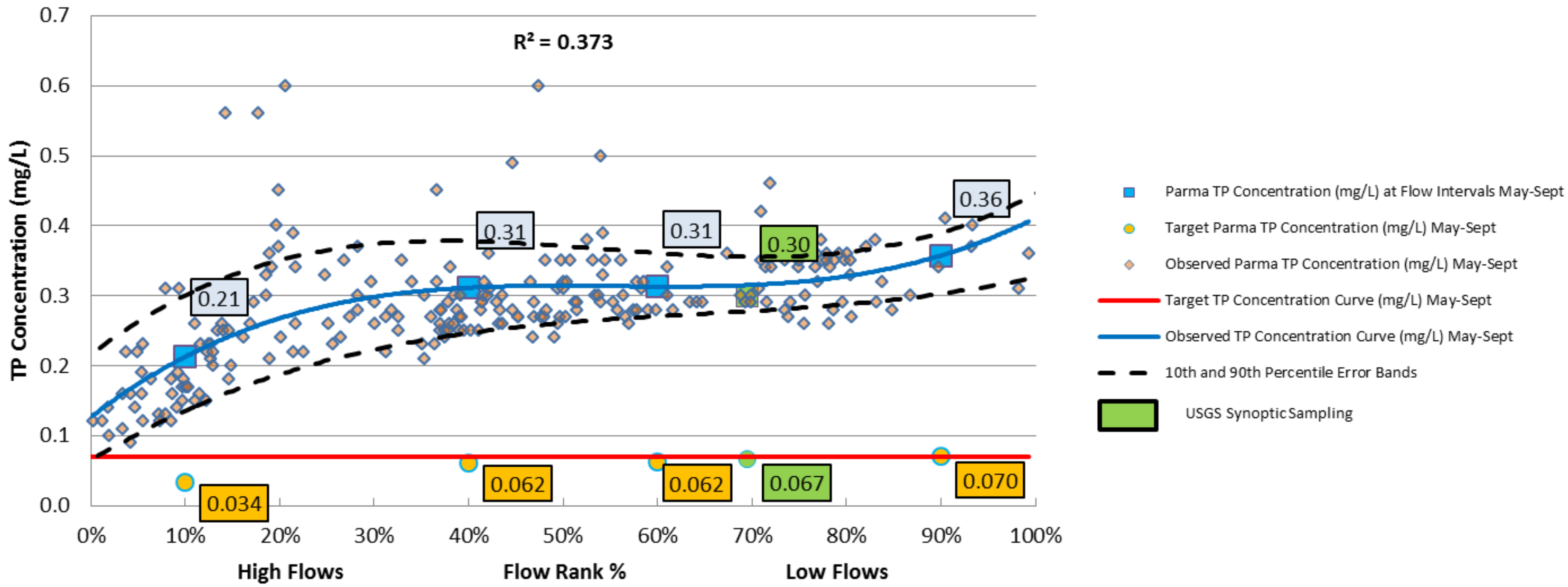


Figure 29. TP concentration targets (orange circles and labels) for the lower Boise River near Parma, relative to current TP concentrations (blue squares and labels) at varying flow conditions and TP target concentration of ≤0.07 mg/L (red line). The green circle and label represents the current load derived from the USGS August 2012 synoptic sampling event (Etheridge 2013).

5.4.2 TP Allocations to Achieve the Chlorophyll *a* Target

For October 1–April 30, the load allocation is set to meet the chlorophyll *a* target of ≤150 mg/m^2 in the impaired AUs of the lower Boise River as well as achieve TP concentrations at or near the EPA Gold Book recommended value of 0.1 mg/L (EPA 1986).

The following analysis and allocations indicate that lower Boise River TP loadings in the impaired AUs of the lower Boise River must be reduced by approximately 65% from October 1 through April 30 to achieve the mean monthly benthic chlorophyll *a* (periphyton) target of ≤150 mg/m^2 in the lower Boise River impaired AUs and also achieve EPA's Gold Book recommended value of 0.1 mg/L (Table 31). Table 31, Table 32, and Figure 30 outline sector-wide and specific allocations that achieve both targets. As with the current load estimates, there are several assumptions identified in the load and wasteload analyses to help achieve the October 1–April 30 TP and periphyton targets.

Table 31. Total phosphorus loads and water quality targets for October 1–April 30, expressed per day as monthly averages. These are calculated for the lower Boise River near Parma (AU ID17050114SW001_06).

Flow[a] (cfs)	Flow Rank (%)	Current Load[a]		Water Quality Targets[b]			
		TP Conc. (mg/L)	TP Load (lb/day)	TP Allocations (lb/day as a monthly average)	TP Load Reductions (lb/day as a monthly average)	TP Conc. (mg/L)	TP Load Reductions (%)
1,293	Mean	0.3	2,302	815	-1,487	0.11	65%

[a] Based on a data from October 1–April 30, 1987 through 2012.
[b] Mean load capacities and water quality targets calculated and applied as instream conditions.

Table 32. Gross load and wasteload allocations by sector for the lower Boise River, October 1–April 30, presented as per day monthly averages. DEQ intends that wasteload allocations are to be expressed as average monthly limits.

Sector	Current TP Conc. (mg/L)	Current TP Load (lb/day)	Target TP Conc. (mg/L)	TP Allocation (lb/day as a monthly average)	Percent Reduction	Notes
Average Daily Background	0.018	Flow dependent	0.018	Flow dependent	**0%**	Background TP concentration of 0.018 mg/L was used based on 2005–2013 USGS Diversion Dam data, with detection levels of 0.01 mg/L (see section 3.2.2). The actual background loading (in pounds) is variable depending on the river inflow from upstream, ground water, and tributary/drain sources.
Average NPDES POTW and Industry	3.32	1,394	0.35	256	**-82%**	POTW and industrial discharge data are based on facility design flows, represented in Table 19.
Average Fish Hatchery	0.07	13	0.1	20	**+50%**	Fish hatchery data represent the Idaho Department of Fish and Game Eagle and Nampa facilities identified in Table 19.
Average Tributary (w/o NPDES Flows and Loads)	0.22	580	0.07	178	**-69%**	Tributary data (Table 21) were calculated by removing all POTW, industrial, and aquaculture design flows, concentrations, and loads that discharge into tributaries.
Average Ground Water and Unmeasured	0.15	127	0.07	57	**-55%**	The USGS October 2012 and March 2013 mass balance models were used to estimate average ground water flows.
Average Nonstormwater Dry Weather	n/a	44	**n/a**	**n/a**	**-84%**	Nonstormwater (dry weather) allocations were derived from the data provided by the LBWC stormwater workgroup and represent an 84% TP load reduction on average across all MS4s in order to achieve a ≤0.07 mg/L TP load equivalent under current flows. Nonstormwater (dry weather) flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.
Average Stormwater Wet Weather	n/a	107	**n/a**	**n/a**	**-43%**	Stormwater (wet weather) allocations were derived from the data provided by the LBWC stormwater workgroup and represent a 43% TP load reduction on average across all MS4s. These flows and loads represent specific precipitation (storm) events.

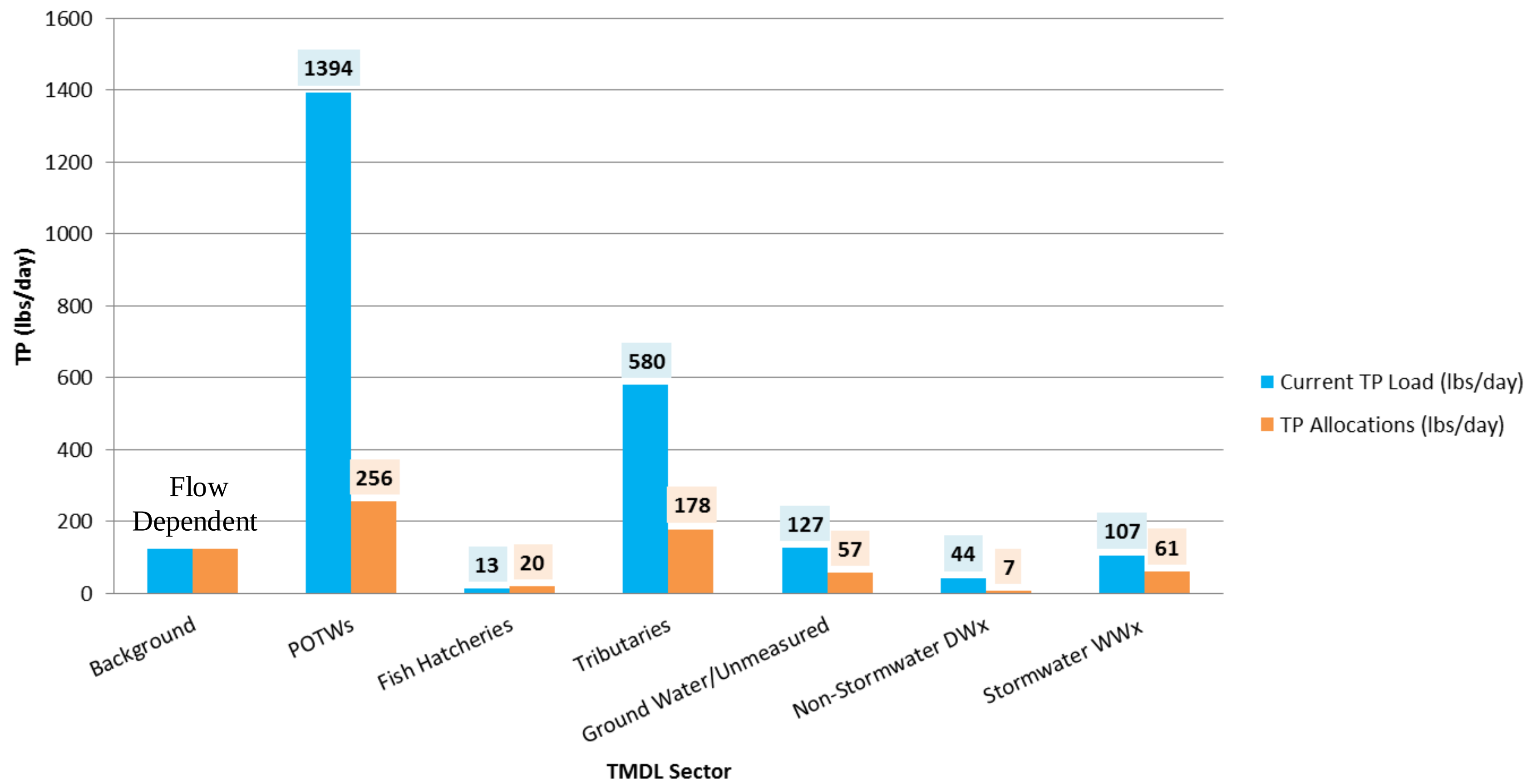


Figure 30. Current TP loads versus allocations for the lower Boise River, October 1–April 30.

Notes: Stormwater (wet weather; WWx) flows and loads are associated with precipitation (storm) events conveyed through permitted and nonpermitted MS4s. Stormwater allocations represent a 43% TP load reduction on average across all MS4s.

Nonstormwater (dry weather; DWx) allocations represent an 84% TP load reduction on average across all MS4s in order to achieve a 0.07 mg/L TP load equivalent under current flows. Nonstormwater flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.

5.4.2.1 Background

The background TP concentration of 0.018 mg/L is based on the 2005–2013 USGS TP data at Diversion Dam, with detection levels of 0.01 mg/L (see section 3.2.2).

To achieve the October 1–April 30 TP target of ≤150 mg/m^2 mean monthly periphyton target and TP Gold Book value of 0.1 mg/L, background contributions received a load allocation of 125 lb/day (0.018 mg/L) TP for various flow conditions (0% reduction) (Table 33).

Table 33. Agricultural and other nonpoint source ground water, unmeasured, and background load allocations for the lower Boise River, October–April. Load allocations are presented per day as monthly averages. See Table 26 for complete description of the May–September TP allocations and load reductions.

	Oct–Apr Mean Flow (cfs)	Current Oct–Apr Average TP Conc. (mg/L)	Current Oct–Apr Average TP Load (lb/day)	Oct–Apr Average Target TP Conc. (mg/L)	Oct–Apr Average TP Allocation (lb as a monthly average)[a]	Average TP Load Reduction
Ground water and unmeasured[b]	133 to 180	0.15	108 to 146	0.07	50 to 68	-55%
Background[c]	1,293	0.018	125	0.018	125	0%

[a] Because the TP target is concentration-based, actual allowable ground water, unmeasured, and background load allocations under the TMDL are dependent on actual flow and will fluctuate year to year.
[b] Ground water and unmeasured flows are derived from the October 2012 and March 2013 USGS synoptic sampling and mass balance (Alex Etheridge, pers. comm., 2014). Ground water/unmeasured TP concentrations were reduced to 0.07 mg/L for all flows.
[c] Background TP concentration of 0.018 mg/L was used based on 2005–2013 USGS Diversion Dam data (see section 3.2.2). The actual background loading (in pounds) is variable depending on the river inflow from upstream, ground water, and tributary/drain sources.

5.4.2.2 NPDES-Permitted Wastewater, Industrial, and Fish Hatchery Facilities

- 0.1 mg/L TP from May 1 through September 30
- 0.35 mg/L TP from October 1 through April 30
- Idaho Department of Fish and Game (IDFG) Eagle and Nampa fish hatchery facilities: 0.1 mg/L TP year-round

All point source targets were modeled to address facility design flows and loads (Table 34). The IDFG Eagle fish hatchery facility—along with Lander, West Boise, Middleton, and Caldwell POTWs—were direct inputs in the AQUATOX model. Therefore, their design capacity loads were simulated in the final TMDL scenario. The remaining NPDES-permitted facilities in Table 34 were included in the model simulation by externally calculating the additional TP load contributions to the tributaries or ground water/unmeasured segments to which they discharge under design flow conditions.

Table 34. Point source TP wasteload allocations for the lower Boise River, October 1–April 30. Wasteload allocations are presented per day as monthly averages. DEQ intends that wasteload allocations are to be expressed as average monthly limits. See Table 27 in section 5.4.1 for detailed description of the May–September TP allocations and load reductions.

Point Source	NPDES Permit No.	Current Oct–Apr Average TP Load (lb/day)	Oct–Apr Average TP Allocation (lb/day as a monthly average) at TP Conc. = 0.35 mg/L	Oct–Dec Average TP Load Reduction (%)
Boise River—Main Stem				
Lander Street POTW	ID-002044-3	180.8	43.8	-76%
West Boise POTW	ID-002398-1	603.3	70.1	-88%
Middleton	ID-002183-1	14.9	5.3	-64%
Caldwell	ID-002150-4	106.6	24.8	-77%
IDFG Eagle[a]	NPDES Aquaculture Permit	0.4	3.6	+714%
Boise River—Tributaries				
Avimor—Dry Creek	In application	n/a	1.2	n/a
Star—Lawrence-Kennedy Canal	ID-002359-1	5.5	5.4	-1%
Meridian—Fivemile Creek and Boise River	ID-002019-2	38.7	29.8	-23%
Sorrento Lactalis—Purdham Drain	ID-002803-7	0.1	4.4	+4,333%
Nampa—Indian Creek	ID-002206-3	424.1	52.6	-88%
Kuna—Indian Creek	ID-002835-5	13.8	10.2	-26%
IDFG Nampa[a]—Indian Creek	IDG-130042 Aquaculture Permit	12.7	16.2	+27%
Darigold—unmeasured drain	ID-002495-3	0.4	5.0	+1,039%
Notus—Conway Gulch	ID-002101-6	2.2	0.32	-86%
Wilder—Wilder Ditch Drain	ID-0020265	3.6	0.73	-80%
Greenleaf—West End Drain	ID-002830-4	0.03	0.70	+2,402%
ConAgra (XL Four Star)—Indian Creek	ID-000078-7	n/a	1.39	n/a
Total		**1,407.1**	**275.5**	**-80%**

Notes: n/a indicates no current discharge.

Point source allocations can be met through trading or offsets as detailed in regulations and guidance documents, such as DEQ's *Water Quality Pollutant Trading Guidance* (DEQ 2010a) and the Lower Boise Trading Framework.

The wasteload allocations and load reductions are estimates that achieve the mean monthly periphyton target of ≤150 mg/m^2 in the lower Boise River and the May–September TP target of ≤0.07 mg/L near Parma.

It is expected that all NPDES point source facilities will achieve the wasteload allocation targets within compliance schedules granted by DEQ and approved by EPA. Achieving the wasteload allocation targets is expected to occur through enhanced technology and/or water quality trading. This TMDL provides opportunity for potentially re-opening NPDES permits by providing new water quality information.

[a] Due to their operations, it is unlikely that the IDFG Eagle and Nampa fish hatcheries will discharge or need to discharge above a TP concentration of 0.1 mg/L. As a result, their wasteload allocation is set for 0.1 mg/L year-round.

5.4.2.3 NPDES-Permitted Municipal Stormwater and Nonstormwater

- Stormwater (wet weather) = 42% TP reduction year-round

  All NPDES-permitted MS4s and nonpermitted areas identified in Table 8 were included in the model simulation by externally calculating the stormwater (wet weather) TP load to ground water/unmeasured segments to which they discharge. Stormwater TP concentrations and loads are elevated for short periods and then, due to short residence time, rapidly decrease to dry weather conditions between events. Using average stormwater TP concentrations in the model would result in higher nonstorm event TP concentrations and loads than would actually be seen in the river. Therefore, a 0.5 correction was modeled to more accurately represent the effect of short-term stormwater (wet weather) TP spikes on monthly periphyton growth.

- Nonstormwater (dry weather) = 84% TP reduction year-round (Table 35)

  The nonstormwater (dry weather) flows and loads are implicitly measured as subcomponents of the tributary and ground water/unmeasured discharge. They can originate from a variety of sources, including, but not limited to, agricultural returns, shallow ground water, urban/suburban sources (e.g., lawn watering), and other unmeasured sources. Since nonstormwater is being estimated as an inherent component of tributaries and ground water/unmeasured flows in the TMDL analyses, this sector received an allocation equivalent of 0.07 mg/L TP for current flow conditions, which is the same allocation for the tributaries and ground water/unmeasured flows.

  The plumbing of MS4 systems is intricate, and the exact quantity of the nonstormwater inputs is unknown. However, MS4 permittees have provided initial estimates for the percentage of their nonstormwater discharge that originates from nonpoint sources (see Table 29). These estimates should be refined through monitoring and mapping in future permit cycles and as part of TMDL implementation.

Table 35. Point source stormwater (wet weather) and nonstormwater (dry weather) TP allocations for MS4-permitted and nonpermitted areas of the Lower Boise River subbasin, October 1–April 30. Wasteload and load allocations are presented as per day as monthly averages. DEQ intends that wasteload allocations are to be expressed as percent load reductions for average monthly limits in NPDES permits.

Permit Holder/Jurisdiction	NPDES Permit Number	MS4 Permit Type	Permitted Areas: Urbanized Area[a] Area (mi^2)	Permitted Areas: City Limits[b,c] Area (mi^2)	Non-Permitted Areas: City Limits[b,c] Area (mi^2)	Area Ratio[d,e]	Oct-April Current stormwater Wet Weather Avg TP Load[f] (lbs/day)	Oct-April stormwater Wet Weather Avg TP Wasteload Allocation[f,g] (% Reduction)	Oct-April Current Non-stormwater Dry Weather Avg TP Load[h] (lbs/day)	Oct-April Non-stormwater Dry Weather Avg TP WasteLoad Allocation[h,I,j] (% Reduction)
Ada County							**Current Load = Qcurrent (CFS) x Ccurrent (mg/L) x 5.39**	**43% Load Reduction = Qcurrent (CFS) x Ccurrent (mg/L) x 5.39 X 0.57**	**Current Load = Qcurrent (CFS) x Ccurrent (mg/L) x 5.39**	**84% Load Reduction = Qcurrent (CFS) x Ccurrent (mg/L) x 5.39 x 0.16**
Boise/Garden City	IDS027561	Phase I		87						
Boise	IDS027561	Phase I		83						
Garden City	IDS027561	Phase I		4						
Ada County Highway District	IDS027561	Phase I		87						
Boise State University	IDS027561	Phase I		0.24						
Ada County Drainage District 3	IDS027561	Phase I		8						
ITD, District 3	IDS027561	Phase I								
Total Area Boise/Garden City Phase I Permit				**87**		0.31				
Ada County Highway District	IDS028185	Phase II	62	84						
Meridian		-	24	28	4					
Eagle		-	12	30	18					
Urbanized Ada County (unincorporated)		-	26	NA						
Total Area Ada County Phase II Permit			**62**			0.22				
Kuna	NA	-			18					
Star	NA	-			4					
Total Ada County Incorporated Non- Permitted Area					**44**	**0.16**				
Canyon County										
Caldwell	IDS028118	Phase II	17.5		4.6					
Nampa	IDS028126	Phase II	25		6.5					
Middleton	IDS028100	Phase II	2.3		2.9					
Urbanized Canyon County (unincorporated)	-	-	24.8							
ITD, District 3	IDS028177	Phase II								
Canyon Highway District #4[c]	IDS028134	Phase II	8							
Nampa Highway District #1[c]	IDS028142	Phase II	8.5							
Notus-Parma Highway District #2[c]	IDS028151	Phase II	2							
Total Area Canyon County Phase II Permits			**70**			0.25				
Greenleaf	NA	-			0.8					
Notus	NA	-			0.4					
Parma	NA	-			1.1					
Wilder	NA	-			0.7					
Total Canyon County Incorporated Non- Permitted Area					**17**	**0.06**		**-43%**		**-84%**

Note: Stormwater (wet weather) and nonstormwater (dry weather) allocations were derived from data provided by the LBWC stormwater workgroup (Appendix C). DEQ intends that wasteload allocations are to be expressed as percent load reductions for monthly average limits in NPDES.

The nonpermitted areas receive load allocations because they are currently not permitted under the NPDES program. As permitting areas change, load and wasteload allocations may be adjusted.

[a] Urbanized area, based on 2010 census, may differ from the MS4-permitted areas, which are based on 2003 decennial census data.

[b] Ada County Assessor, July 9, 2014

[c] Canyon County Assessor, May 28, 2014

[d] Area data from NPDES permit factsheets (2000 census)

[e] Area ratio = the area contribution of each MS4 permit relative to the total service area for MS4s

[f] Stormwater (wet weather) allocations for October to April represent a 43% average TP load reduction on average across all permitted and nonpermitted MS4 areas. The gross current TP load estimate is 107 lb/day, requiring a reduction to 61 lb/day. In the wasteload allocation equation, Qcurrent (cfs) is current baseline discharge, Ccurrent (mg/L) is current baseline TP concentration, and 5.39 is a standard conversion factor (Hammer 1986).

[g] Higher maximum daily stormwater (wet weather) target loads may exceed average daily loads and still allow MS4s to comply with the load and wasteload reductions.

[h] Nonstormwater (dry weather) allocations represent an 84% TP load reduction on average across all permitted and nonpermitted MS4 areas in order to achieve a 0.07 mg/L TP load equivalent under current flows. The gross current TP load estimate is 44 lb/day, with a reduction to 7 lb/day. Nonstormwater flows and loads are largely unmeasured throughout the subbasin and are a subcomponent of, and not summed separately from, tributary and ground water load allocations. In the wasteload allocation equation, Qcurrent (cfs) is current baseline discharge, Ccurrent (mg/L) is current baseline TP concentration, and 5.39 is a standard conversion factor (Hammer 1986).

[i] It is DEQ's intent to include in the MS4 wasteload allocation only that nonstormwater that is categorized as allowable under the MS4 NPDES permit and to treat other nonstormwater flow as a nonpoint source. If the other nonstormwater flow can be identified and quantified by the MS4, it will be treated under this TMDL as a nonpoint source (see Table 8). Further, this TMDL does not excuse the responsibility of the MS4 owner or operator to comply with the terms of the applicable NPDES permit.

[j] The October–April 84% reduction for nonstormwater dry weather is an estimated average across all MS4s. The actual percent reduction would be based on the current loading for each individual MS4.

5.4.2.4 Nonpoint Source Tributary, Ground Water, and Unmeasured Flows

- 0.07 mg/L TP year-round

Load from agricultural and other nonpoint source tributaries, ground water, and unmeasured flow, including nonstormwater (dry weather), were set at the concentration equivalent of 0.07 mg/L TP year-round. However, agricultural tributaries and ground water/unmeasured flow segment loads were adjusted to 0.07 mg/L, as appropriate, to account for TP contributions from NPDES-permitted facilities or stormwater (wet weather) loads (Table 36 and Table 33).

The following analyses and tables identify the sector-wide and specific October 1–April 30 TP allocations and load reductions that correspond with the final model scenario and are necessary to achieve the mean monthly periphyton target.

Table 36 Agricultural and other nonpoint source tributary TP load allocations for the Lower Boise River subbasin, October–April. Load allocations are presented per day as monthly averages. DEQ intends that load allocations are to be expressed as monthly averages. See Table 30 for complete description of the May–September TP allocations and load reductions.

Tributary	Boise River Receiving River Mile	Current Oct–Apr Average TP Load (lb/day)	Oct–Apr Average Target TP Conc. (mg/L)	Oct–Apr Average TP Allocation (lb/day as a monthly average)[a]	Oct–Apr Average TP Load Reduction	Notes
Eagle Drain	42.7	9.8	0.070	4.4	-55%	
Dry Creek[b]	42.5	9.9	0.083	6.5	-35%	Load allocation includes the design flow and TP contributions from Avimor POTW: 0.1 mg/L May 1–September 30 and 0.35 mg/L October 1–April 30.
Thurman Drain	41.9	6.1	0.070	3.1	-49%	
Fifteenmile Creek[c]	30.3	104.9	0.146	45.7	-56%	Load allocation includes the design flow and TP contributions from Meridian POTW: 0.1 mg/L May 1–September 30 and 0.35 mg/L October 1–April 30.
Mill Slough[d]	27.2	60.3	0.084	25.4	-58%	Load allocation includes the design flow and TP contributions from Star POTW: 0.1 mg/L May 1–September 30 and 0.35 mg/L October 1–April 30.
Willow Creek	27.0	37.5	0.070	8.1	-78%	
Mason Slough	25.6	11.1	0.070	2.2	-80%	
Mason Creek[e]	25.0	92.6	0.080	29.1	-69%	Load allocation includes the design flow and TP contributions from Sorrento Lactalis: 0.1 mg/L May 1–September 30 and 0.35 mg/L October 1–April 30.
Hartley Gulch	24.4	17.9	0.070	4.0	-77%	
Indian Creek[f]	22.4	516.9	0.132	119.4	-77%	Load allocation includes the design flow and TP contributions from Kuna and Nampa POTWs and ConAgra: 0.1 mg/L May 1–September 30 and 0.35 mg/L October 1–April 30. It also includes the design flow and TP contributions from the IDFG Nampa facility: 0.1 mg/L year-round.
Conway Gulch[g]	14.2	22.6	0.072	8.6	-62%	Load allocation includes the design flow and TP contributions from Notus POTW: 0.1 mg/L May 1–September 30 and 0.35 mg/L October 1–April 30.
Dixie Drain[h]	10.5	191.3	0.072	44.3	-77%	Load allocation includes the design flow and TP contributions of 0.3 mg/L from Wilder and Greenleaf POTWs: 0.1 mg/L May 1–September 30 and 0.35 mg/L October 1–April 30.
Total		**1,081.0**	**0.100**	**300.9**	**-72%**	

[a] Because the TP target is concentration-based, actual allowable tributary load allocations under the TMDL are dependent on actual tributary flow and will fluctuate year to year.

5.4.3 AQUATOX Model and Scenarios

The AQUATOX model of the lower Boise River was used to simulate load and wasteload allocations in comparison to water quality targets and to help select the appropriate TMDL allocation scenarios to meet the mean benthic chlorophyll a target (DEQ 2014a).

DEQ narrowed down the number of TP reduction scenarios through consultation with the LBWC, EPA, and other interested stakeholders to the following seven:

1. Existing conditions (the calibrated model)
2. Scenario 1 plus a 0.23-foot depth increase in model segment 10 (Hwy 20-26 Bridge to Notus Bridge)
3. Final model scenario—point sources at 0.1 mg/L TP May–September and 0.35 mg/L TP October–April; agricultural and other nonpoint source tributaries and ground water at 0.07 mg/L TP year-round; stormwater (wet weather) TP loads at 42% reduction; nonstormwater (dry weather) TP loads at 84% reduction
4. Scenario 2 plus a 0.23-foot depth increase in model segment 10
5. Point sources, agricultural and other nonpoint source tributaries, and ground water at 0.07 mg/L TP year-round; stormwater (wet weather) TP loads at 42% reduction; nonstormwater (dry weather) TP loads at 84% reduction
6. Scenario 3 plus a 0.23-foot depth increase in model segment 10
7. Point sources at 0.05 mg/L TP year-round (approximate limits of technology); agricultural and other nonpoint source tributaries and ground water at 0.07 mg/L TP year-round; stormwater (wet weather) TP loads at 42% reduction; nonstormwater (dry weather) TP loads at 84% reduction

The final AQUATOX model scenario (Scenario 3) and TMDL allocation resulted from hundreds of model scenario runs and analyses to identify TP allocations that would help achieve the mean monthly periphyton target and support beneficial uses, while also being technically, socially, and economically viable options. These analyses included evaluating point sources at 0.5 and 1.0 mg/L seasonally (October–April) as requested by interested stakeholders. DEQ determined that these concentrations caused additional exceedances of the SR-HC TMDL TP target of ≤0.07 mg/L for May–September due to the persistence of phosphorus in the aquatic environment.

The final AQUATOX model scenario (Scenario 3) and TMDL allocation is described below. Additional information is outlined in Appendix D summarizing the model results for the final TMDL allocation scenario. The TMDL Scenario 3 and TP allocation structure does the following:

- Includes the TP allocations necessary to achieve the May 1–September 30 target of ≤0.07 mg/L TP in the lower Boise River near Parma based on long-term load duration data (see section 5.4.1)
- Achieves the mean monthly benthic chlorophyll a target of ≤150 mg/m^2 in the impaired AUs of the lower Boise River. Multiple lines of evidence indicate that the TMDL phosphorus reductions are sufficient to achieve the mean monthly periphyton target on an AU basis, as well as achieve TP concentrations at or near the EPA Gold Book recommended value of 0.1 mg/L (EPA 1986). See Appendix D, Tables D-3 and D-4 for mean monthly periphyton and TP concentrations under the final AQUATOX model

scenario. Although brief periods of elevated periphyton may occur during August in model segment 10 and September in segment 11 (Boise River at Notus to above Dixie Drain), these are likely due to growth of low-nutrient diatoms that can proliferate under low nutrient and other habitat conditions (Appendix D, Table D-3). These rationales are further discussed in the model report (DEQ 2014a).

5.4.3.1 Additional Assumptions and Model Inputs

For a summary of model inputs, see Appendix D, Table D-1.

Total Suspended Sediment

As described in more detail in the model report (DEQ 2014a), the total suspended sediment data were represented as a 37% reduction. This reduction was used to approximate water quality conditions that could result from phosphorus-targeted BMPs and was identified in the lower Boise River sediment TMDL (DEQ 1999). DEQ is currently developing a subsequent sediment TMDL for lower Boise River tributaries. Clearing suspended sediment out of the water column increases periphyton growth. Model results show that periphyton growth is limited by light availability, and clearer water increases light reaching the substrate.

Other Forms of Organic Enrichment

As detailed in the model report (DEQ 2014a), the phosphorus reduction scenarios for the river segments, tributaries, and ground water applied the same ratio of TP reduction required to achieve the TP target to any existing ammonia, nitrogen, biochemical oxygen demand, or chlorophyll data. In order to more accurately model phosphorus reduction scenarios, reductions in nitrogen and carbon must also be simulated. This approach is reasonable because watershed improvement projects that reduce phosphorus also control nitrogen and other forms of organic enrichment. Simulating this reduction scenario included the following:

- Using the monthly average of historic water quality data at the same precision as historical data, which was necessary because of the uneven temporal scale of available water quality data. This approach allows more general application of the results. Nondetects in the historical data were treated as equal to the detection limit, which is a conservative assumption.
- Replacing total soluble phosphorus data with total phosphorus, which allows the model to calculate stoichiometry on existing data rather than using literature values.
- Reducing monthly averages of ammonia, nitrogen, biochemical oxygen demand, and chlorophyll data according to the same ratio as required by bringing historical monthly average TP data to the TP target.

Mean Dynamic Depth (Water)

Although not included as part of the final TMDL model scenario and allocations, the model report (DEQ 2014a) discusses the potential impacts on periphyton growth and accrual that could result from adjustments to the width-to-depth ratio in segments of the lower Boise River. The potential adjustments were identified through the modeling process when it was discovered that channel depth is an important limiting factor for algal growth. As such, a modeled increase channel depth, along with the significant TP reductions described above, illustrate a potential approach to further reduce periphyton growth and accrual. This approach could be further investigated if it appears that full support of beneficial uses in the lower Boise River is not being attained during a 5-year review or subsequent post-TMDL implementation monitoring under the significant year-round TP load reductions identified above.

An artificially high width-to-depth ratio for freshwater streams is a known sign of impairment (Rosgen 1996). Common habitat improvement designs for restoring impaired streams include adding habitat complexity and decreasing the width-to-depth ratio of stream channels.

Model Limitations

AQUATOX is a robust EPA-approved water quality model that was used to help develop TP load and wasteload allocations to achieve the mean monthly benthic chlorophyll *a* target of ≤ 150 mg/m^2. Even so, all models are mathematical approximations of a true system, with some uncertainty being an inherent component of model results. Through TMDL implementation and continued monitoring, DEQ, the LBWC, and other stakeholders will continue to improve our knowledge and understanding of the phosphorus and benthic algae relationships in the lower Boise River.

Figure 31 shows the relationships between yearly average periphyton levels and TP reductions under the seven model scenarios. The periphyton-TP relationship illustrates a point of diminishing returns, beyond which further TP reductions do not result in further significant reductions in periphyton, likely due to other environmental factors and organic enrichment in the system. TP reductions beyond those modeled in the final TMDL model scenario (Scenario 3) do not yield measureable improvements in periphyton reductions without further reductions in carbon (organic detritus, carbonaceous biochemical oxygen demand, and phytoplankton) and nitrogen sources.

Lower instream TP concentrations can be realized with further TP load reductions, but these reductions would be expensive to implement and not likely to improve ecological conditions or further support beneficial uses in the river. Additionally, mean and median TP concentrations in the lower Boise River near Parma are less than the May–September 0.07 mg/L target and less than the EPA Gold Gook recommended value of 0.1 mg/L for the remainder of the year under the final model scenario (Appendix D, Table D-2).

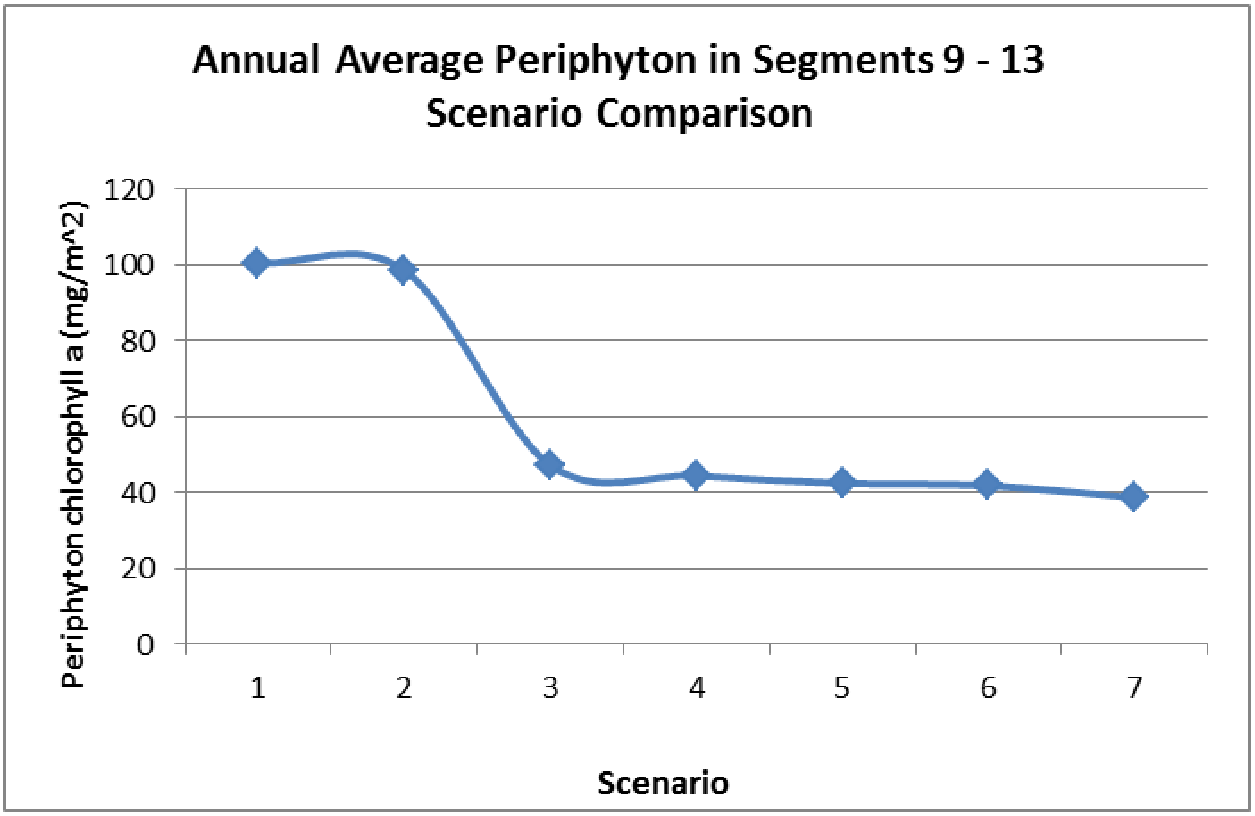


Figure 31. Annual average periphyton in model segments 9–13 (the impaired AUs of the lower Boise River) under seven model scenarios.

Figure 32 shows the existing modeled conditions and mean monthly periphyton in segments 9–13, with elevated periphyton occurring during multiple months in model segments 9–12. Figure 33 shows mean monthly periphyton in segments 9–13 under the final model scenario (Scenario 3) and TMDL allocations. This scenario results in a significant reduction in overall periphyton growth throughout the year. Although overall periphyton drops throughout these segments, the temporary elevated periphyton in segments 10 and 11 occur because of a shift in periphyton species, becoming dominated by low-nutrient diatoms, which proliferate under low nutrient concentrations and other habitat conditions.

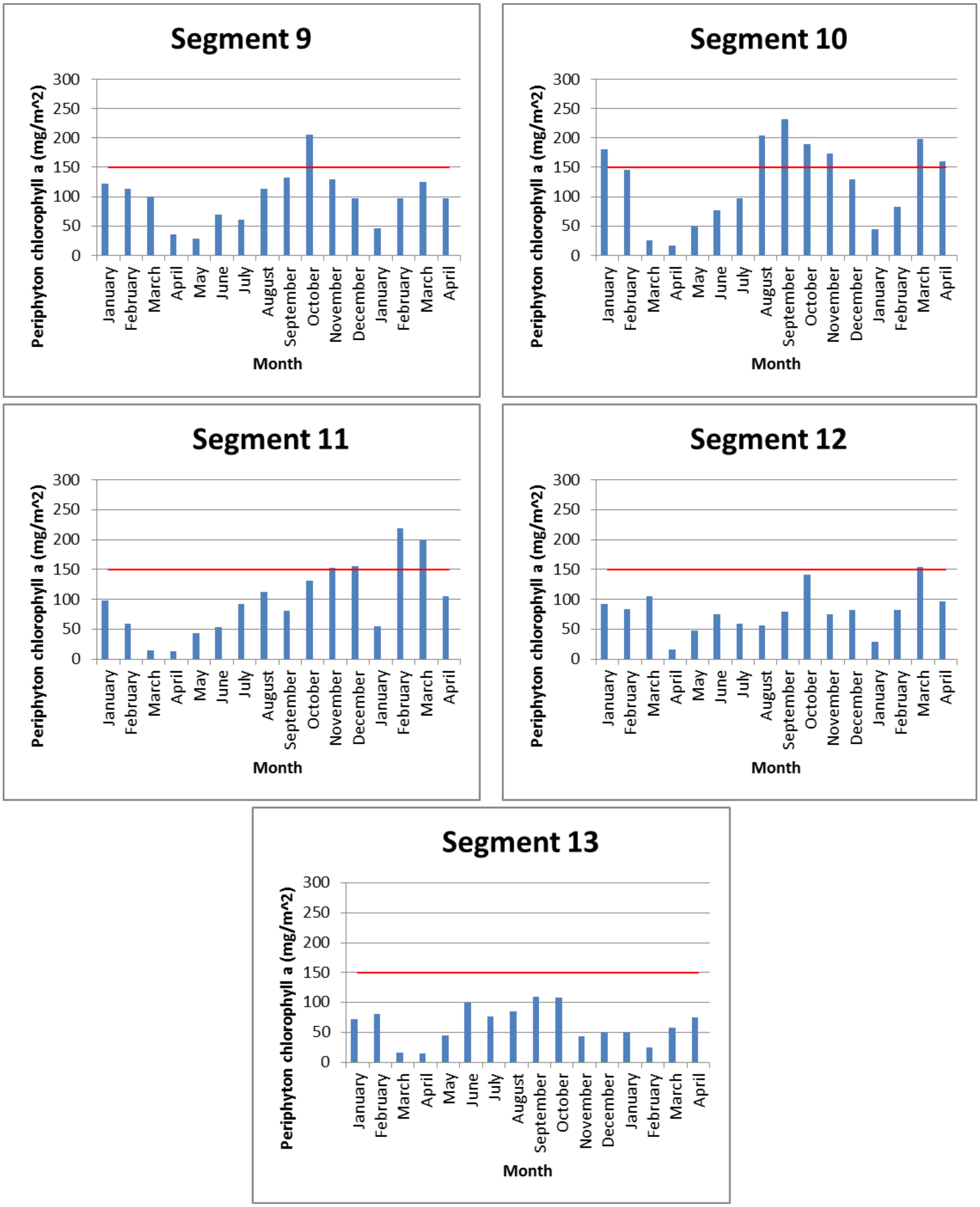


Figure 32. Scenario 1—existing conditions. Current modeled mean monthly periphyton from January 1, 2012, through April 22, 2013. Model segments 9–13 correspond with the TP-impaired AUs of the lower Boise River from Middleton to the mouth, near Parma. The red line indicates the mean monthly periphyton target of ≤150 mg/m^2.

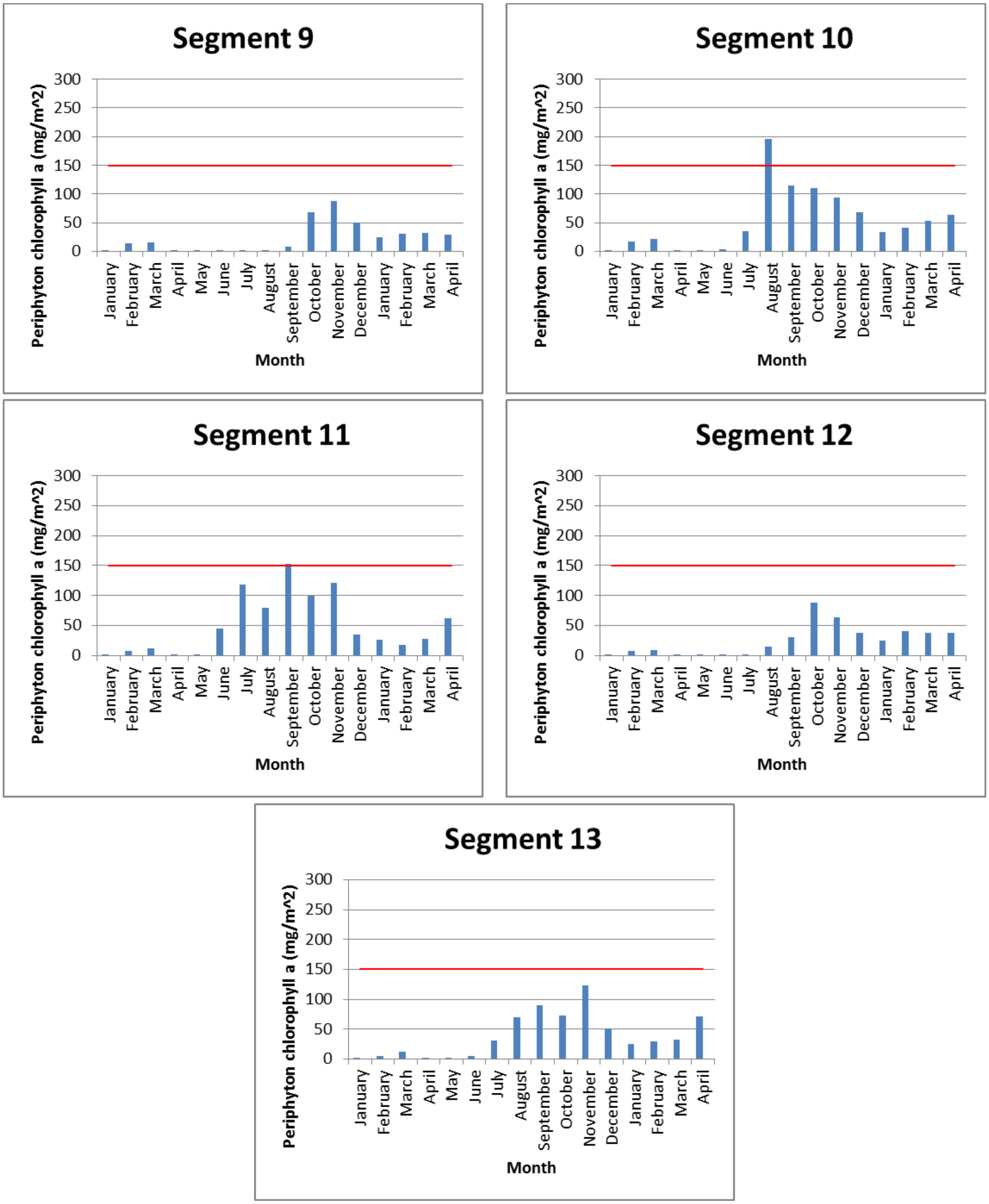


Figure 33. Senario 3—predicted mean monthly periphyton from January 1, 2012, through April 22, 2013, under the final TMDL scenario and TP allocation structure. Model segments 9–13 correspond with the TP-impaired AUs of the lower Boise River from Middleton to the mouth, near Parma. The red line indicates the mean monthly periphyton target of ≤150 mg/m^2.

Results for the model scenarios described above are reported on a model segment basis. In Figure 34 through Figure 39, current and modeled conditions are averaged according to the AU for periphyton as a monthly average and rolling 30-day average and for TP as a monthly average. The results for the final model scenario and TMDL allocations (Scenario 3) show no exceedances of the mean monthly periphyton target (Figure 36) or a 30-day rolling average of periphyton target (Figure 37), and the EPA Gold Book recommended value for TP[7] is mostly attained (Figure 39).

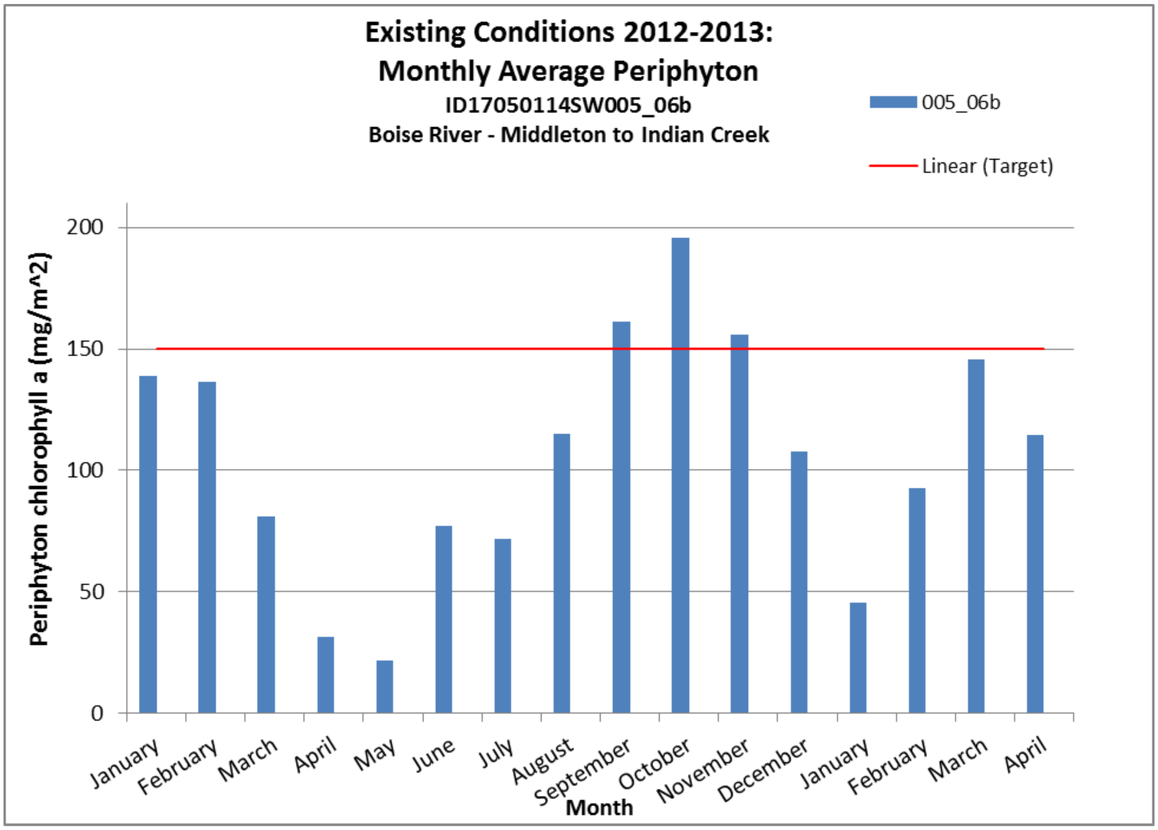
Because the impaired AUs don't correspond exactly with the model segments, a weighted average of the model segments within each AU was used to calculated periphyton and TP concentrations on an AU basis:

- ID17050114SW001_06 is 18.64 miles (Indian Creek to the mouth)
  - 6.78 miles of Segment 10 (36.4%)
  - The entire length of Segment 11 (27.1%)
  - The entire length of Segment 12 (9.8%)
  - The entire length of Segment 13 (26.7%)
- ID17050114SW005_06b is 5.49 miles (Middleton to Indian Creek)
  - 3.95 miles of Segment 9 (71.9%)
  - 1.54 miles of Segment 10 (28.1%)

Examining the difference between the existing and TP reduction scenarios shows that a relatively large phosphorus reduction is necessary to create a relatively smaller periphyton reduction. Existing TP averages 0.28 mg/L annually for the two listed AUs, whereas the average annual TP for the reduction Scenario 3 is 0.08 mg/L. This requires a 71% annual reduction in phosphorus. Existing periphyton averages 101 mg/m^2 annually for the two listed AUs, whereas the annual average is 47 mg/m^2 for the TP reduction Scenario 3, requiring a 53% reduction.

The following figures illustrate that the final AQUATOX model scenario and TMDL allocations result in substantial TP and periphyton reductions within impaired AUs of the lower Boise River and that further TP reductions alone will not, and are not needed to, further improve support for beneficial uses.

[7] Although there is no specific phosphorus target in the lower Boise River outside of the May–September time frame, a TP target of 0.10 mg/L should help to meet the ≤ 150 mg/m2 periphyton target. The target for the lower Boise River from May 1 through September 30 near Parma is ≤ 0.07 mg/L TP.



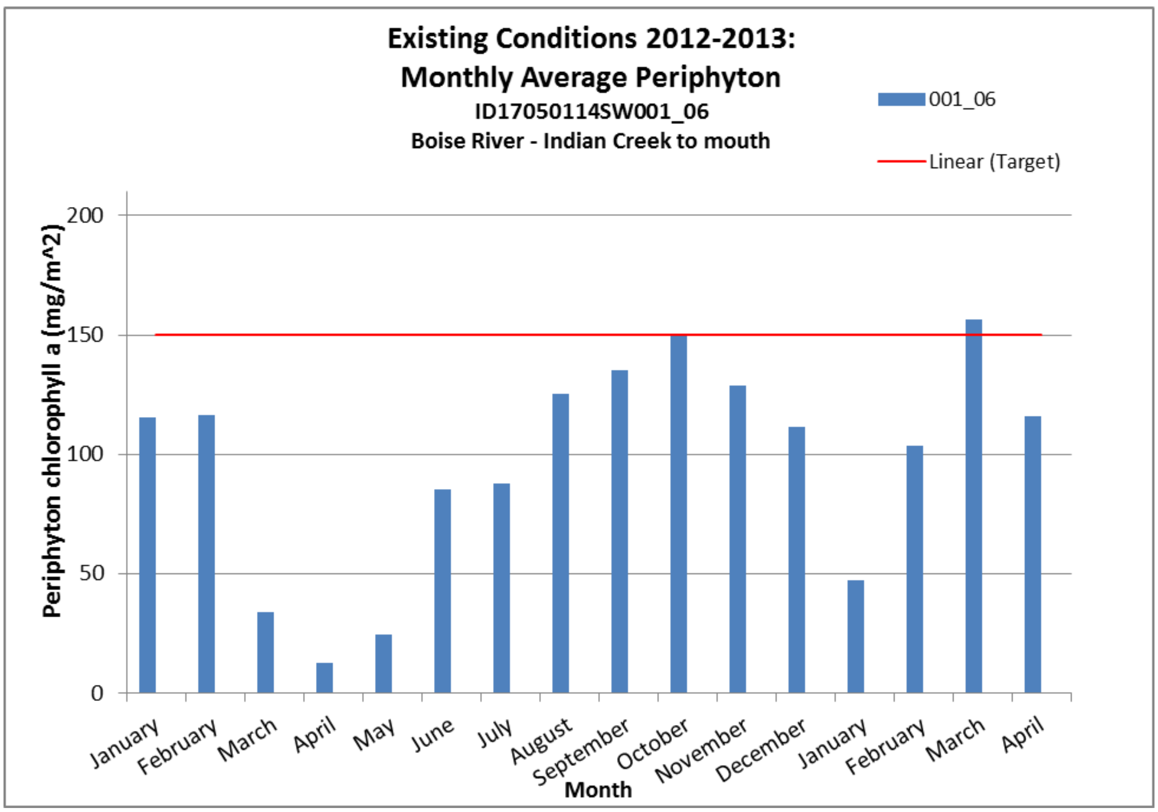
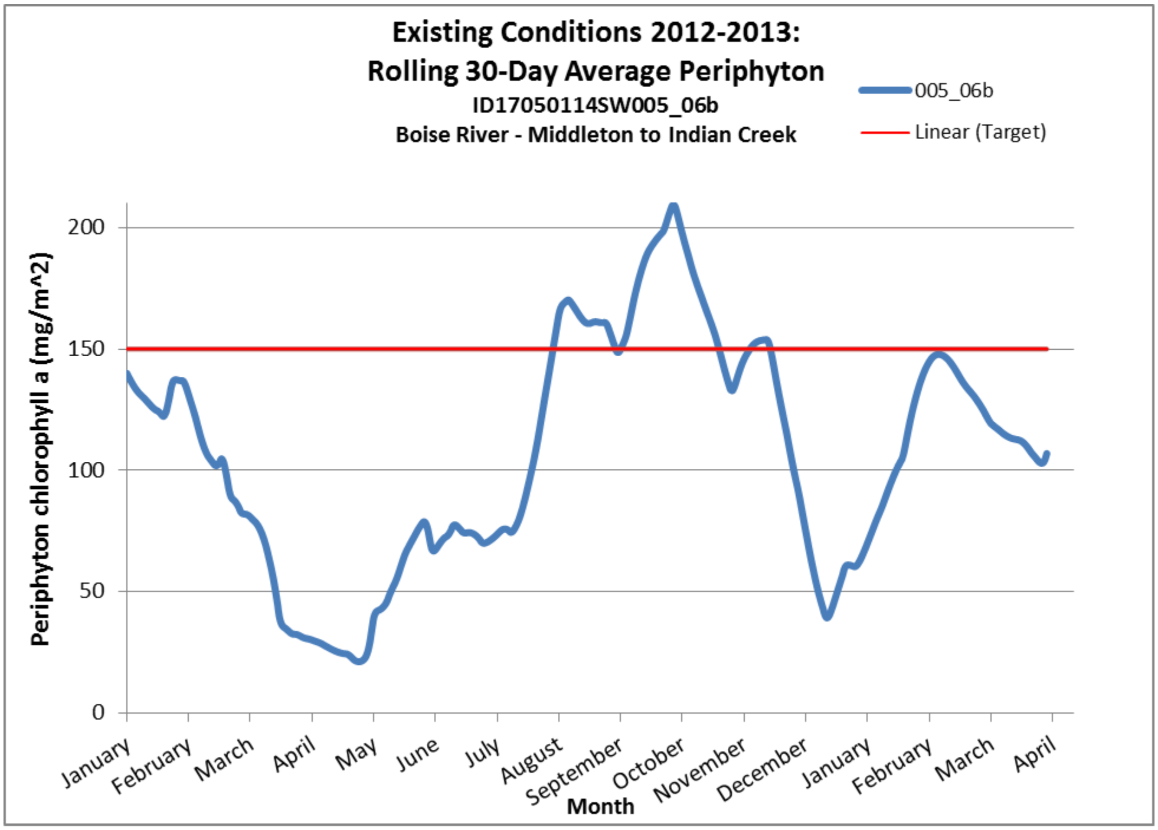


Figure 34. Current modeled mean monthly periphyton from January 1, 2012, through April 22, 2013, in the TP-impaired AUs of the lower Boise River. The red line indicates the mean monthly periphyton target of ≤150 mg/m^2.



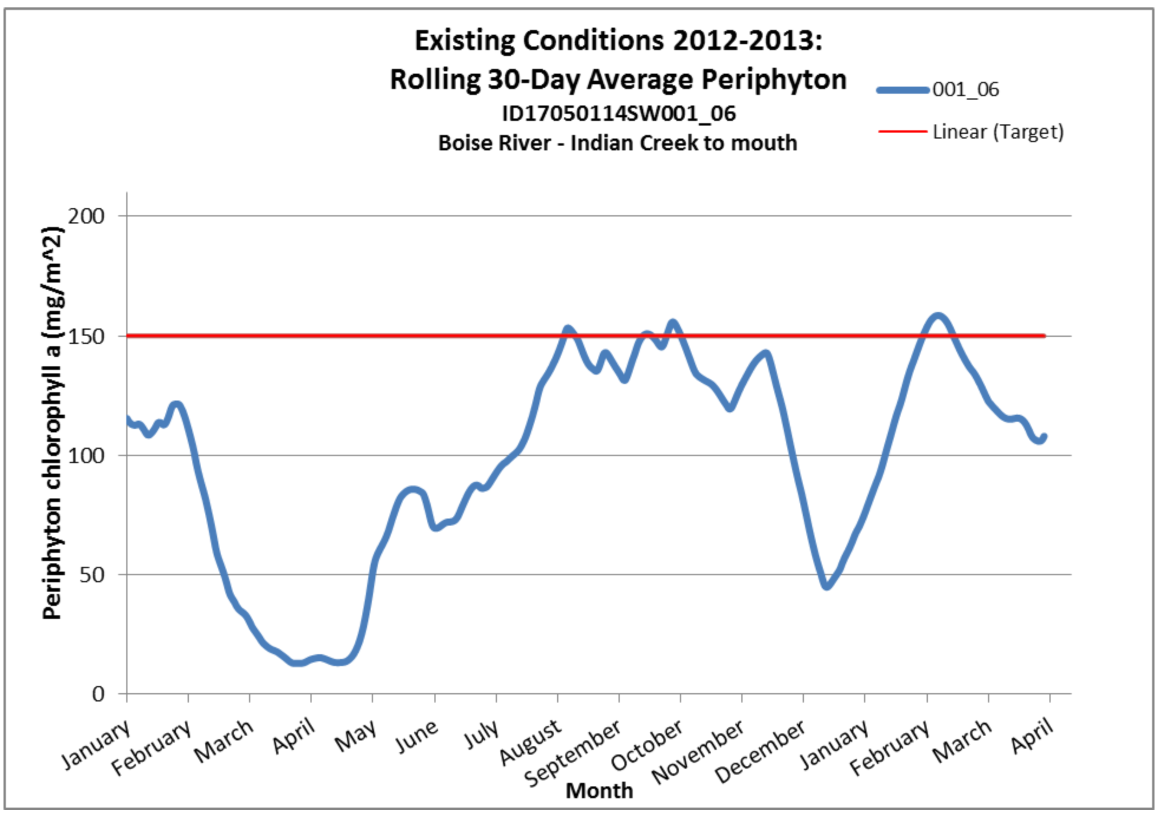
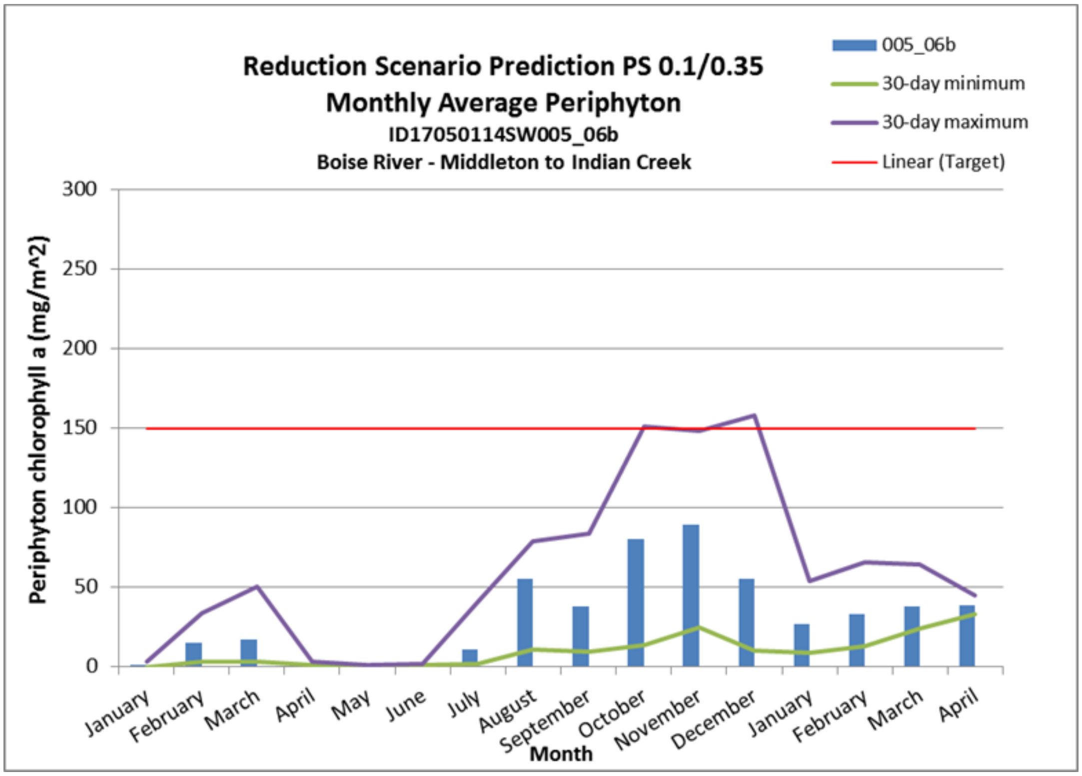


Figure 35. Current modeled 30-day rolling average periphyton from January 1, 2012, through April 22, 2013, in the TP-impaired AUs of the lower Boise River. The red line indicates the mean monthly periphyton target of ≤150 mg/m^2.



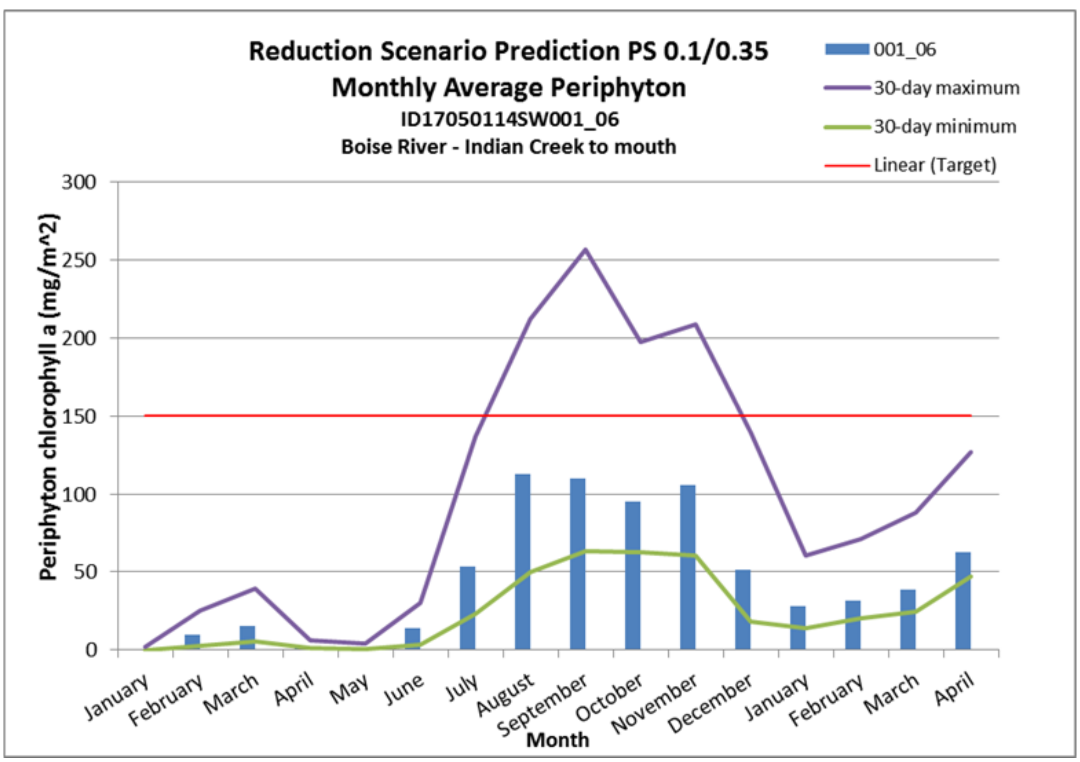


Figure 36. Predicted mean monthly periphyton from January 1, 2012, through April 22, 2013, under the final TMDL scenario (Scenario 3) and TP allocation structure in the TP-impaired AUs of the lower Boise River. The red line indicates the mean monthly periphyton target of ≤150 mg/m^2.

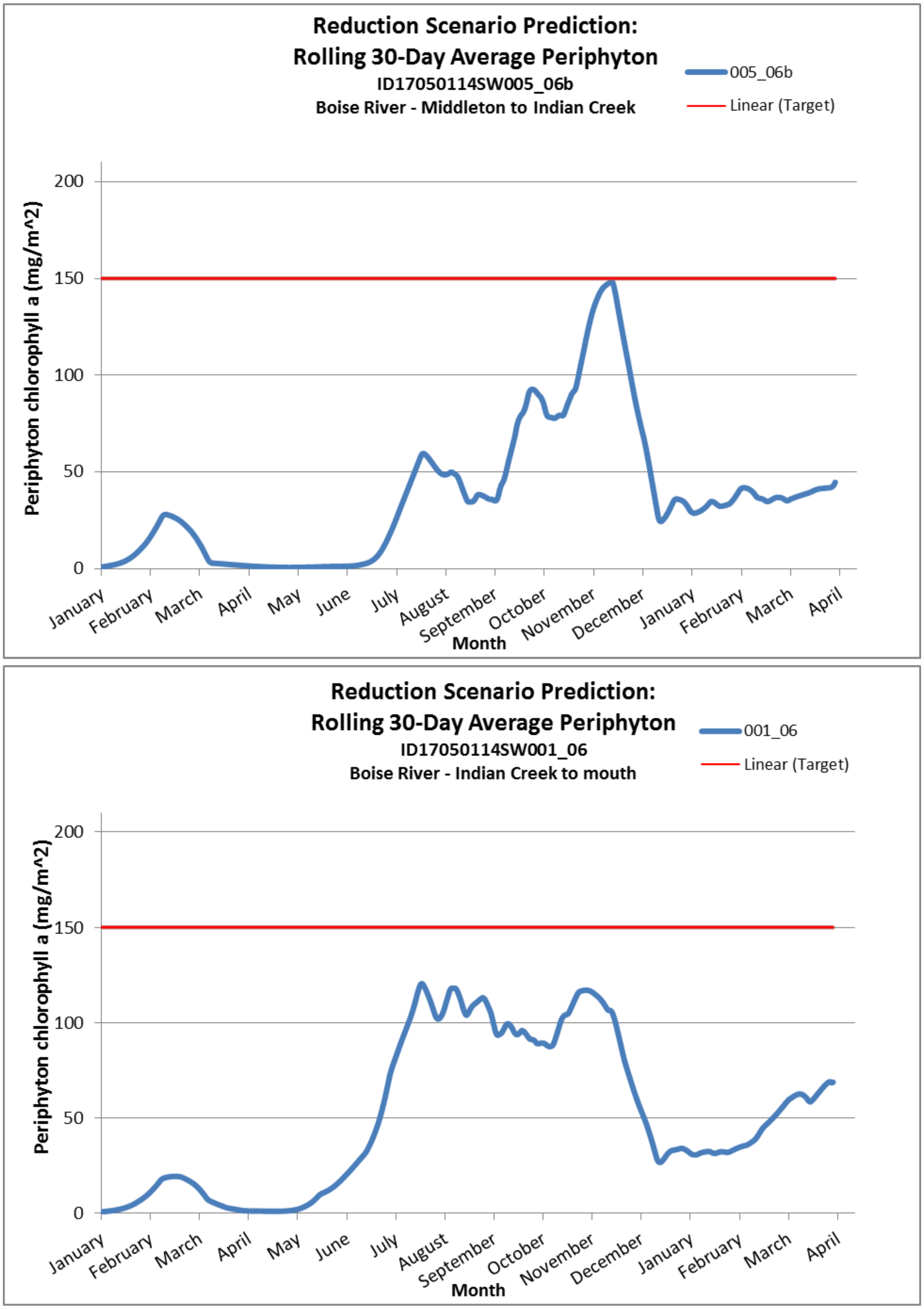
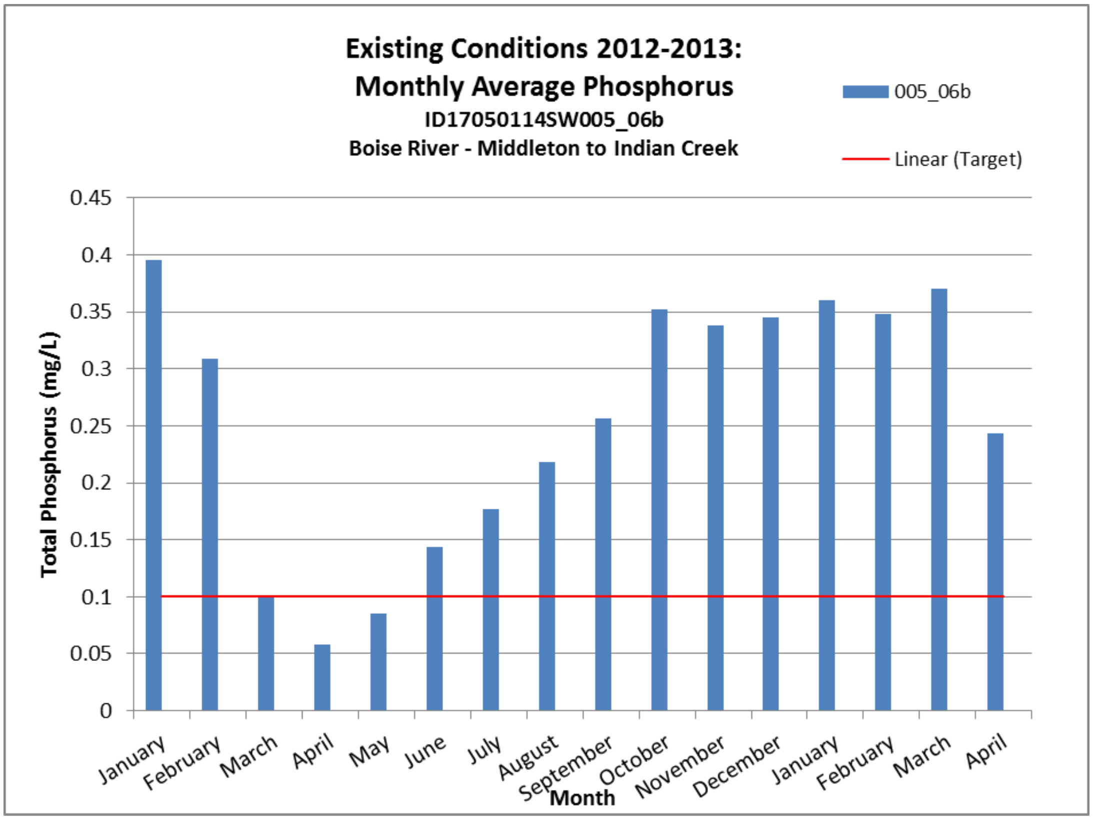


Figure 37. Predicted 30-day rolling average periphyton from January 1, 2012, through April 22, 2013, under the final TMDL scenario (Scenario 3) and TP allocation structure in the TP-impaired AUs of the lower Boise River. The red line indicates the mean monthly periphyton target of ≤150 mg/m^2.



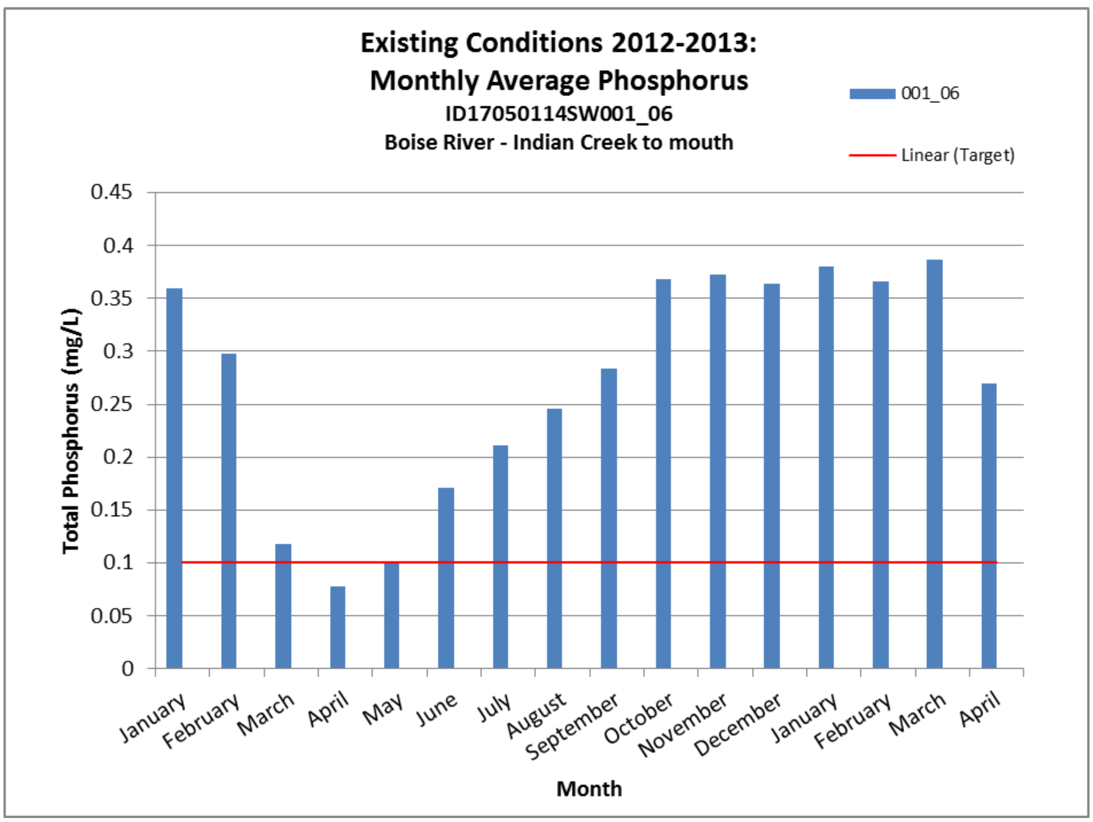
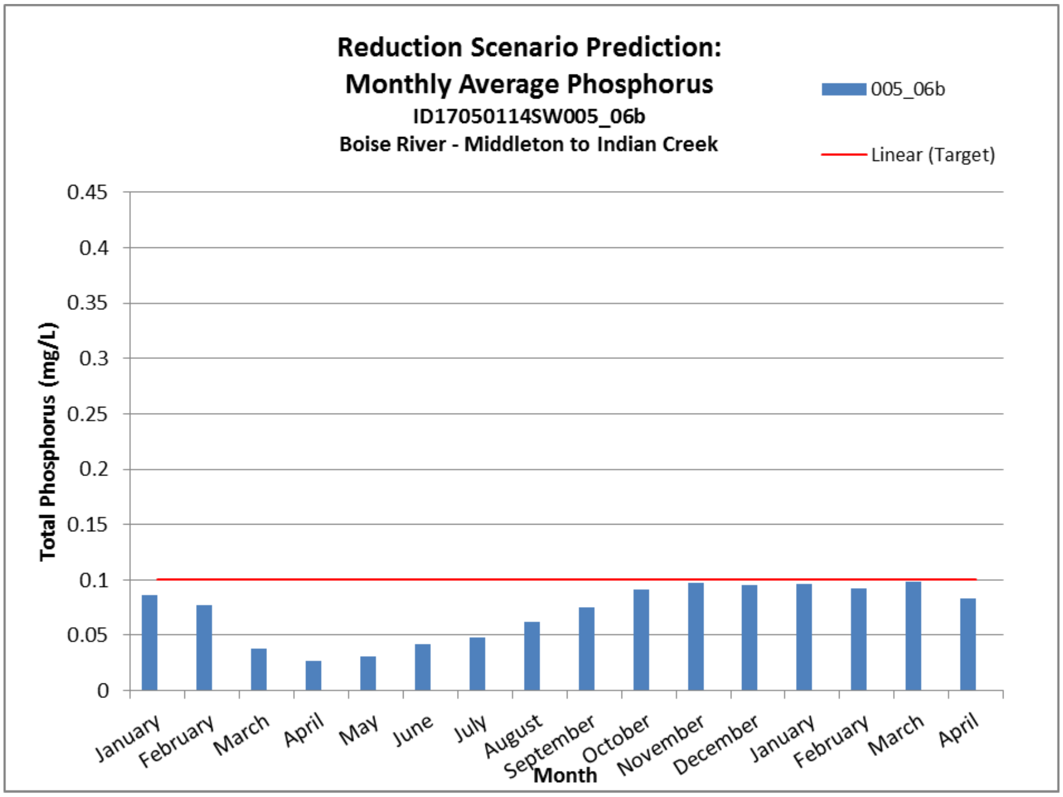


Figure 38. Current modeled monthly TP concentration from January 1, 2012, through April 22, 2013, in the TP-impaired AUs of the lower Boise River. The red line indicates the EPA Gold Book recommended value of 0.1 mg/L.



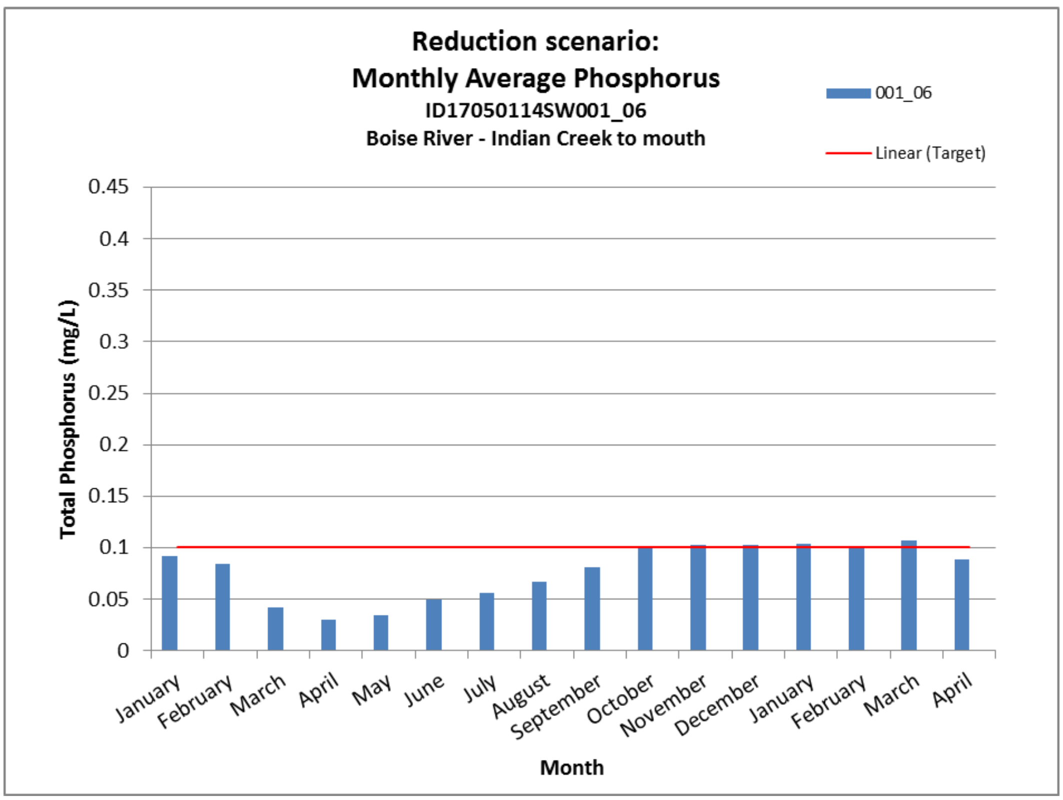


Figure 39. Predicted modeled monthly TP concentration from January 1, 2012, through April 22, 2013, under the final TMDL scenario (Scenario 3) and TP allocation structure in the TP-impaired AUs of the lower Boise River. The red line indicates the EPA Gold Book recommended value of 0.1 mg/L.

5.4.4 Margin of Safety

This TMDL and the SR-HC TMDL include several conservative implicit and explicit margins of safety.

1. An explicit 13% margin of safety was applied to the SR-HC TMDL ≤0.07 mg/L TP target and was incorporated into the TP load capacity and allocations. The margin of safety was determined by the accuracy, representativeness of sampling techniques, and analytical methods. Applying this margin of safety to the initial 16 µg/L threshold value yielded a target of 14 µg/L chlorophyll *a* to achieve the ≤0.07 mg/L TP target.
2. This TMDL complies with the target TP allocations identified in the SR-HC TMDL and sets load and wasteload allocations that achieve ≤0.07 mg/L TP for 90th percentile low flow conditions and maintains those same concentrations and loads under higher flows in order to comply with the lower Boise River mean monthly periphyton target (section 5.2.2). Essentially, this TMDL TP allocation structure provides an explicit margin of safety for all flows greater than the 90th percentile.
3. The USGS mass balance model and long-term flow, load, and concentration data sets (1987–2012) were used to help develop the load and wasteload allocations in a conservative mass balance approach to account for nutrients.
4. This TMDL assumes that orthophosphorus from all sources is completely bioavailable and was modeled as such for a conservative approach. Additional research shows that all orthophosphorus may not be equally bioavailable for algal and plant uptake and growth. However, more data and analysis would be necessary to further categorize the orthophosphorus sources throughout the subbasin.
5. The AQUATOX model was used to simulate long-term TP loads, concentrations, and periphyton biomass relationships to help develop the load and wasteload allocations that achieve the mean monthly periphyton target in a conservative manner.
6. The margin of safety accounts for uncertainty about assimilative capacity and the relationship between the selected target and support of beneficial uses and includes variability in target measurement.

5.4.5 Seasonal Variation

5.4.5.1 May 1–September 30 TP Target

DEQ believes the May 1–September 30 seasonal TP target of ≤0.07 mg/L is protective of cold water aquatic life and contact recreation and will also achieve the SR-HC TMDL target of phytoplankton in the Snake River and reservoirs at <14 µg/L. Achieving this seasonal TP target in the lower Boise River will help reduce the frequency, magnitude, and duration of algal blooms and other aesthetic, ecological, and physical nuisances for contact recreation and ecological impacts for cold water aquatic life in the Snake River and the lower Boise River. TP is not toxic and does not result in immediate water quality impairment conditions. TP, along with many other water quality characteristics of the lower Boise River, exhibits seasonal variations in conditions as observed from May 1–September 30. Incorporating seasonal variation within this TMDL provides for flexibility in managing pollutant sources and the river.

5.4.5.2 Mean Monthly Benthic Chlorophyll a *Target*

Through the TMDL process, DEQ, in consultation with the LBWC, developed a target that relates nuisance algae growth to the impairment of beneficial uses in the lower Boise River. Specifically, the target strives to limit mean monthly benthic chlorophyll *a* to ≤150 mg/m^2 (indicator of nuisance algae) within impaired AUs of the lower Boise River (see section 5.2.2).

DEQ asserts that this target of ≤150 mg/m^2 protects contact recreation beneficial uses and will also help to meet the ≤0.07 mg/L TP target at the mouth of the lower Boise River, which will also protect cold water aquatic life uses. The target also corresponds well with values established in the academic literature (see section 2.3.1) and is similar to targets developed and implemented for waters in Montana (MDEQ 2008), Minnesota (MPCA 2013), and Colorado (CDPHE 2013).

5.4.6 Reasonable Assurance

The point source wasteload allocations and nonpoint source load allocations are complementary toward effectively achieving the TP load capacity for the lower Boise River. DEQ has reasonable assurance that point source wasteload allocations will be implemented effectively through the NPDES permit program. However, because point source contributions are regulated by the EPA through NPDES permits, the reasonable assurances for this TMDL apply almost exclusively toward nonpoint source load reductions.

TP loading from agricultural and other nonpoint sources that are measured through tributaries and ground water are anticipated to decline due to cumulative effects from point source TP reductions, BMPs, nutrient management, and land conversion. Achieving such load reductions will require time and resources beyond what point source regulation can provide. However, based on the USGS mass balance model and other data and reports (e.g., Etheridge 2013; Fox et al. 2002; Ferguson 1999), DEQ believes that TP concentrations and loads from nonpoint tributary and ground water sources can be effectively reduced to achieve the TMDL targets in the lower Boise River.

The necessary reductions will result from the combination of regulated point source reductions (which inherently influence the amount of TP moving through the system and are subsequently used by nonpoint sources), along with concerted voluntary nonpoint source reductions, which will depend on funding, cost-sharing, willing partners, and effective BMP implementation to achieve the target.

For example, the 2008 total phosphorus implementation plan asserts the following:

> 2. BMP Effectiveness. The Rock Creek watershed drains to the Snake River upstream from the SR-HC reach. With very little existing infrastructure, a 68% reduction in the discharge of TP from the watershed was achieved. Despite this improvement, TP concentrations from the watershed remained above 0.1 mg/l. (After project funding declined, the range of improvement also declined to approximately 40% due to the inability to fund the recurring annual BMP costs.)
>
> 3. Prioritizing Lands for Treatment. It is not necessary to treat all agricultural lands to substantially reduce the discharge of pollutants. BMP implementation should focus on priority lands where treatment will be most effective. Lands can be prioritized in three tiers as described earlier. To the maximum extent possible, treatment should focus on Tier 1 and Tier 2 lands with little or no existing BMPs. Prioritizing lands for treatment will increase BMP effectiveness and the probability of meeting allocation objectives within predictable timeframes…

> 7. Existing Implementation Levels. …The greatest water quality benefits from BMP implementation will be realized where there has been little or no BMP implementation, on "high priority" lands. Experience in the Rock Creek watershed has demonstrated that, in such areas, implementation of lower per-acre cost BMPs can result in substantial load reductions from irrigated lands. Implementation efforts should therefore be focused in these areas… (DEQ 2008)

DEQ is confident that implementing voluntary measures is reasonably likely to reduce TP concentrations and loads from nonpoint tributary and ground water sources so as to achieve water quality standards and fully support beneficial uses. Through targeted restoration action on priority lands and investment in high impact pollutant reduction actions, DEQ reasonably expects that progress toward these water quality standards will occur, especially as supplemented by the point source reductions described above. DEQ expects that significant voluntary investment in water quality trading—which is expected to achieve net environmental gain—may occur. Further, DEQ expects that continued investment will occur through the Clean Water Act §319 grant program. Since 1997, DEQ has allocated approximately $1.4 million toward §319 grants in the Lower Boise River subbasin for implementing BMPs to reduce and prevent pollutant runoff (e.g., sediment and nutrients) from reaching surface waters (see Table 12). In addition to §319 grants, numerous projects have been completed within the subbasin through federal programs such as the Conservation Stewardship Program, Environmental Quality Incentives Program, and Wildlife Habitat Incentives Program (see Table 13). DEQ expects to see continued strong investment in these programs over the coming years.

Idaho water quality standards assign specific agencies responsibility for implementing, evaluating, and modifying BMPs to restore and protect impaired water bodies. The State of Idaho is committed to developing implementation plans within 18 months of EPA TMDL approval. DEQ and the LBWC will assist designated management agencies (e.g., ISWCC) to develop an implementation plan, and DEQ will periodically reassess the beneficial use support status. BMP implementation and revision will continue until full beneficial use support status is documented and the TMDL target is achieved.

Nonpoint sources (e.g., agricultural) achieve their water quality obligations under the Clean Water Act through voluntary implementation of BMPs typically identified by the ISWCC. Idaho Code states that "…nothing in this section shall be interpreted as requiring best management practices for agricultural operations which are not adopted on a voluntary basis" (Idaho Code §39-3610(1)). Idaho Code also states that "Nothing in this section shall be interpreted as requiring best management practices for agricultural nonpoint source activities which are not adopted on a voluntary basis…" (Idaho Code §39-3611(10)).

5.4.7 Reserve for Growth

Where applicable, states must include an allowance for future loads in their TMDLs that accounts for reasonably foreseeable increases in pollutant loads with careful documentation of the decision-making process. This allowance is based on existing and readily available data at the time the TMDL is established.

In the case of the lower Boise River TP TMDL, the May–September TP allocations are based on achieving a TP concentration of ≤0.07 mg/L near Parma, which also contributes to achieving the mean monthly periphyton target of ≤150 mg/m^2 in the two impaired AUs. Alternatively, the

October–April TP allocations correspond only with achieving the mean monthly periphyton target.

Future growth is anticipated to impact future flows and phosphorus loadings; however, the use of design flows for wastewater treatment facilities, the margin of safety, water quality trading, the implementation plan, and an adaptive management approach are anticipated to address future growth issues and the objectives of the TMDL.

Because these allocations are necessary to achieve the May–September TP concentration target and the mean monthly periphyton target, an allowance for future growth is not recommended at this time, unless new or expansion of existing point sources discharging directly or indirectly to the lower Boise River: (1) receive a mean monthly NPDES permit limit for TP of ≤0.07 mg/L May through September and ≤0.10 mg/L October through April, (2) a DEQ 5-year review identifies a growth reserve calculated as the difference between current TP loads and TP allocations, where the difference is divided among new/existing point sources, (3) implement approved water quality offsets or trading occur, (4) no additional discharge occurs, or (5) DEQ accepts studies and technical papers demonstrating the proposal to discharge meets the TMDL target. However, any changes to the TMDL would need to be made through the 5-year review process and an addendum to the TMDL.

Alternatively, if a 5-year review indicates that TP reductions have led to full support of beneficial uses and state water quality standards being met, additional growth could be allowed. Under those conditions the allowance of new or expanded TP effluent concentrations and loads would need to be developed in a manner consistent with the two objectives presented in this TMDL: (1) achieving a TP concentration of ≤0.07 mg/L in the lower Boise River near Parma from May through September and (2) achieving the mean monthly periphyton target of ≤150 mg/m^2 in the two impaired AUs of the lower Boise River.

5.5 Implementation Strategies

The implementation strategy outlines a pathway by which the ISWCC, Ada Soil and Water Conservation District, and Canyon Soil Conservation District can develop a comprehensive implementation plan within 18 months after TMDL approval. The implementation plan will provide details of the actions needed to achieve load reductions set forth in this TMDL, a schedule of those actions, and the monitoring needed to document actions and progress toward meeting state water quality standards.

DEQ recognizes that implementation strategies for TMDLs may need to be modified if monitoring shows that TMDL goals are not being met or significant progress is not being made toward achieving the goals. Reasonable assurance (addressed in section 5.4.6) for the TMDL to meet water quality standards is based on the implementation strategy.

A TP implementation plan for the lower Boise River, previously created by DEQ and the LBWC (DEQ 2008), presented strategies to achieve the May 1–September 30 SR-HC TP allocation target on the lower Boise River. DEQ asserts that a new implementation plan should be developed to reflect this current TMDL for the lower Boise River. Activities addressed in a new implementation plan should include the following:

- TP reductions from point source facilities taking into account the following:
    - Effluent load and concentration targets
    - Projected flows
    - Projected loads on a seasonal basis
- TP reductions from stormwater dischargers through BMPs, increased attention to on-site stormwater inspection, and public education
- For MS4 permittees, system input and outfall maps, identification of any nonstormwater (dry weather) discharges of a nonpoint-source origin, and steps to mitigate/eliminate these flows within the implementation timeframe
- Voluntary BMP implementation on agricultural lands, contingent on available funding, cost-sharing, willing partners, and opportunities for water quality trading
- Conversion of agricultural land to other land uses
- Water quality trading framework
- Monitoring strategy
- Permitting of new septic systems, including examining and considering limiting the use of old technology and promoting the use of new technology for septic systems
- Measuring and quantifying the loading of existing septic systems and estimating the additional loading from future septic systems based on growth patterns and development policies
- Offset credits for reducing nonpoint source loads (i.e., sewering of septic systems)
- Growth and development (i.e., paving new road surfaces)
- Other nonpoint sources

Some of the original implementation measures from the previous implementation plan (DEQ 2008) could be appropriate for the current TMDL, although revising and expanding may be necessary to address the specific needs of the AUs in this document given current conditions and knowledge. The 2003 agricultural implementation plan (DEQ 2003) will be updated to reflect reductions necessary to meet the load allocations and to account for relevant water quality trading activities.

5.5.1 Time Frame

The targets established for point and nonpoint sources in this TMDL may take decades to be achieved. The lower Boise River TP TMDL relies on a staged implementation strategy as referenced in EPA’s phased TMDL clarification memo (EPA 2006). The staged implementation strategy for the lower Boise River acknowledges that NPDES-permitted point sources will strive to achieve the TMDL target as soon as possible, consistent with 40 CFR 122.47. In consultation with DEQ, appropriate compliance schedules may be considered on a case-by-case basis for point source permits.

This TMDL does not define an implementation time frame for nonpoint sources; rather, implementation would begin as quickly as possible and continue until the load allocation targets are met. This acknowledges that successfully achieving the TMDL target and allocations will depend in part on voluntary measures and be influenced by available funding, cost-sharing, willing partners, and opportunities for water quality trading.

5.5.2 Approach

Point source contributions will be determined and regulated by EPA through NPDES permitting. Funding provided under §319, water quality trading, and other funds will be used to encourage voluntary projects to reduce nonpoint source pollution. Additionally, it is expected that a lower Boise River trading framework will be updated and that trading may be used to achieve the pollutant targets in the subbasin (see section 5.5.5).

DEQ does not expect that load allocations will be met immediately. Load allocations will be met over a reasonable period of time based on current pollution conditions in the watershed, current land management practices, and other relevant factors. DEQ may provide further guidance on the phased implementation of load allocations and will provide oversight to ensure that appropriate water quality milestones and targets are being achieved. If trading has been authorized in the area covered by this TMDL, any phased implementation plan targets for meeting load allocations may be used to derive trading baseline requirements for individual landowners wishing to sell water quality trading credits.

5.5.3 Responsible Parties

The final implementation plan for this TMDL will be developed under the existing practice established for the state of Idaho. The plan will be cooperatively developed by DEQ, the LBWC, affected private landowners, and designated management agencies with input through the established public process. Other individuals may also be identified to assist in developing site-specific implementation plans as their areas of expertise are identified as beneficial to the process. Stakeholders in the subbasin have a responsibility for implementing the TMDL.

DEQ and the designated management agencies in Idaho have primary responsibility for overseeing implementation in cooperation with landowners and managers. Designated state agencies are responsible for assisting with preparation of specific implementation plans, particularly for those resources for which they have regulatory authority or programmatic responsibilities:

- **Idaho Department of Lands (IDL)** for timber harvest, oil and gas exploration and development, and mining. IDL will maintain and update approved BMPs for forest practices and mining. IDL is responsible for ensuring use of appropriate BMPs on state and private lands.
- **Idaho Soil and Water Conservation Commission (ISWCC)** for grazing and agriculture. Working in cooperation with local soil and water conservation districts, the ISDA, and the Natural Resources Conservation Service, the ISWCC will provide technical assistance to agricultural landowners. These agencies will help landowners design BMPs appropriate for their property and identify and seek appropriate cost-share funds. They also will provide periodic project reviews to ensure BMPs are working effectively.
- **Idaho Transportation Department** for public roads. The Idaho Transportation Department will ensure appropriate BMPs are used when constructing and maintaining public roads.
- **Idaho State Department of Agriculture (ISDA)** for aquaculture, animal feeding operations, and concentrated animal feeding operations. ISDA will work with aquaculture

facilities to install appropriate pollutant control measures. Under a memorandum of understanding with EPA and DEQ, ISDA also inspects animal feeding operations, concentrated animal feeding operations, and dairies to ensure compliance with NPDES requirements.

- **WAG** and other agencies for other activities. Idaho Code states the following:

  "…recommending those specific actions needed to control point and nonpoint sources of pollution within the watershed so that, within reasonable periods of time, designated beneficial uses are fully supported and other state water quality plans are achieved...consult with the director and participate in the development of each TMDL and any supporting subbasin assessment for water bodies within the watershed, and shall develop and recommend actions needed to effectively control sources of pollution..." (Idaho Code §39-3616)

- **DEQ** for other activities. DEQ will oversee and track overall progress on the specific implementation plan and monitor the watershed response. DEQ will also work with local governments on urban/suburban issues.

In Idaho, these agencies, and their federal and state partners, are charged by the Clean Water Act to lend available technical assistance and other appropriate support to local efforts for water quality improvements.

The designated management agencies, LBWC, and other appropriate public process participants are expected to do the following:

- Develop BMPs to achieve load allocations including incorporating relevant trading baseline requirements from the Lower Boise Trading Framework
- Provide reasonable assurance that management measures will achieve load allocations through both quantitative and qualitative analysis of management measures
- Adhere to measurable milestones for progress
- Develop a timeline for implementation, with reference to costs and funding
- Develop a monitoring plan to determine if BMPs are being implemented, individual BMPs are effective, load allocations and wasteload allocations are being met, and water quality standards are being met

In addition to the designated management agencies, the public, through the LBWC and other processes, will be provided with opportunities to be involved in developing the implementation plan to the maximum extent practical. Public participation will significantly affect public acceptance of the document and the proposed control actions. Stakeholders (i.e., landowners, local governing authorities, taxpayers, industries, and land managers) are the most educated regarding the pollutant sources and will be called upon to help identify the most appropriate control actions for each area. Experience has shown that the best and most effective implementation plans are those developed with substantial public cooperation and involvement.

5.5.4 Implementation Monitoring Strategy

The objectives of a monitoring strategy should be to demonstrate long-term recovery, better understand natural variability, track project and BMP implementation, and track the TMDL implementation effectiveness. This monitoring and feedback mechanism is a major component of the "reasonable assurance" component of the TMDL and implementation plan.

Monitoring will provide information on progress being made toward achieving TMDL allocations and achieving water quality standards and will help in the interim evaluation of progress, including in the development of 5-year reviews and future TMDLs.

TP concentration compliance points for May–September will be applied at the mouths of the lower Boise River near Parma. Mean monthly chlorophyll-a (periphyton) targets of ≤150 mg/m^2 will be applied within the impaired AUs (ID17050114SW001_06 and ID17050114SW005_06b) of the lower Boise River. The implementation monitoring strategy should specifically focus on the following aspects:

1. **May 1–September 30**
   a. Measure TP concentration trends (mg/L) and loadings (lb/day) in the lower Boise River near Parma relative to the allocation target of ≤0.07 mg/L.
      i. Focus monitoring efforts on the various sectors identified in this TMDL (i.e., POTWs, stormwater, tributaries and drains, and ground water/unmeasured flow).
2. **Mean Monthly Benthic Chlorophyll *a* ≤150 mg/m^2**
   a. Identify TP concentration trends (mg/L) and loadings (lb/day) in the lower Boise River relative to TP allocation targets designed to help achieve the mean monthly benthic chlorophyll *a* (periphyton) target of ≤150 mg/m^2.
      i. Focus monitoring efforts on the various sectors identified in this TMDL (i.e., POTWs, stormwater, tributaries and drains, and ground water/unmeasured flow).
   b. Measure mean monthly benthic chlorophyll *a* (periphyton) in the two lower Boise River AUs that are currently listed as TP impaired in the 2012 Integrated Report (DEQ 2014c) in order to help determine the extent to which changes in TP concentrations and TP load equivalents are helping to achieve the algae growth target.

The implementation monitoring strategy should be designed by DEQ, USGS, designated management agencies, the LBWC, and other affected agencies/organizations/individuals to help ensure scientifically defensible and meaningful methodologies are used to track progress toward meeting the TMDL objectives. All sampling and analyses would be conducted under DEQ, USGS, ISWCC, or other scientifically defensible and approved protocols.

5.5.5 Water Quality Trading

Water quality trading (also known as pollutant trading) is a contractual agreement to exchange pollution reductions between two parties. Water quality trading is a business-like way of helping to solve water quality problems by focusing on cost-effective, local solutions to problems caused by pollutant discharges to surface waters. Water quality trading is one of the tools available to meet reductions called for in a TMDL where point and nonpoint sources both exist in a watershed.

The appeal of trading emerges when pollutant sources face substantially different pollutant reduction costs. Typically, a party facing relatively high pollutant reduction costs compensates another party to achieve an equivalent, though less costly, pollutant reduction.

Water quality trading is voluntary. Parties trade only if both are better off because of the trade, and trading allows parties to decide how to best reduce pollutant loadings within the limits of certain requirements.

Water quality trading is recognized in Idaho's water quality standards at IDAPA 58.01.02.055.06. DEQ allows for water quality trading as a means to meet TMDLs, thus restoring water quality limited water bodies to compliance with water quality standards. DEQ's *Water Quality Pollutant Trading Guidance* sets forth the procedures to be followed for water quality trading (DEQ 2010a).

5.5.5.1 Trading Components

The major components of water quality trading are trading parties (buyers and sellers) and credits (the commodity being bought and sold). Ratios are used to ensure the environmental equivalency of trades on water bodies covered by a TMDL. All trading activity must be recorded in the trading database by DEQ or its designated party.

Both point and nonpoint sources may create marketable credits, which are a reduction of a pollutant load beyond a level required by existing federal, state, local, and tribal regulations and TMDL implementation documents:

- Point sources create credits by reducing pollutant discharges below NPDES effluent limits set consistent with the assumptions and requirements of the TMDL wasteload allocations.
- Nonpoint sources create credits by implementing approved BMPs that reduce pollutant runoff below current loading levels. Nonpoint sources must follow the specific design, maintenance, and monitoring requirements for that BMP, as established in relevant trading guidance and framework documents; apply discounts to credits generated, if required (i.e., attenuation or uncertainty ratios); meet trading baseline requirements (i.e., existing federal, state, tribal, and local regulations and any requirements established via TMDL implementation plans); and provide a water quality contribution to ensure a net environmental benefit. The water quality contribution also ensures the reduction (the marketable credit) is surplus to the reductions the TMDL assumes the nonpoint source is achieving to meet the water quality goals of the TMDL. This last step is important because it helps to demonstrate reasonable assurance toward meeting TMDL goals and not just pollutant offsetting between point and nonpoint sources.

5.5.5.2 Watershed-Specific Environmental Protection

Trades must be implemented so that the overall water quality of the water bodies covered by the TMDL is protected. To do this, hydrologically based ratios are developed to ensure trades between sources distributed throughout TMDL water bodies result in environmentally better outcomes at the point of environmental concern. Moreover, localized adverse impacts to water quality are not allowed.

5.5.5.3 Trading Authorization

Water quality trading is authorized in the Idaho water quality standards (IDAPA 58.01.02.055). Trading should be implemented consistent with the Clean Water Act and other existing regulations, EPA's water quality trading policy (EPA 2003), DEQ's water quality trading guidance (DEQ 2010a), and the Lower Boise Trading Framework.

After adoption of an EPA-approved TMDL, DEQ, in concert with the WAG, must develop a water quality trading framework document. The Lower Boise River subbasin has an existing trading framework that DEQ is currently evaluating to revise ratios and policies consistent with this TMDL and the Joint Regional Recommendations (JRR) for water quality trading (DEQ, 2010a). The JRR were developed as a joint effort between Idaho, Oregon, and Washington, with technical oversight from EPA Region 10 and facilitated through a US Department of Agriculture–Natural Resources Conservation Service Conservation Innovation Grant awarded to the Willamette Partnership. The framework will mesh with the implementation plan. The elements of a trading document are described in DEQ's water quality trading guidance (DEQ 2010a).

6 Conclusions

The identified TP pollutant sources in this TMDL are both point and nonpoint in nature. Point sources include POTW, industrial, fish hatchery, and stormwater contributions. Nonpoint sources include tributaries and drains that are generally agriculturally fed or supplemented streams, ground water and other unmeasured sources, and background. Allocations in the TMDL are designed to achieve two targets: (1) the May 1–September 30 SR-HC TP target of ≤0.07 mg/L in the Snake River (i.e., in the lower Boise River near Parma) and (2) TP targets designed to help achieve the mean monthly benthic chlorophyll *a* (periphyton) target of ≤150 mg/m^2 in the lower Boise River year-round. Achieving these targets is expected to result in full support of cold water aquatic life and contact recreation beneficial uses in the lower Boise River.

Table 37 provides a summary of assessment outcomes and recommended changes to the next Integrated Report.

Table 37. Summary of 303(d)-listed assessment units and outcomes in this TMDL.

Water Body	Assessment Unit	Pollutant	TMDL Completed	Recommended Changes to the Next Integrated Report	Justification
Boise River—Indian Creek to Mouth	ID17050114SW001_06	Total phosphorus	Yes	Move to Category 4a	TP TMDL completed
Boise River—Middleton to Indian Creek	ID17050114SW005_06b	Total phosphorus	Yes	Move to Category 4a	TP TMDL completed

In addition, data analysis for a 5-year review of the subbasin was completed in 2009 (DEQ 2009b), and a TP implementation plan for the subbasin was completed in 2008 (DEQ 2008). These documents are available at *http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/boise-river-lower-subbasin.aspx*.

This document was prepared with input from the public, as described in Appendix A, which will include public comments and DEQ's responses in the final version of this document. A distribution list will be included in Appendix F.

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Glossary

§303(d)

Refers to section 303 subsection "d" of the Clean Water Act. Section 303(d) requires states to develop a list of water bodies that do not meet water quality standards. This section also requires total maximum daily loads (TMDLs) be prepared for listed waters. Both the list and the TMDLs are subject to United States Environmental Protection Agency approval.

Assessment Unit (AU)

A group of similar streams that have similar land use practices, ownership, or land management. However, stream order is the main basis for determining AUs. All the waters of the state are defined using AUs, and because AUs are a subset of water body identification numbers, they tie directly to the water quality standards so that beneficial uses defined in the water quality standards are clearly tied to streams on the landscape.

Beneficial Use

Any of the various uses of water that are recognized in water quality standards, including, but not limited to, aquatic life, recreation, water supply, wildlife habitat, and aesthetics.

Beneficial Use Reconnaissance Program (BURP)

A program for conducting systematic biological and physical habitat surveys of water bodies in Idaho. BURP protocols address lakes, reservoirs, and wadeable streams and rivers.

Exceedance

A violation (according to DEQ policy) of the pollutant levels permitted by water quality criteria.

Fully Supporting

In compliance with water quality standards and within the range of biological reference conditions for all designated and existing beneficial uses as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002).

Load Allocation (LA)

A portion of a water body's load capacity for a given pollutant that is given to a particular nonpoint source (by class, type, or geographic area).

Load(ing)

The quantity of a substance entering a receiving stream, usually expressed in pounds or kilograms per day or tons per year. Loading is the product of flow (discharge) and concentration.

Load Capacity (LC)

How much pollutant a water body can receive over a given period without causing violations of state water quality standards. Upon allocation to various sources, a margin of safety, and natural background contributions, it becomes a total maximum daily load.

Margin of Safety (MOS)

An implicit or explicit portion of a water body's load capacity set aside to allow for uncertainly about the relationship between the pollutant loads and the quality of the receiving water body. The margin of safety is a required component of a total maximum daily load (TMDL) and is often incorporated into conservative assumptions used to develop the TMDL (generally within the calculations and/or models). The margin of safety is not allocated to any sources of pollution.

Nonpoint Source

A dispersed source of pollutants generated from a geographical area when pollutants are dissolved or suspended in runoff and then delivered into waters of the state. Nonpoint sources are without a discernable point or origin. They include, but are not limited to, irrigated and nonirrigated lands used for grazing, crop production, and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites.

Not Assessed (NA)

A concept and an assessment category describing water bodies that have been studied but are missing critical information needed to complete an assessment.

Not Fully Supporting

Not in compliance with water quality standards or not within the range of biological reference conditions for any beneficial use as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002).

Point Source

A source of pollutants characterized by having a discrete conveyance, such as a pipe, ditch, or other identifiable "point" of discharge into a receiving water. Common point sources of pollution are industrial and municipal wastewater plants.

Pollutant

Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.

Pollution

A very broad concept that encompasses human-caused changes in the environment that alter the functioning of natural processes and produce undesirable environmental and health effects. Pollution includes human-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media.

Stream Order

Hierarchical ordering of streams based on the degree of branching. A 1st-order stream is an unforked or unbranched stream. Under Strahler's (1957) system, higher-order streams result from the joining of two streams of the same order.

Synoptic

A sampling event that takes place over a relatively short timeframe and under relatively stable hydrologic conditions.

Total Maximum Daily Load (TMDL)

A TMDL is a water body's load capacity after it has been allocated among pollutant sources. It can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual basis. A TMDL is equal to the load capacity, such that load capacity = margin of safety + natural background + load allocation + wasteload allocation = TMDL. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.

Wasteload Allocation (WLA)

The portion of receiving water's load capacity that is allocated to one of its existing or future point sources of pollution. Wasteload allocations specify how much pollutant each point source may release to a water body.

Water Body

A stream, river, lake, estuary, coastline, or other water feature, or portion thereof.

Water Quality Criteria

Levels of water quality expected to render a body of water suitable for its designated uses. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, aquatic habitat, or industrial processes.

Water Quality Standards

State-adopted and United States Environmental Protection Agency-approved ambient standards for water bodies. The standards prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses.

Appendix A. Site-Specific Water Quality Standards and Criteria

Idaho water quality standards (IDAPA 58.01.02.140.12) for the Lower Boise River subbasin.

12. **Lower Boise Subbasin**. The Lower Boise Subbasin, HUC 17050114, is comprised of seventeen (17) water body units

Unit	Waters	Aquatic Life	Recreation	Other
SW-1	Boise River- Indian Creek to mouth	COLD	PCR	
SW-2	Indian Creek - Sugar Ave. (T03N, R02W, Sec. 15) to mouth	COLD	SCR	
SW-3a	Split between New York Canal and historic creek bed to Sugar Ave. (T03N, R02W, Sec. 15)	COLD SS	SCR	
SW-3b	Indian Creek Reservoir to split between New York Canal and historic creek bed	COLD	SCR	
SW-3c	Indian Creek Reservoir	COLD	PCR	
SW-3d	Indian Creek - source to Indian Creek Reservoir	COLD	SCR	

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Department of Environmental Quality *Water Quality Standards*

Unit	Waters	Aquatic Life	Recreation	Other
SW-4	Lake Lowell	WARM	PCR	
SW-5	Boise River - river mile 50 (T04N, R02W, Sec. 32) to Indian Creek	COLD SS	PCR	
SW-6	Mason Creek - New York Canal to mouth		SCR	
SW-7	Fifteenmile Creek - Miller Canal to mouth		SCR	
SW-8	Tenmile Creek - Blacks Creek Reservoir Dam to Miller Canal	COLD	SCR	
SW-9	Blacks Creek - source to and including Blacks Creek Reservoir			
SW-10	Fivemile Creek - source to Miller Canal	COLD	SCR	
SW-11a	Boise River - Diversion Dam to river mile 50 (T04N, R02W, Sec. 32)	COLD SS	PCR	DWS
SW-11b	Boise River - Lucky Peak Dam to Diversion Dam	COLD	PCR	DWS
SW-12	Stewart Gulch, Cottonwood and Crane Creeks -source to mouth			
SW-13	Dry Creek - source to mouth			
SW-14	Big/Little Gulch Creek complex			
SW-15	Willow Creek - source to mouth			
SW-16	Langley/Graveyard Gulch complex			
SW-17	Sand Hollow Creek - source to mouth		SCR	

Idaho water quality standards (IDAPA 58.01.02.278.01–05) for the Lower Boise River subbasin.

278. LOWER BOISE RIVER SUBBASIN, HUC 17050114 SUBSECTION 140.12.

01. Boise River, SW-1 and SW-5 -- Salmonid Spawning and Dissolved Oxygen. The waters of the Boise River from Veterans State Park to its mouth will have dissolved oxygen concentrations of six (6) mg/l or seventy-five percent (75%) of saturation, whichever is greater, during the spawning period of salmonid fishes inhabiting those waters. (3-15-02)

02. Boise River, SW-5 and SW-11a -- Copper and Lead Aquatic Life Criteria. The water-effect ratio (WER) values used in the equations in Subsection 210.02 for calculating copper and lead CMC and CCC values shall be two and five hundred seventy-eight thousandths (2.578) for dissolved copper and two and forty-nine thousandths (2.049) for lead. These site-specific criteria shall apply to the Boise River from the Lander St. wastewater outfall to where the channels of the Boise River become fully mixed downstream of Eagle Island.

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Department of Environmental Quality ***Water Quality Standards***

(5-3-03)

03. Indian Creek, SW-3a -- Site-Specific Criteria for Water Temperature. A maximum weekly maximum temperature of thirteen degrees C (13°C) to protect brown trout and rainbow trout spawning and incubation applies from October 15 through June 30. (3-29-12)

04. Boise River, SW-5 and SW-11a -- Site-Specific Criteria for Water Temperature. A maximum weekly maximum temperature of thirteen degrees C (13°C) to protect brown trout, mountain whitefish, and rainbow trout spawning and incubation applies from November 1 through May 30. (3-29-12)

05. Point Source Thermal Treatment Requirement. With regard to the limitations set forth in Section 401 relating to point source wastewater discharges, only the limitations of Subsections 401.01.a. and 401.01.b. and the temperature limitation relating to natural background conditions shall apply to discharges to any water body within the Lower Boise River Subbasin. (3-29-12)

Appendix B. Data Sources

Table B-1. Data sources for Lower Boise River subbasin assessment and TMDL.

Source/Water Body	Type of Data	Data Source	Collection Date
Lander Street	Effluent parameters	Kate Harris, City of Boise	2006–2013
West Boise	Effluent parameters	Kate Harris, City of Boise	2006–2013
Middleton	Effluent parameters	Brad Green, City of Middleton; Michael Moore, Analytical Laboratories	2011–2013
Caldwell	Effluent parameters	Lee Van DeBogart, City of Caldwell	2012–2013
IDFG Eagle Hatchery	Flow	Jeff Heindel, IDFG	2003–2013
IDFG Eagle Hatchery	Effluent parameters	Kate Harris, City of Boise	2007–2013
Darigold, Inc.	Effluent parameters	Scott Algate, Darigold, Inc.	2012–2013
Avimor	Effluent parameters	Jeremy Aulbach, Pharmer Engineering LLC	2012-2013
Star	Effluent parameters	Ken Vose, Star Sewer and Water	2006–2013
Meridian	Effluent parameters	Michael Kasch, HDR	2012–2013
Sorrento Lactalis	Effluent parameters	Wendy York, Sorrento Lactalis	2012–2013
Nampa	Effluent parameters	Matt Gregg, Brown and Caldwell	2012–2013
Kuna	Effluent parameters	Tom Shaffer, City of Kuna	2012–2013
IDFG Nampa Hatchery	Effluent parameters	DMR data; Kate Harris, City of Boise	2012–2013
IDFG Eagle Hatchery	Effluent parameters	Kate Harris, City of Boise	2007–2013
Notus	Effluent parameters	Mike Black, City of Notus	2007–2013
Wilder	Effluent parameters	Wendy Burrows, City of Wilder	2012–2013
Greanleaf	Effluent parameters	DMR data	2012–2013
Parma	Effluent parameters	Ken Steinhaus, City of Parma	2012–2013
Lower Boise River, Mason Creek, Sand Hollow Creek, and Lower Boise River tributaries	Water quality, periphyton, habitat, and flow parameters	Alex Etheridge, USGS	1983–2013
Lower Boise River tributaries	Water quality parameters	Kirk Campbell, ISDA	1998–2008
Lower Boise River and tributaries	BURP	DEQ	1995, 1996, 2003
Lower Boise River, Dixie Drain, and point sources	Water quality, periphyton, habitat, and flow parameters	Kate Harris, City of Boise	1993–2013
Stormwater	LBWC Stormwater Workgroup	Lee Van de Bogart, City of Caldwell; Erica Anderson-Maguire, ACHD; Jack Harrison, HyQual; Cheryl Jenkins, City of Nampa; Ted Douglas, Brown and Caldwell	2007–2013

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Appendix C. Stormwater Information Provided to DEQ by the LBWC Stormwater Workgroup

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Lower Boise River

Stormwater Phosphorus Loads

Prepare for: LBR Stormwater Workgroup

Prepared by: Jack Harrison, PhD, PE

Date: November 20, 2014

Purpose and Acknowledgements

Stormwater discharge total phosphorus loading analyses and example wasteload and load allocations were prepared to support Boise River TP TMDL development by Idaho DEQ. Stormwater discharges met on August 11, 19, 27, September 12 and October 14, 2014, to discuss loads and potential allocation scenarios. During these meetings workgroup attendees reviewed and discussed draft information, stormwater data, methodologies for calculations of loads, and allocation options. The analyses and example allocations summarized below were developed with significant input from stormwater representatives for local NPDES permittees, including:

- Erica Anderson-Maguire/ACHD
- Lee Van De Bogart/Caldwell
- ~~Cheryl Jenkins/Nampa~~[1]
- ~~Michael Mieyr/Nampa~~[1]
- Jack Harrison/ACHD and Middleton
- ~~Ted Douglass/Nampa~~[1]

[1] The following individuals requested to be removed from this document: Cheryl Jenkins, Michael Mieyr, and Ted Douglass.

Contents

Summary of Stormwater Loads

To support Lower Boise River total phosphorus TMDL development, stormwater data collected and reported to EPA were used to estimate total phosphorus (TP) loads in pounds per day (lb/d) discharged to the Lower Boise River (Table 1). The areas used in the load estimates are based on the 2010 U.S. Census Bureau census (U.S Census Bureau, 2010) and Ada and Canyon County assessors data (Ada and Canyon Assessor's Offices, 2014). As requested by DEQ, the loads were divided by periods established in the Snake River – Hells Canyon TMDL (IODEQ 2004).

Table 1 - Estimated total phosphorus (TP) loads in pounds per day (lb/d) for urban areas based on 2010 Census and other available data (Ada and Canyon County Assessors Offices, 2014). Also shown are example allocations based on 60% reductions.

Stormwater	Permitted	Non-Permitted	Totals
Areas (ac)	139,704	40,617	180,321
Loads and Example Allocations (lb/d)			
May-Sep Total Load	361	105	465
May-Sep Example Allocations	144	42	186
Oct-Apr Total Load	117	34	151
Oct-Apr Example Allocations	47	14	60

The loads are also divided into permitted and non-permitted urban areas. The loads for the permitted areas are covered by NPDES stormwater permits, are considered point sources and should receive wasteload allocations. The non-permitted loads are for urban areas without permits and should receive load allocations.

Average daily stormwater flows were also estimated based on the calculated average loads and average measured concentrations estimated using the average of the average wet and dry weather concentrations. These flows (Table 2) are assumed to occur throughout the watershed and contribute discharge to the Boise River and tributaries. And, while the October through April flows would generally occur during wet weather periods, the May through September flows could occur throughout the period during wet or dry weather.

Table 2 - Measured average runoff total phosphorus (TP) concentrations, estimated TP loads, and calculated daily average flows

Stormwater	Permitted	Non-Permitted	Totals	Units
Measured Avg. Concentration	0.44	0.44	0.44	mg/L
May-Sep Load (estimated)	361	105	465	lb/d
Average Flow (May-Sep)	154	45	198	cfs
Oct-Apr Load (estimated)	117	34	151	lb/d
Average Flow (Oct-Apr)	50	14	64	cfs

It should be noted that while average flows, concentrations and loads will be used for the TMDL allocations, actual stormwater discharge flows, concentrations and loads can be much higher due to precipitation events with high intensity and/or duration. These and other concerns and issues are discussed below and should be acknowledged in the TMDL.

Stormwater Load Calculations and Methods

The stormwater loads provided in Tables 1 and 2 are based on calculations and information shown in Table 3. To estimate these loads, first the baseline loads were calculated on a per acre basis using the available stormwater runoff data for both wet and dry weather periods (i.e., precipitation and no precipitation periods, respectively). This is similar to the procedure used to estimate loads for Lower Boise River Implementation Plan (DEQ 2008) and Lake Lowell TMDL (DEQ 2010). One difference used to avoid potential double counting is that wet and dry weather loads were added after reducing loads by the estimated fraction of area where dry weather flows dominate. The calculated baseline loads were then partitioned into "seasonal average daily load" estimates as requested by DEQ. Finally, example allocations were calculated assuming 60% load reductions consistent with anticipated reduction targets. Actual allocations will be proposed by DEQ.

The basis for the assumptions is discussed below and additional supporting information is provided in Appendices A through E (provided in separate document).

Table 3 - Wet and dry weather loads for the anticipated TMDL periods (i.e., May-Sep and Oct-Apr) basis and references to more detailed information to support the load estimates

Stormwater	Permitted	Non-Permitted	Totals	Units	Note
Area	218	63		mi^2	Appendix A
	139,704	40,617	180,321	ac	
Baseline Loads					
Wet Weather (WWx)	0.64	0.64		g/ac/d	Appendix B
Full Yr Load	90	26	116	kg/d	
	197	57	254	lb/d	
Percent of area	70%	70%	70%		
	138	**40**	**178**		
Dry Weather (DWx)	3.68	3.68		g/ac/d	Appendix C
Full Yr Load	514	149		kg/d	
	1131	329	1460		
Percent of area	30%	30%			
	339	**99**	**438**	lb/d	
Seasonal Periods					
WWx season fraction	**0.4**	**0.4**			Appendix D
May-Sep Wet Wx	55	16	71	lb/d	
DWx season fraction	**0.9**	**0.9**			
May-Sep Dry Wx	305	89	394	lb/d	
May-Sep Total	361	105	465	lb/d	(SR-HC Critical Period)
WWx season fraction	**0.6**	**0.6**			Appendix D
Oct-Apr Wet Wx	83	24	107	lb/d	
DWx season fraction	**0.1**	**0.1**			
Oct-Apr Dry Wx	34	10	44	lb/d	
Oct-Apr Total	117	34	151	lb/d	(NON Critical Period)
Example Allocations					
% reduction	60%	60%			Example for discussion
May-Sep Allocations	144	42	186	lb/d	(SR-HC Critical Period)
% reduction	60%	60%			Example for discussion
Oct-Apr Allocations	47	14	60	lb/d	(NON Critical Period)

Basis for Load Calculations

The basis for the assumptions is discussed below and additional supporting information is provided in Appendices A through D. Additionally, a summary of previous dry weather TMDL data and load allocations are provided in Appendix E.

Stormwater Management Areas

Stormwater in the selected areas within Lower Boise River watershed is regulated under either a Phase I or a Phase II NPDES Permit issued by EPA. In the lower Boise River (LBR) TP TMDL, the Permitted (i.e., regulated) stormwater entities are considered point sources and will be assigned "wasteload allocations". Additionally, "load allocations" should be assigned to the non-point source (un-regulated) urban stormwater entities and areas.

The Table 4 shows permitted and non-permitted areas and includes a breakdown of permitted and non-permitted areas based on:

- City limits data from 7/29/14 (Ada County Assessor's Office, 2014) and 5/28/14 (Canyon County Assessor's Office, 2014);
- Urbanized Areas based on 2010 Census (U.S. Census Bureau, 2010);
- Area data from NPDES Permit Factsheets (2000 Census);

Table 4 - Permitted and non-permitted areas

	Permitted Area (ac)	Non-Permitted Area (ac)
Ada	95,149	29,749
Canyon	44,555	10,868
Total	139,704	40,617

Appendix A provides more details on the areas for individual permittees or jurisdictions. Non-permittees in regulated areas (e.g. Meridian, Eagle, unincorporated urbanized Ada County, e.g., Southwest Boise) and unregulated areas need to be identified in the TMDL to ensure they are given allocations and understand their responsibilities. Many of these jurisdictions have regulatory authority over private and municipal properties that are potential sources of wet weather stormwater and dry weather runoff.

Wet Weather Data Summary

Stormwater data collected during storm events under provisions specified in NPDES permits and reported annually to EPA was compiled and summarized by the stormwater workgroup participants.

The average concentrations shown in Table 5 represent the average measured concentrations of the samples collected by each entity. Data collected by Caldwell, Nampa, and ACHD (Phase II) were collected via grab sampling. ACHD Phase I data was collected as composite samples. See Appendix B for complete data sets.

Table 5 – Averages of wet weather data reported to EPA by permittees

Source	TP Conc. (mg/L)	TP Load Annual (g/ac/d)
ACHD Phase I (Composite)	0.36	0.36
ACHD Phase II (Grab)	0.42	0.22
Nampa (Grab)	1.17	0.61
Caldwell (Grab)*	1.09	1.33
Average	**0.75**	**0.64**

* Note- Caldwell loads estimated using precipitation data and C-Factor

Dry Weather Data Summary

Agricultural runoff, over-irrigation runoff, irrigation water, groundwater discharges, and urban related discharges (e.g. wash water, process/condensate water, etc.) occur during dry weather and can also occur in wet weather. The flows are defined as non-stormwater discharges or dry weather flows. For the purposes of this discussion these types of discharges will be referred to as dry weather discharges. In the Treasure Valley dry weather discharges commonly mix with stormwater discharges. These discharges are authorized if they are "uncontaminated" and/or they do not cause, or have the reasonable potential to cause or contribute to, an excursion above the Idaho water quality standards. Due to the large volumes of water associated with dry weather discharges and their potential to contain pollutants, the stormwater workgroup has identified them as an issue of concern and that the issue needs to be identified and addressed within the TMDL.

Stormwater data collected during dry weather periods was compiled by the stormwater workgroup and summarized in Table 6. The average used in Table 6 is an average of the averages of the data sets available (Appendix C). It is important to note that the 2013 EPA issued NPDES Phase I permit requires dry weather discharges to sampled and analyzed beginning in 2015. Data collected by Phase I permittees will help to better understand and evaluate the pollutant loads associated with dry weather discharges. At this time, EPA issue NPDES Phase II permits do not require permittees to collect and analyze dry weather discharges.

Table 6 – Averages of dry weather data collected by ACHD and Nampa

Dry Weather Data Summary	TP Conc. (mg/L)	TP Load Annual (g/ac/d)
ACHD	0.095	2.4
Caldwell	0.146	5.0
Average of Average	**0.12**	**3.68**

Dry weather data used for the previous TMDLs indicated dry weather flows were about 0.37 g/ac/d (Appendix E). However, these were primarily associated with groundwater and background flows. The earlier loading rate was about 10% of the rate observed in more current data of 3.68 g/ac/d (Table 6). While the current load estimate (based on the more recent data) is substantially higher, as discussed below it is applied to a smaller area.

Dry Weather Percent of Area

For the purpose of the TMDL the Dry Weather Percent of Area is estimated to be 30% based on rough mapping of Ada County areas that have irrigation and groundwater in the stormwater system. This map (Figure 1), which was developed by ACHD, shows approximately 46% of area contributes dry weather flows from groundwater and/or irrigation flows. The 30% estimate for the TMDL incorporates a margin of error.

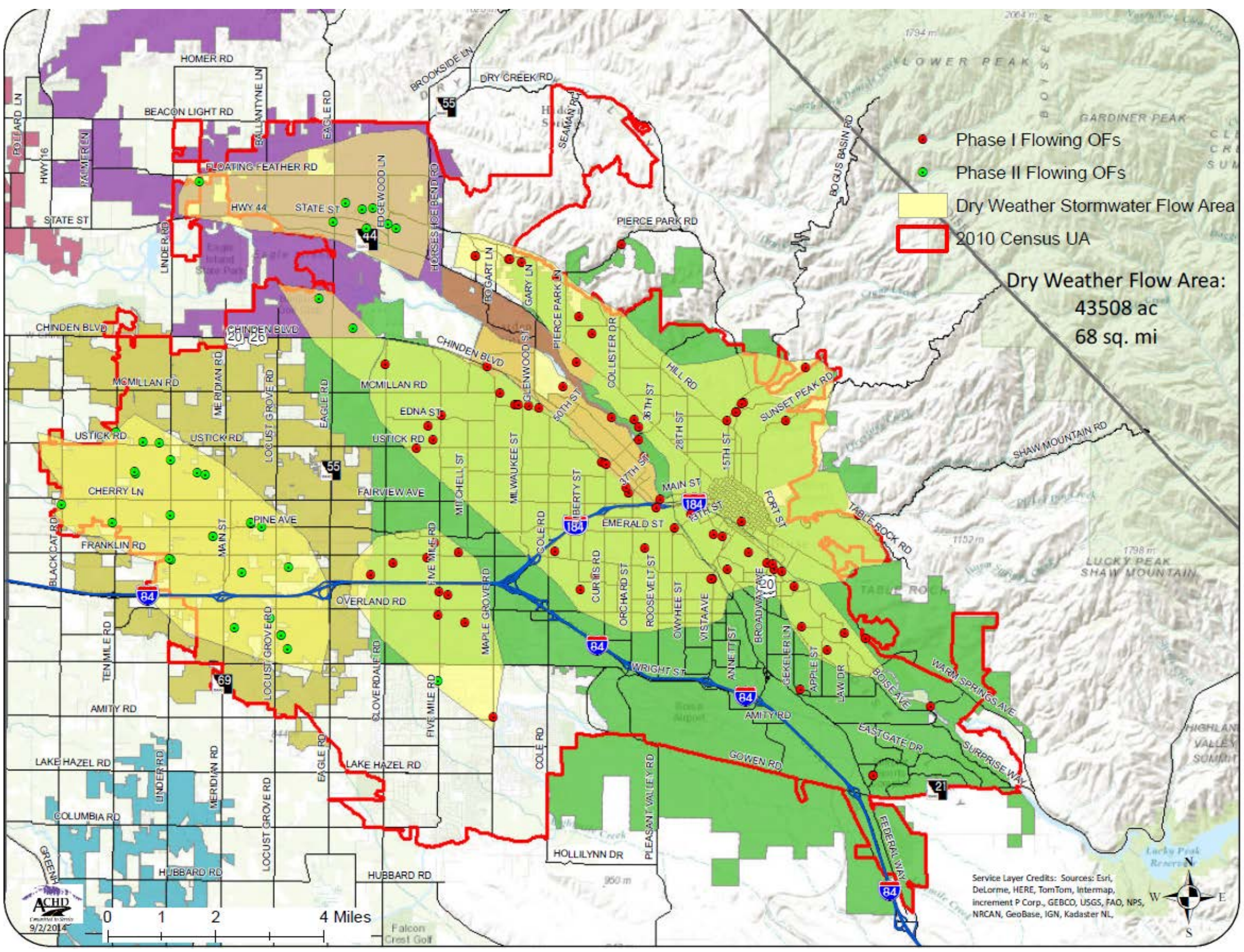

Figure 1 Map of Ada County showing areas with irrigation and shallow groundwater flow into the stormwater system

Wet Weather Fractions

The Wet Weather (WetWx), May- September fraction of 0.4 is the fraction of the wet weather load that is estimated to occur during the May through September period. The fraction was estimated based on precipitation frequency and magnitude as reported at the Boise Airport (Table 7 and Appendix D). The rainfall events during May through September divided by the total number of events suggest a fraction of 0.26 (i.e., 11/42). This also indicates that that the October-April period is the when approximately 74% of the storms that produce greater than 0.1 inches of precipitation occur in the area.

However, keep in mind that loads shown reflect how loads are used and represent a “daily annual average for the period”. For example, the data show that the maximum precipitation rates for the May-September period tend to be higher compared to the October-April period (i.e., 1.6 and 1.1 inches, respectively). Also, on any day the actual rate tends to be 0.5 inches higher, and therefore the runoff during the May-September period can exceed the average.

This suggests on a daily basis for the period, the loads can be higher, and therefore, the fraction of 0.4 was used in calculations for the May-September periods and a fraction of 0.6 was used for the October-April period.

Table 7 - Summary of precipitation data collected at the Boise Airport from 1940 to 2012 (WRCC, 2014)

Statistic	May-Sep Period	Oct-Apr Period
# of Days with Precipitation >= 0.1in	11	31
Average Maximum 1-Day Precipitation	1.6	1.1
Maximum 1-Day Precipitation	1.9	1.6

Dry Weather Fractions

The Dry Weather (DryWx) May-September fraction is the fraction of dry weather load that is estimated to occur during the May through September period. The primary sources of the runoff during this period include agriculture and urban irrigation runoff, and groundwater. A fraction of 0.9 is assumed for the DryWx May-September period because the largest portion of these flows is associated with summer-season irrigation runoff. A DryWx fraction of 0.1 during the October-April period represents the generally smaller groundwater flows that occur throughout this period.

General Issues and Concerns

Loads and allocations are based on limited data and many assumptions that often may be considered overly conservative. To provide a better understanding of how loads are represented within the TMDL and how the allocations should be applied, the following issues and concerns should be identified and discussed. Additional issues and concerns may be identified in final documentation.

Concentration vs. Load

It is generally understood that attempting to meet a concentration target at point of discharge for stormwater would be difficult and costly. For this reason, most stormwater management BMPs are designed and implemented to reduce loads. To facilitate implementation, we request that load allocations be express as a percent reduction from the baseline that can then be translated into management practices.

Low frequency occurrence of storm

There is a relatively low frequency occurrence of storms with only about 40 annual events causing runoff producing volumes. And, while the lowest occurrence is during the summer, precipitation and runoff rates can exceed average.

Permittees and Non-permittees

Non-permittees in regulated areas (e.g. Meridian, Eagle, unincorporated urbanized Ada County, e.g, Southwest Boise) and unregulated areas need to be included and listed in the TMDL. These jurisdictions have regulatory authority over private and municipal properties that are potential sources of stormwater/dry weather runoff.

Ag/Over-irrigation/Groundwater

Agricultural runoff, over-irrigation runoff, irrigation water, and groundwater discharges can mix with stormwater discharges. These discharges are authorized if they are “uncontaminated” and/or they do not cause, or have the reasonable potential to cause or contribute to, an excursion above the Idaho water quality standards. This needs to be identified and addressed within the TMDL.

MS4 Allocations

Total phosphorus concentration and some flow data are available for the individual MS4s that could be included in the LBR TMDL. This would allow for more localized baseline estimates and possibly specific WLAs for each MS4. If this approach is used, then percent reductions may need to be adjusted such that the resulting allocations are equal.

References

Internet links to data stormwater data include:

http://www.achdidaho.org/Departments/TechServices/Drainage.aspx
http://city.cityofcaldwell.com/StormWater
http://www.cityofnampa.us/stormwater/
http://canyonhd4.org/stormwater.php
http://www.nampahighway1.com/Stormwater.php

U.S. Census Bureau, 2010. https://www.census.gov/cgi-bin/geo/shapefiles2010/main

Ada County Assessor's Office, 2014. 7/9/14 data update sent to ACHD server via FTP data transfer.

Canyon County Assessor's Office, 2014. 5/28/14 data update sent to ACHD server via FTP data transfer.

WWRC. Western Regional Climate Center. http://www.wrcc.dri.edu/
http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?id1022

DEQ, 2008. Lower Boise River Implementation Plan

DEQ, 2010. Lake Lowell TMDL

Appendices

Appendix A – Stormwater Areas

Appendix B – Wet Weather Data and Analyses

Appendix C – Dry Weather Data and Analyses

Appendix D – Wet Weather May -Sep Fraction

Appendix E – Previous TMDL Dry Weather Loads

Appendices

For

Lower Boise River

Stormwater Phosphorus Loads and Example Allocations

November 20, 2014

Contents

Appendix A – Permitted and Non-Permitted Stormwater Management Areas

Stormwater in the selected areas within Lower Boise River watershed is regulated under either a Phase I or a Phase II NPDES Permit issued by EPA. In the lower Boise River (LBR) TP TMDL, the permitted (i.e., regulated) stormwater entities are considered point sources and will be assigned "wasteload allocations". Additionally, "load allocations" should be assigned to the non-point source (un-regulated) urban stormwater entities and areas.

Stormwater management areas for LBR TP TMDL area have been updated based on 2010 census (US Census Bureau) and current GIS mapping information. Figures 1a and 1b are maps based on available GIS information for Ada and Canyon County. These show the 2010 urbanized areas and city boundaries (i.e., incorporated areas). Cities included in urbanized areas include Boise, Meridian, Eagle, Caldwell, Nampa, and Middleton. Within the urbanized areas are also areas that are unincorporated – urbanized unincorporated Ada County, and urbanized unincorporated Canyon County. Additionally, there are areas in each county that are incorporated, but not included in the permitted urbanized areas. These areas included the Ada County cities of Kuna and Star, and small Canyon County cities of Greenleaf, Notus, Parma, and Wilder.

The Table A includes a breakdown of permitted and non-permitted areas based on:

- City limits data from 7/29/14 (Ada County Assessor) and 5/28/14 (Canyon County Assessor);
- Urbanized Area based on 2010 Census;
- Area data from NPDES Permit Factsheets (2000 Census);

The basis for area calculations and areas for individual permittees or jurisdictions are discussed in the text that follows.

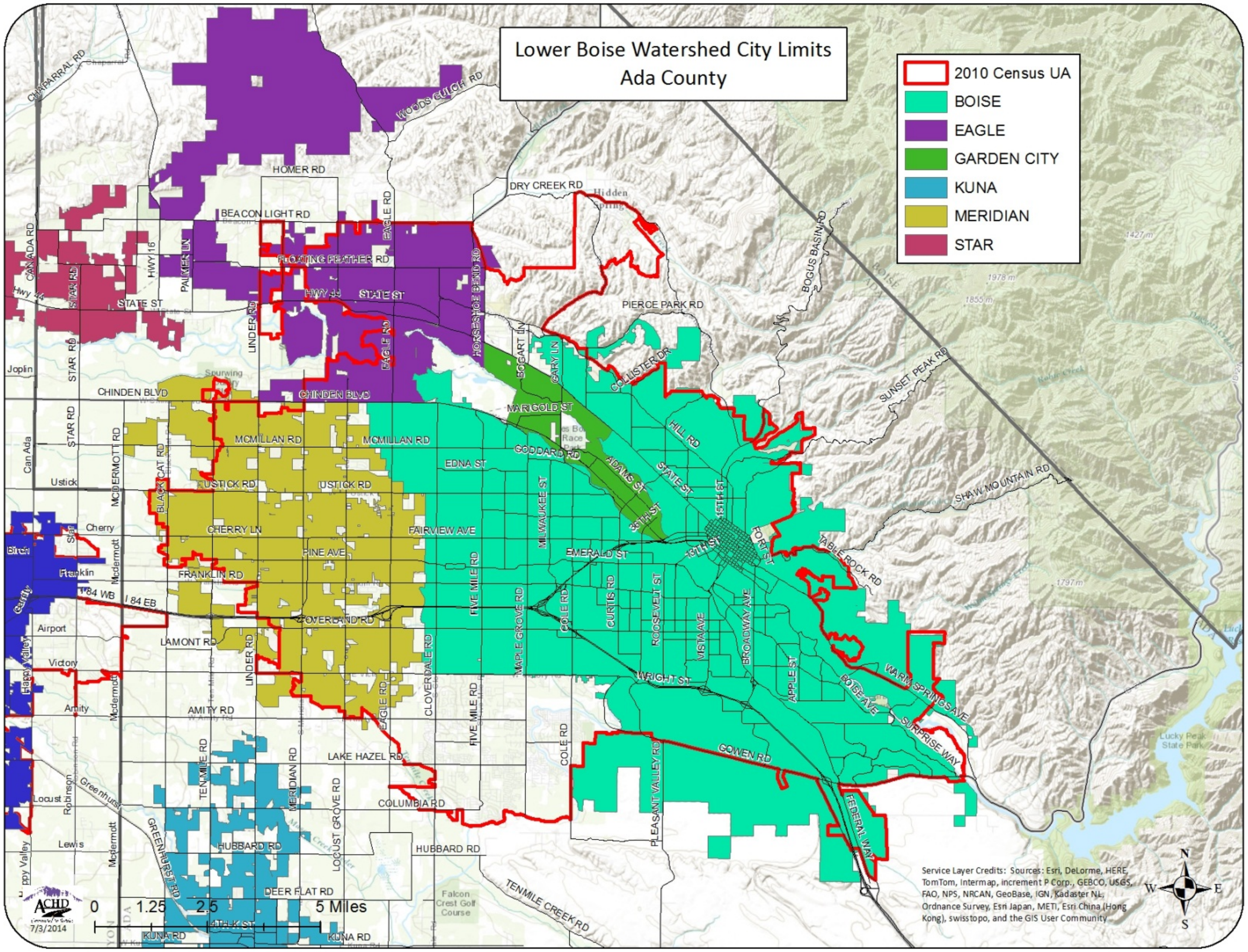

Figure 1a Map of Ada County stormwater management areas (prepared by ACHD, 7/3/2014)

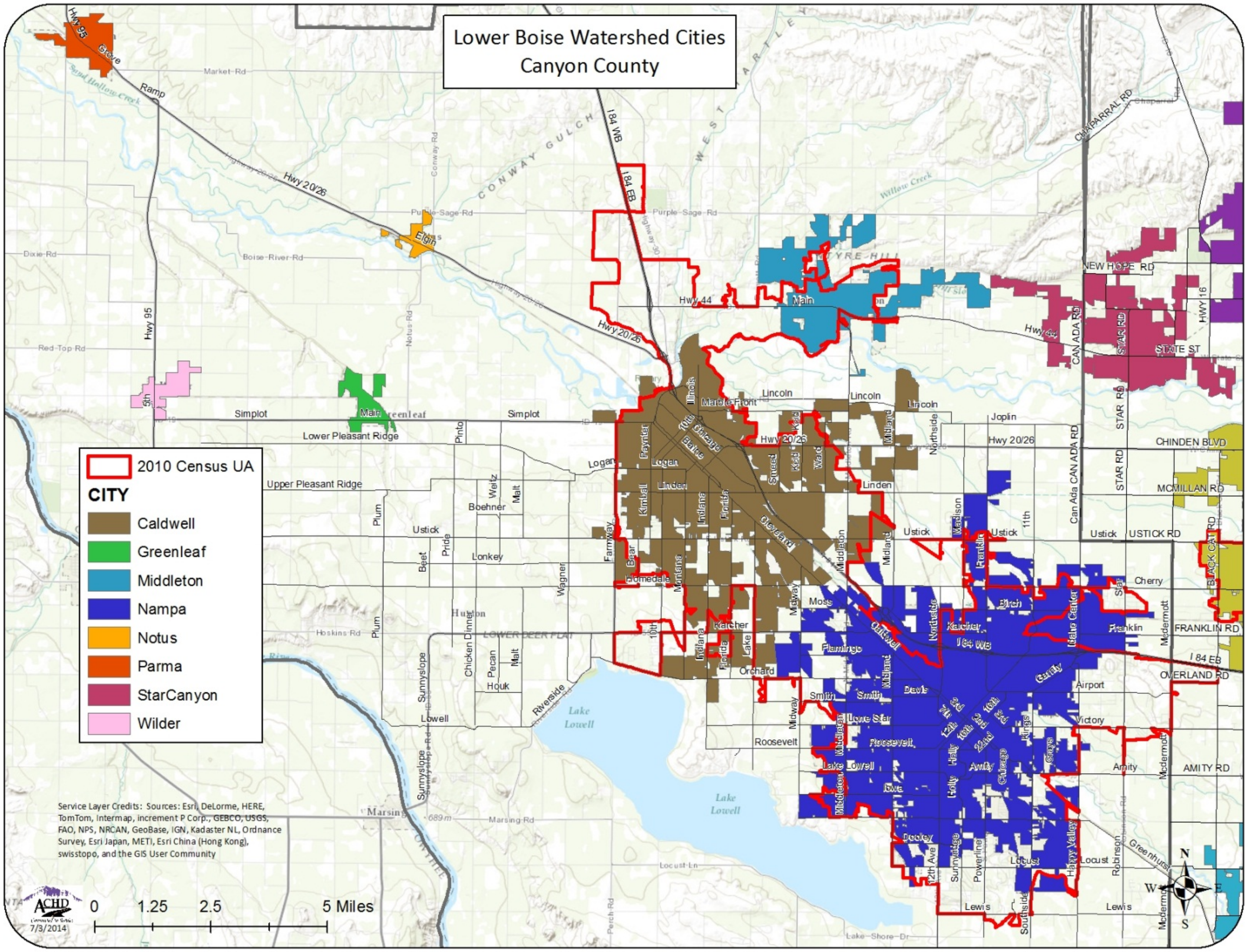

Figure1b Map of Canyon County stormwater management areas (prepared by ACHD, 7/3/2014)

Table A 2010 Census Boise Urbanized Area and other areas (prepared by ACHD)

Permit Holder/Jurisdiction	NPDES Permit Number	MS4 Permit Type	Permitted Areas				Permitted Urbanized & City Limits	Non-Permitted Areas	
			Urbanized Area[3]		City Limits [1,2]			City Limits [1,2]	
			Area (mi^2)	Acre	Area (mi^2)	Acre	Acre	Area (mi^2)	Acre
Ada County									
Boise/Garden City	IDS027561	Phase I			87	55,773			
Boise	IDS027561	Phase I			83	53,053			
Garden City	IDS027561	Phase I			4	2,720			
Ada County Highway District	IDS027561	Phase I			87	55,773			
Boise State University	IDS027561	Phase I			0.24	153			
Ada County Drainage District 3	IDS027561	Phase I			8	4,801			
ITD, District 3	IDS027561	Phase I							
Total Area Boise/Garden City Phase I Permit					**87**	**55,773**			
Ada County Highway District	IDS028185	Phase II	62	39,376	84	54,218			
Meridian		-	24	15,178	28	18,160		4	2,982
Eagle		-	12	7,518	30	19,378		18	11,860
Urbanized Ada County (unincorporated)		-	26	16,680	NA	NA			
Total Area Ada County Phase II Permit			**62**	**39,376**					
Total Area Ada County Phase I and II Permits							**95,149**		
Kuna	NA	-						18	11,619
Star	NA	-						4	3,288
Total Ada County Incorporated Non- Permitted Area								**44**	**29,749**
Canyon County									
Caldwell	IDS028118	Phase II	17.5	11,172				4.6	2,979
Nampa	IDS028126	Phase II	25	16,015				6.5	4,129
Middleton	IDS028100	Phase II	2.3	1,478				2.9	1,851
Urbanized Canyon County (unincorporated)	-	-	24.8	15,890					
ITD, District 3	IDS028177	Phase II							
Canyon Highway District #4[3]	IDS028134	Phase II	8	5,120					
Nampa Highway District #1[3]	IDS028142	Phase II	8.5	5,440					
Notus-Parma Highway District #2[3]	IDS028151	Phase II	2	1,280					
Total Area Canyon County Phase II Permits			**70**	**44,555**					
Greenleaf	NA	-						0.8	493
Notus	NA	-						0.4	246
Parma	NA	-						1.1	706
Wilder	NA	-						0.7	464
Total Canyon County Incorporated Non- Permitted Area								**17**	**10,868**

[1]Ada County Assessor 7/9/14; [2]Canyon County Assessor 5/28/14; [3]Urbanized Area based on 2010 Census; 4Area data from NPDES Permit Factsheets (2000 Census)

Permitted (Regulated) Stormwater

As stated above, point source "waste load allocations" will be assigned to regulated stormwater entities in the LBR TP TMDL. The areas total 139,704 acres for the Ada and Canyon Counties (Table A).

Both Phase I and Phase II NPDES permits have been issued in LBR watershed.

Areas permitted under the Phase I permit are defined as the corporate boundaries of Boise and Garden City.
Areas permitted under the Phase II permits are based on city/highway district/state transportation department jurisdiction boundaries within the U.S Census-based urbanized areas.

Notes:

- "Urbanized Area" is defined as an area with a population of more than 50,000. The U.S. Census Bureau urbanized area criteria for the 2010 census is described in the Federal Register**,** Vol. 76, No. 164 , Wednesday, August 24, 2011 .
  The urbanized areas for current Phase II permits are based on 2000 Census. To more accurately reflect current conditions, the areas have been updated using the 2010 Census Boise Urbanized Area (see Maps and Tables).
- To determine the Phase II Areas for ACHD's Phase II permit on the map, the most recent corporate boundaries (aka city limits) for Boise and Garden City were subtracted from the Boise Urbanized Area. .

Non-Permitted (Unregulated) Stormwater

In the LBR TP TMDL, nonpoint source "load allocations" should be assigned to un-regulated urban stormwater entities and areas. The areas total 40,617 acres for Ada and Canyon Counties (Table A). These areas are also in the corporate boundary areas but <u>are not in the corporate boundary</u> <u>within the 2010 Nampa Urbanized Area or the 2010 Boise Urbanized Area</u>. For example, Eagle has an area of 30 mi^2, but only 12 mi^2 is in the Boise Urbanized Area. The difference is that Eagle's city limits include all the land annexed for Avimor.

Appendix B - Wet Weather TP Loads

Previous TMDL Stormwater Baseline TP Loads

Critical period (May through September) loads in previous TMDL (Lake Lowell) and Implementation Plan for Lower Boise River were as follows:

- wet weather TP load is 0.15 g/ac/day.
- dry weather TP load is 0.37g/ac/day.
- **total TP load of 0.52 g/ac/day**.

The previous wet weather TP loads were based on a more limited data set collected in Ada County by ACHD.

Based on:

- ACHD data collected from 3 locations – Americana, Lucky, and Walnut
- Runoff volume was estimated as a percent of annual runoff (i.e., C-Factor)
- The load estimated also included the Walnut site….Walnut was excluded from average the current average because:
  - it has extensive treatment ponds that disconnect most of the wet weather flow;
  - it has continuous dry weather (and groundwater?) flow occurring during much of the year;
  - dry weather flow is from the Boise Canal that conveys low phosphorus (0.03 mg/L) discharged from Lucky Peak

Current Wet Weather Loads

Data from ACHD, Nampa and Caldwell were reviewed, compiled, and analyzed to assess variability in wet weather loads throughout the valley. The tables that follow show the average total phosphorus (TP) runoff loads for each sampling location calculated using similar assumptions:

- ACHD and Nampa runoff volumes are based on measured runoff; Caldwell runoff volume is based on measured precipitation and C-Factor
- Day (or 24-hr) loads (g/ac/d) are event loads assuming the load is produced over a 24-hr period
  Average annual loads (g/ac/d) are calculated using Average Annual load and assuming 40 events per year; these are similar to baseline loads calculated for previous TMDLs as previously discussed.

Data from ACHD, Nampa and Caldwell are provided in this Appendix (B) and Appendix C and include precipitation, runoff, reported concentrations. Load analyses for each location and event are calculated, and can include the “Event Load” (lb/ac/ev), which is the average load produced during the measured precipitation period.

ACHD

The following tables summarize site information for ACHD monitoring locations.

Table ACHD-1a Phase I monitoring sites

Boise/Garden City Phase I Monitoring Sites				
Site	Location	Drainage Area (ac)	Land Use	Receiving Water
Walnut	Boise, Id	567	58% low-density residential 15% high-density residential 26% open space 0.4% commercial/industrial	Boise River
Koppels	Boise, Id	12	66% commercial/industrial 34% transportation	Boise River
Lucky	Boise, Id	105	100% low-density residential	Eagle Drain
Production	Boise, Id	25	100% commercial/industrial	Fivemile Creek
Franklin	Boise, Id	16	44% low-density residential 56% transportation	Ridenbaugh Canal

Table ACHD-1b Phase II monitoring sites

ACHD Phase II Monitoring Sites				
Site:	Location:	Drainage Area (ac):	Land Use	Receiving Water:
Edgewood	Eagle, Id	25	30% low-density residential 42% residential rural 13% recreation 15% residential farmland	Eagle Drain
Chrisfield	Meridian, Id	12	100% low-density residential	Fivemile Creek

Notes:

- All sites have limited BMPs except for Walnut, which has extensive wet and dry pond system in upper reaches of watershed. Walnut system is heavily influenced by irrigation water from Boise City Canal.

Table ACHD-2 Average wet weather runoff volumes and loads

Monitoring Site	Area	Precip.	Runoff Volume	Runoff Fraction		TP Conc.	TP Load 24-hr	TP Load Annual
	(ac)	(in)	(in)	(Calc.)		(mg/L)	(g/ac/d)	(g/ac/d)
Phase 1 (Comp.)								
Koppels	12	0.21	0.13	0.80		0.31	4.73	0.52
Lucky	105	0.25	0.03	0.16		0.51	1.43	0.16
Franklin	16	0.23	0.11	0.60		0.38	3.89	0.43
Production	25	0.25	0.13	0.57		0.21	2.97	0.33
Average								**0.36**
Walnut	567	0.20	0.01	0.04		0.36	0.27	0.03
Phase 2 (grab)								
Chrisfield	12	0.22	0.04	0.20		0.56	2.47	0.27
Edgewood	25	0.25	0.06	0.21		0.28	1.57	0.17
Average								**0.22**

Notes:

- Phase I water quality samples are based on composite water quality samples for period 2007 to 2012
- Phase II are grab samples from 2011 to 2013 sampling periods
- Walnut was excluded from average due to extensive treatment ponds that disconnect most of the wet weather flow; also, this site has continuous dry weather (and groundwater?) flow occurring during much of the year

ACHD wet weather data for each site are provided in the following tables:

Site: Walnut Location: Boise, Idaho			Receiving Water: Boise River Drainage Area: 567 acres							
Type of Sample	Date	Precipitation (in)	runoff volume(cf)	runoff coefficient	Total Phosphorus (TP) (mg/l)	Runoff (in)	Runoff %	TP Load (lb/ac/d)	TP Load (g/ac/d)	TP Load Annual (g/ac/d)
Wet Comp	10/19/2007	0.46	17024	0.068	0.47	0.008	2%	0.00088	0.40	0.04
Wet Comp	12/18/2007	0.14	23983	0.068	0.35	0.012	8%	0.00092	0.42	0.05
Wet Comp	3/1/2008	0.25	21502	0.068	0.48	0.010	4%	0.00113	0.52	0.06
Wet Comp	11/2/2008	0.31	14016	0.072	0.66	0.007	2%	0.00102	0.46	0.05
Wet Comp	3/3/2009	0.13	11556	0.072	0.45	0.006	4%	0.00057	0.26	0.03
Wet Comp	3/25/2009	0.13	23112	0.072	0.21	0.011	9%	0.00053	0.24	0.03
Wet Comp	12/21/2009	0.18	13664	0.069	0.22	0.007	4%	0.00033	0.15	0.02
Wet Comp	2/24/2010	0.33	15616	0.069	0.32	0.008	2%	0.00055	0.25	0.03
Wet Comp	5/10/2010	0.13	13664	0.069	0.37	0.007	5%	0.00056	0.25	0.03
Wet Comp	12/11/2010	0.18	15616	0.069	0.2	0.008	4%	0.00034	0.16	0.02
Wet Comp	4/5/2011	0.13	9080	0.069	0.23	0.004	3%	0.00023	0.10	0.01
Wet Comp	5/8/2011	0.16	6258	0.069	0.2	0.003	2%	0.00014	0.06	0.01
Wet Comp	11/17/2011	0.08	15392	0.07	0.42	0.007	9%	0.00071	0.32	0.04
Wet Comp	12/28/2011	0.21	15392	0.07	0.61	0.007	4%	0.00103	0.47	0.05
Wet Comp	3/25/2012	0.13	5432	0.07	0.19	0.003	2%	0.00011	0.05	0.01
MEAN	n=15				**0.36**					

Table ACHD 3 – Walnut (Phase I site) runoff and load data.

Site: Koppels			Receiving Water: Boise River								
Location: Boise, Idaho			Drainage Area: 12 acres								
Type of Sample	Date	Precipitation (in)	runoff volume(cf)	runoff coefficient	Total Phosphorus (TP) (mg/l)	Runoff (in)	Runoff %		TP Load (lb/ac/d)	TP Load (g/ac/d)	TP Load Annual (g/ac/d)
Wet Comp	10/19/2017	0.46	2624	0.528	0.42	0.060	13%		0.00572	2.60	0.28
Wet Comp	12/18/2007	0.14	3260	0.528	0.35	0.075	53%		0.00592	2.69	0.29
Wet Comp	3/26/2007	0.17	1450	0.528	0.22	0.033	20%		0.00166	0.75	0.08
Wet Comp	11/2/2008	0.31	14016	0.513	0.66	0.322	104%		0.04801	21.82	2.39
Wet Comp	3/3/2009	0.13	11556	0.513	0.45	0.265	204%		0.02699	12.27	1.34
Wet Comp	3/25/2009	0.13	23112	0.513	0.21	0.531	408%		0.02519	11.45	1.25
Wet Comp	12/21/2009	0.18	3344	0.589	0.13	0.077	43%		0.00226	1.03	0.11
Wet Comp	2/24/2010	0.33	2816	0.589	0.14	0.065	20%		0.00205	0.93	0.10
Wet Comp	5/10/2010	0.13	1584	0.589	0.29	0.036	28%		0.00238	1.08	0.12
Wet Comp	10/24/2010	0.39	6368	0.589	0.3	0.146	37%		0.00991	4.51	0.49
Wet Comp	1/13/2011	0.24	4394	0.589	0.4	0.101	42%		0.00912	4.15	0.45
Wet Comp	4/5/2011	0.13	4394	0.589	0.16	0.101	78%		0.00365	1.66	0.18
Wet Comp	11/17/2011	0.08	2640	0.588	0.35	0.061	76%		0.00480	2.18	0.24
Wet Comp	12/28/2011	0.21	2816	0.588	0.4	0.065	31%		0.00585	2.66	0.29
Wet Comp	3/25/2012	0.13	2640	0.588	0.18	0.061	47%		0.00247	1.12	0.12
MEAN	n=15				**0.31**						

Table ACHD 4 – Koppels (Phase I site) runoff and load data.

Site: Lucky			Receiving Water: Eagle Drain							
Location: Boise, Idaho			Drainage Area: 105 acres							
Type of Sample	Date	Precipitation (in)	runoff volume(cf)	runoff coefficient	Total Phosphorus (TP) (mg/l)	Runoff (in)	Runoff %	TP Load (lb/ac/d)	TP Load (g/ac/d)	TP Load Annual (g/ac/d)
Wet Comp	12/18/2007	0.14	6080	0.159	0.3	0.016	11%	0.00108	0.49	0.05
Wet Comp	3/26/2007	0.17	3803	0.159	0.32	0.010	6%	0.00072	0.33	0.04
Wet Comp	5/20/2007	0.29	13902	0.159	1.65	0.036	13%	0.01360	6.18	0.68
Wet Comp	11/2/2008	0.31	14016	0.156	0.66	0.037	12%	0.00549	2.49	0.27
Wet Comp	3/3/2009	0.13	11556	0.156	0.45	0.030	23%	0.00308	1.40	0.15
Wet Comp	3/25/2009	0.13	23112	0.156	0.21	0.061	47%	0.00288	1.31	0.14
Wet Comp	10/13/2009	0.13	6324	0.156	0.39	0.017	13%	0.00146	0.66	0.07
Wet Comp	3/10/2010	0.46	21735	0.156	0.17	0.057	12%	0.00219	1.00	0.11
Wet Comp	4/27/2010	0.07	7736	0.156	0.87	0.020	29%	0.00399	1.81	0.20
Wet Comp	12/11/2010	0.18	6736	0.156	0.2	0.018	10%	0.00080	0.36	0.04
Wet Comp	1/13/2011	0.24	12630	0.156	0.24	0.033	14%	0.00180	0.82	0.09
Wet Comp	4/5/2011	0.13	13854	0.156	0.25	0.036	28%	0.00205	0.93	0.10
Wet Comp	12/28/2011	0.21	6912	0.164	0.67	0.018	9%	0.00275	1.25	0.14
Wet Comp	3/25/2012	0.13	6912	0.164	0.34	0.018	14%	0.00139	0.63	0.07
Wet Comp	5/25/2012	0.98	6912	0.164	0.98	0.018	2%	0.00402	1.83	0.20
MEAN	n=15				**0.51**					

Table ACHD 5 – Lucky (Phase I site) runoff and load data.

Site: Franklin		Receiving Water: Ridenbaugh Canal										
Location: Boise, Idaho			Drainage Area: 16 acres									
Type of Sample	Date	Precipitation (in)	runoff volume(cf)	runoff coefficient	Total Phosphorus (TP) (mg/l)		Runoff (in)	Runoff %		TP Load (lb/ac/d)	TP Load (g/ac/d)	TP Load Annual (g/ac/d)
Wet Comp	10/19/2007	0.46	7260	0.45	0.32		0.125	27%		0.00904	4.11	0.45
Wet Comp	12/18/2007	0.14	5408	0.45	0.77		0.093	67%		0.01621	7.37	0.81
Wet Comp	3/1/2008	0.25	5577	0.45	0.49		0.096	38%		0.01064	4.83	0.53
Wet Comp	3/3/2009	0.13	11556	0.507	0.45		0.199	153%		0.02024	9.20	1.01
Wet Comp	3/25/2009	0.13	23112	0.507	0.21		0.398	306%		0.01889	8.59	0.94
Wet Comp	4/29/2009	0.36	4830	0.507	0.68		0.083	23%		0.01278	5.81	0.64
Wet Comp	10/13/2009	0.13	3933	0.507	0.32		0.068	52%		0.00490	2.23	0.24
Wet Comp	12/21/2009	0.18	6464	0.507	0.2		0.111	62%		0.00503	2.29	0.25
Wet Comp	3/10/2010	0.46	7648	0.507	0.21		0.132	29%		0.00625	2.84	0.31
Wet Comp	10/24/2010	0.39	3936	0.507	0.55		0.068	17%		0.00843	3.83	0.42
Wet Comp	12/11/2010	0.18	3328	0.507	0.22		0.057	32%		0.00285	1.30	0.14
Wet Comp	1/13/2011	0.24	5616	0.507	0.39		0.097	40%		0.00852	3.87	0.42
Wet Comp	11/17/2011	0.08	2070	0.502	0.32		0.036	45%		0.00258	1.17	0.13
Wet Comp	12/28/2011	0.21	2277	0.502	0.33		0.039	19%		0.00292	1.33	0.15
Wet Comp	3/25/2012	0.13	3312	0.502	0.18		0.057	44%		0.00232	1.05	0.12
Wet Comp	4/25/2012	0.38	3105	0.502	0.45		0.053	14%		0.00544	2.47	0.27
MEAN	n=16				**0.38**							

Table ACHD 6 – Franklin (Phase I site) runoff and load data.

Site: Production			Receiving Water: Fivemile Creek						TP Load		
Location: Boise, Idaho			Drainage Area: 25 acres								
Type of Sample	Date	Precipitation (in)	runoff volume(cf)	runoff coefficient	Total Phosphorus(TP) (mg/l)	Runoff (in)	Runoff %	TP Load (lb/ac/d)	TP Load Day (g/ac/d)	TP Load Annual (g/ac/d)
Wet Comp	10/19/2007	0.46	14528	0.994	0.32	0.160	35%	0.01158	5.26	0.58
Wet Comp	12/18/2007	0.14	17696	0.994	0.29	0.195	139%	0.01278	5.81	0.64
Wet Comp	3/1/2008	0.25	13702	0.994	0.28	0.151	60%	0.00956	4.34	0.48
Wet Comp	3/25/2009	0.13	17344	0.855	0.17	0.191	147%	0.00734	3.34	0.37
Wet Comp	5/2/2009	0.53	26016	0.855	0.16	0.287	54%	0.01037	4.71	0.52
Wet Comp	6/2/2009	0.23	8130	0.855	0.41	0.090	39%	0.00830	3.77	0.41
Wet Comp	10/13/2009	0.13	11880	0.562	0.26	0.131	101%	0.00769	3.50	0.38
Wet Comp	12/21/2009	0.18	9477	0.562	0.13	0.104	58%	0.00307	1.39	0.15
Wet Comp	2/24/2010	0.33	11232	0.562	0.13	0.124	38%	0.00364	1.65	0.18
Wet Comp	10/24/2010	0.39	7856	0.562	0.19	0.087	22%	0.00372	1.69	0.19
Wet Comp	12/11/2010	0.18	5152	0.562	0.08	0.057	32%	0.00103	0.47	0.05
Wet Comp	3/15/2011	0.27	6640	0.562	0.22	0.073	27%	0.00364	1.65	0.18
Wet Comp	12/28/2011	0.21	5408	0.544	0.26	0.060	28%	0.00350	1.59	0.17
Wet Comp	3/25/2012	0.13	3408	0.544	0.13	0.038	29%	0.00110	0.50	0.05
Wet Comp	4/25/2012	0.38	15886	0.544	0.27	0.175	46%	0.01068	4.86	0.53
MEAN	n=15				**0.22**					

Table ACHD 7 – Production (Phase I site) runoff and load data.

Site: Chrisfield				Receiving Water: Fivemile Creek			
Location: Meridian, Idaho				Drainage Area: 12 acres			
Type of Sample	Date/Time	Precipitation (in)	runoff volume (cf)	runoff coefficient	Total Phosphorus (TP) (mg/l)	Total Suspended Solids (TSS) (mg/l)	E. Coli (MPN/100 mL)
Wet Grab	3/10/2011 18:51	0.10	1198.00	0.275	0.1286	23.2	5.1
Wet Grab	4/5/2011 5:23	0.24	2875	0.275	0.336	28.3	117.8
Wet Grab	5/8/2011 7:35	0.09	1078	0.275	0.263	46	>2419.6
Wet Grab	10/4/2011 15:30	0.51	6109	0.275	0.783	17.2	816.4
Wet Grab	12/28/2011 3:24	0.18	2,561	0.275	0.455	25.3	8.6
Wet Grab	3/25/2012 22:14	0.29	2,192	0.275	0.153	17.2	6.2
Wet Grab	5/3/2012 11:52	0.10	637	0.275	0.706	28.2	1229.7
Wet Grab	5/25/2012 8:37	0.13	518	0.275	0.281	16.8	866.4
Wet Grab	10/16/2012 1:27	0.36	2,880	0.275	0.422	23	151.5
Wet Grab	11/17/2012 19:21			0.275	1.56	24.9	20.5
Wet Grab	2/22/2013 20:00	0.30	803	0.275	0.224	75.5	42.4
Wet Grab	3/20/2013 4:10	0.13	594	0.275	0.448	133	178.5
Wet Grab	6/19/2013 14:28	0.17	1,796	0.275	0.446	227	1119.9
Wet Grab	9/3/2013 10:13	0.10	774	0.275	1.205	97	980
Wet Grab	11/16/2013 0:41	0.35	3,125	0.49	0.553	18.4	1100
Wet Grab	4/22/2014 8:33	0.23	1,861	0.49	0.748	14	313
Wet Grab	5/8/2014 22:05	0.20	2,290	0.49	0.867	22.1	633.1
WET MEAN	n=17				0.563		

Table ACHD 8 – Chrisfield (Phase II site) runoff and concentration data.

Site: Edgewood					Receiving Water: Eagle Drain		
Location: Eagle, Idaho					Drainage Area: 25 acres		
Type of Sample	Date/Time	Precipitation (in)	runoff volume(cf)	runoff coefficient	Total Phosphorus (TP) (mg/l)	Total Suspended Solids (TSS) (mg/l)	E. Coli (MPN/100mL)
Wet Grab	3/10/2011 18:15	0.10	2516.00	0.275	0.192	68.2	10.9
Wet Grab	4/5/2011 6:10	0.26	6541	0.275	0.1034	25.7	45.9
Wet Grab	5/8/2011 6:43	0.35	8805	0.275	0.0774	13.7	95.5
Wet Grab	10/5/2011 5:37	0.61	15345	0.275	0.0743	4.6	410.6
Wet Grab	12/28/2011 2:27	0.23	931	0.275	0.379	30.8 J	3.1
Wet Grab	3/25/2012 23:07	0.36	4,064	0.275	0.2293	18.3	9.7
Wet Grab	5/3/2012 12:35	0.09	464	0.275	0.158	12.2	461.1
Wet Grab	5/25/2012 7:51	0.09	965	0.275	0.345	128	2590
Wet Grab	10/16/2012 0:53	0.53	15,936	0.275	0.333	24.2	347.6
Wet Grab	2/22/2013 19:22	0.32	9,371	0.275	0.898	765	4.1
Wet Grab	3/20/2013 4:10	0.10	558	0.275	0.482	82.7	8.4
Wet Grab	6/24/2013 18:45	0.09	6,424	0.275	0.104	10.3	579.4
Wet Grab	9/3/2013 11:00	0.13	1,621	0.275	0.142	12.3	1986.3
Wet Grab	11/16/2013 1:42	0.40	3,212	0.29	0.329	75.2	58.8
Wet Grab	3/9/14 11:29	0.10	554	0.29	0.154	18.5	101
Wet Grab	4/22/2014 9:31	0.23	3,647	0.29	0.209	52.4	816.4
Wet Grab	5/8/2014 22:56	0.31	4,470	0.29	0.477	156	3230
WET MEAN	n=17				**0.263**		

Table ACHD 9 – Edgewood (Phase II site) runoff and concentration data.

Nampa

Nampa monitoring sites (Table Nampa -1) were selected to represent baseline conditions and have no or very limited existing BMPs within the monitored runoff contributing areas.

Table Nampa 1 - Phase II monitoring sites

Site	Drainage Area (ac)
Indian Creek	31.1
Mason Creek	7.8
Wilson Creek	3.6

The Nampa data were collected as grab samples during the precipitation event. Average annual TP loads based on Nampa data (Table Nampa-2) have a somewhat higher range compared to ACHD. Also note that average concentrations are about twice as high.

Table Nampa 2 - Day and Average Annual TP load (g/ac/d) for 2012 and 2013 monitoring sites

Monitoring Site	Area (ac)	Precip. (in)	Runoff Volume (in)	Runoff Fraction (Calc.)		TP Conc. (mg/L)	TP Load 24-hr (g/ac/d)	TP Load Annual (g/ac/d)
Indian Ck	31.1	0.37	0.12	0.32		1.0	4.5	0.49
Mason Ck	7.8	0.37	0.07	0.19		1.4	2.3	0.25
Wilson Ck	3.6	0.37	0.13	0.35		1.1	9.8	1.08
Average								**0.61**

Table Nampa 3 - Precipitation and Measured Runoff

Date	Precipitation Amount (in)	Measured Runoff (cf)	Measured Runoff (in)	Calculated C-Factor
Indian Creek				
25-Mar-12	0.98	49850	0.44	0.45
25-May-12	0.01	133	0.00	0.12
16-Oct-12	0.51	9984	0.09	0.17
4-Dec-12	0.21	3026	0.03	0.13
22-Feb-13	0.31	15769	0.14	0.45
19-Apr-13	0.27	288	0.00	0.01
19-Jun-13	0.39	26051	0.23	0.59
22-Aug-13		2892	0.03	
24-Sep-13	0.25	12717	0.11	0.45
Avg	0.37	13412	0.12	0.32
Mason Creek				
25-Mar-12	0.98	7621	0.27	0.27
25-May-12	0.01	78	0.00	0.27
16-Oct-12	0.51	1318	0.05	0.09
4-Dec-12	0.21	192	0.01	0.03
22-Feb-13	0.31	2411	0.09	0.27
19-Apr-13	0.29	813	0.03	0.10
19-Jun-13	0.39	1896	0.07	0.17
22-Aug-13		1919	0.07	
24-Sep-13	0.25	1313	0.05	0.19
Avg	0.37	1951	0.07	0.19
Wilson Creek				
25-Mar-12	0.98	2783	0.21	0.22
25-May-12	0.01	618	0.05	4.73
16-Oct-12	0.51	3413	0.26	0.51
4-Dec-12	0.21	384	0.03	0.14
22-Feb-13	0.31	2867	0.22	0.71
19-Apr-13	0.34	1072	0.08	0.24
19-Jun-13	0.39	1085	0.08	0.21
22-Aug-13		662	0.05	
24-Sep-13	0.25	2312	0.18	0.71
Avg	0.38	1688	0.13	0.34

Table Nampa 4 - Nampa Loads

Date	Meas. Runoff (cf)	TP (mg/L)	P Load/ event	P Load/ day	P Load/ yr
Indian Ck					
25-Mar-12	49,850	0.55	22.4	15.85	1.74
25-May-12	133	0.65	0.2	0.40	0.04
16-Oct-12	9,984	1.05	10.1	8.39	0.92
4-Dec-12	3,026	0.25	0.3	0.10	0.01
22-Feb-13	15,769	0.57	2.6	0.65	0.07
19-Apr-13	288	0.4	0.1	0.02	0.00
19-Jun-13	26,051	1.9	23.8	9.90	1.08
22-Aug-13	2,892	2.35	0.0		
24-Sep-13	12,717	1.3	4.0	0.83	0.09
		Avg			0.5
Mason Ck					
25-Mar-12	7,621	0.32	7.9	5.63	0.62
25-May-12	78	2.75	2.0	3.93	0.43
16-Oct-12	1,318	1.25	6.3	5.26	0.58
4-Dec-12	192	0.35	0.1	0.03	0.00
22-Feb-13	2,411	0.6	1.7	0.42	0.05
19-Apr-13	813	1.1	2.6	1.61	0.18
19-Jun-13	1,896	0.4	1.7	0.87	0.10
22-Aug-13	1,919	4.5	0.0		
24-Sep-13	1,313	1.4	2.1	0.53	0.06
		Avg			0.3
Wilson Ck					
25-Mar-12	2,783	1.9	37.3	26.43	2.90
25-May-12	618	0.95	11.7	23.41	2.57
16-Oct-12	3,413	0.78	22.1	18.42	2.02
4-Dec-12	384	0.28	0.3	0.07	0.01
22-Feb-13	2,867	1.35	9.6	2.41	0.26
19-Apr-13	1,072	1.1	8.3	5.89	0.65
19-Jun-13	1,085	0.49	2.0	0.74	0.08
22-Aug-13	662	1.65	0.0		
24-Sep-13	2,312	1.4	6.7	1.40	0.15
		Avg			1.1

Caldwell

The following table summarizes the monitoring location information for each Caldwell monitoring site. It should be noted that existing BMPs for the runoff areas vary widely, from none to ponds that almost eliminate surface discharge.

Table Caldwell 1 - Monitoring site information

Caldwell Monitoring Sites				
Site	Receiving Water	Drainage Area	C factor	Land Use Description
10th Ave-	Boise River	14.2 acres	.9	mainly freeway roadway
Skyway Drive	Mason creek	27.4 acres	.5 to pond and 0.2 at outfall	2006 Copper creek
12th AVE	Indian Creek	60.0 acres	0.5 with 1,000 gal S&G only	old part of town
	Mason creek	16.3 acres	0.5 to pond and 0.0 out of pond	Delaware park no 6

Caldwell total phosphorus (TP) stormwater loads (Table Caldwell-2) are calculated using measured precipitation and an estimated "C-Factor" as shown in the table. Thus, these loads are not directly comparable to loads calculated using ACHD and Nampa data. Note that concentrations are in the same range as Nampa data, while loads vary more widely and somewhat in proportion to the C-Factor.

Table Caldwell 2- Average Annual TP load (g/ac/d) for 2012 and 2013 monitoring sites

Monitoring Site	Area (ac)	Precip. Volume (in)	Runoff Volume (Est.) (in)	C-Factor (Est.)		TP Conc. (mg/L)	TP Load 24-hr (g/ac/d)	TP Load Annual (g/ac/d)
10th Ave	14.2	0.17	0.16	0.90		1.4	24.50	2.69
Skyway Dr	27.2	0.17	0.02	0.10		0.4	0.45	0.05
12th Avg	60	0.17	0.09	0.50		1.4	11.48	1.26
Average						**1.1**		**1.33**

Table Caldwell 3 - Caldwell Stormwater Monitoring Site Data and Loads:

Date	Total P	Est. Runoff cf	TP Load Event	Day	Annual
10th Ave	mg/L	cf	g/ac/ev	g/ac/24-hr	g/ac/d
4/16/2012	1.33	6,038	36.6	16.0	1.8
5/3/2012	0.48	8,825	20.8	8.4	0.9
10/22/2012	0.87	6,502	45.1	11.3	1.2
11/24/2012	2.63	13,934	134.9	73.1	8.0
3/20/2013	1.55	9,754	38.6	30.1	3.3
6/19/2013	1.53	12,076	126.3	36.8	4.0
9/2/2013	1.88	2,322	46.4	8.7	1.0
9/24/2013	1.25	4,645	39.7	11.6	1.3
	C- Factor =	0.90		**Avg**	**2.7**
Skyway Dr					
4/16/2012	0.78	1,293	2.4	1.0	0.12
5/3/2012	0.24	1,890	1.2	0.5	0.05
10/22/2012		1,392	0.0	0.0	0.00
11/24/2012		2,984	0.0	0.0	0.00
3/20/2013	0.35	2,089	1.0	0.8	0.08
6/19/2013	0.36	2,586	3.3	1.0	0.11
9/2/2013	0.29	497	0.8	0.2	0.02
9/24/2013	0.21	995	0.7	0.2	0.02
	C- Factor =	0.20		**Avg**	**0.05**
12th Avg					
4/16/2012	1.01	14,194	15.5	6.8	0.7
5/3/2012	1.00	20,746	24.1	9.8	1.1
10/22/2012	1.21	15,286	34.9	8.7	1.0
11/24/2012	0.84	32,756	24.0	13.0	1.4
3/20/2013	0.50	22,929	6.9	5.4	0.6
6/19/2013	2.58	28,389	118.5	34.6	3.8
9/2/2013	3.52	5,459	48.4	9.1	1.0
9/24/2013	0.89	10,919	15.7	4.6	0.5
	C- Factor =	0.50		**Avg**	**1.3**
	Average	**0.5**		**Average**	**1.3**

Appendix C - Dry Weather Loads Discharged from MS4s

Agricultural runoff, over-irrigation runoff, irrigation water, and groundwater discharges can discharge into the urban stormwater drainage systems and then discharge with stormwater during periods of rainfall runoff or without stormwater during dry weather periods.

These discharges are authorized if they are "uncontaminated" and/or they do not cause, or have the reasonable potential to cause or contribute to, an excursion above the Idaho water quality standards. Because these discharges are included under the NPDES permit they need to be identified and addressed within the TMDL.

Current data available for dry weather flows include sampling results from ACHD and Caldwell:

- ACHD Phase II data (available for years 2011 through 2014)
- Caldwell data for residential area developed in 1960s

Data from ACHD and the City of Caldwell were used to estimate dry weather loads (Table C1).

Table C1 – Average of dry weather data reported to EPA by permittees

Dry Weather Data Summary	TP Conc. (mg/L)	TP Load Annual (g/ac/d)
ACHD	0.095	2.4
Caldwell	0.146	5.0
Average of Average	**0.12**	**3.7**

Comparing the more recent data with the earlier data (Appendix E) indicates that groundwater can represent about 10 percent of the dry weather flows.

Permitted Dry Weather Flows

MS4 Permitted stormwater discharges can include "**Non-Storm Water Discharges"** if the water meets permit conditions. For example, the following is an excerpt from Middleton's NPDES Permit. The same language is found in all the Treasure Valley Phase II NPDES permits.

The permittee is not authorized to discharge non-storm water from the MS4, except where such discharges satisfy one of the following three conditions:

a) The non-storm water discharges are in compliance with a separate NPDES permit;

b) The non-storm water **discharges result from a spill and**:

(i) **are the result of an unusual and severe weather event** where reasonable and prudent measures have been taken to minimize the impact of such discharge; or

(ii) **consist of emergency discharges** required to prevent imminent threat to human health or severe property damage, provided that reasonable and prudent measures have been taken to minimize the impact of such discharges;

or

c) The non-storm water discharges satisfy each of the following two conditions:

(i) The discharges consist of uncontaminated water line flushing; potable water sources; landscape irrigation (provided all pesticides, herbicides and fertilizer have been applied in accordance with manufacturer's instructions); lawn watering; irrigation water; flows from riparian habitats and wetlands; diverted stream flows; springs; rising ground waters; uncontaminated ground water infiltration (as defined at 40 CFR § 35.2005(20)) to separate storm sewers; uncontaminated pumped ground water or spring water; foundation and footing drains (where flows are not contaminated with process materials such as solvents); uncontaminated air conditioning or compressor condensate; water from crawlspace pumps; individual residential car washing; dechlorinated swimming pool discharges; routine external building wash down which does not use detergents; street and pavement wash waters, where no detergents are used and no spills or leaks of toxic or hazardous materials have occurred (unless all spilled material has been removed); fire hydrant flushing; or flows from emergency firefighting activities;

and

(ii) The discharges are not sources of pollution to waters of the United States. A discharge is considered a source of pollution to waters of the United States for the purposes of this permit if it:

(a) Contains hazardous materials in concentrations found to be of public health significance or to impair beneficial uses in receiving waters. (Hazardous materials are those that are harmful to humans and animals from exposure, but not necessarily ingestion);

(b) Contains toxic substances in concentrations that impair designated beneficial uses in receiving waters. (Toxic substances are those that can cause disease, malignancy, genetic mutation, death, or similar consequences);

(c) Contains deleterious materials in concentrations that impair designated beneficial uses in receiving waters. (Deleterious materials are generally substances that taint edible species of fish, cause taste in drinking waters, or cause harm to fish or other aquatic life);

(d)Contains radioactive materials or radioactivity at levels exceeding the values listed in 10 CFR Part 20 in receiving waters;

(e) Contains floating, suspended, or submerged matter of any kind in concentrations causing nuisance or objectionable conditions or in concentrations that may impair designated beneficial uses in receiving waters;

(f) Contains excessive nutrients that can cause visible slime growths or other nuisance aquatic growths that impair designated beneficial uses in receiving waters;

(g) Contains oxygen-demanding materials in concentrations that would result in anaerobic water conditions in receiving waters; or

(h) Contains sediment above quantities specified in IDAPA 58.01.02.250.02.e or in the absence of specific sediment criteria, above quantities that impair beneficial uses in receiving waters, or

(i) Contains material in concentrations that exceed applicable natural background conditions in receiving waters (IDAPA 58.01.02.200. 09). Temperature levels may be increased above natural background conditions when allowed under IDAPA 58.01.02.401.

ACHD Phase II Data

Dry weather data collected from the Edgewood subdivision during 2012- May 2014 (Table C2) was used to calculate phosphorus loads for this comparatively small suburban catchment. Flows are relatively continuous with lowest reported flows generally occurring in winter.

Table C2 - Dry weather data collected from the Edgewood subdivision during 2011-May 2014

Site: Edgewood Eagle, Idaho	Receiving Water: Eagle Drain Drainage Area: 25 acres		
Date	**Discharge (cfs)**	**TP conc. (mg/L)**	**TP Load (g/ac/d)**
3/10/2011	0.28	0.095	2.59
4/4/2011	tricle, 0	0.097	0.00
5/7/2011	0.55	0.050	2.68
10/4/2011	0.77	0.082	6.18
12/27/2011		0.105	0.00
3/25/2012	0.064	0.097	0.60
5/2/2012	0.08	0.071	0.55
5/24/2012	1.05	0.082	8.38
10/15/2012	0.06	0.106	0.62
11/29/2012	0.121	0.118	1.40
2/21/2013	0.01	0.123	0.12
6/24/2013	0.55	0.075	4.04
11/15/2013	0.57	0.131	7.30
3/7/2014	trickle, 0	0.138	0.00
4/21/2014	0.17	0.076	1.27
5/8/2014	0.29	0.072	2.04
Average	0.35	0.095	2.36

The loads vary widely but average almost an order-of-magnitude higher than previously reported dry weather loads for the much larger catchments in Phase I permit area (see Tables E2 and E3 in Appendix E).

Graphs of the ACHD Phase II dry weather data (Figures C1 and C2) show how loads and concentrations change by month for three years. Note that lower loads generally occurred in non-growing season months and are associated with lower flows, while somewhat higher concentrations occurred in these winter months.

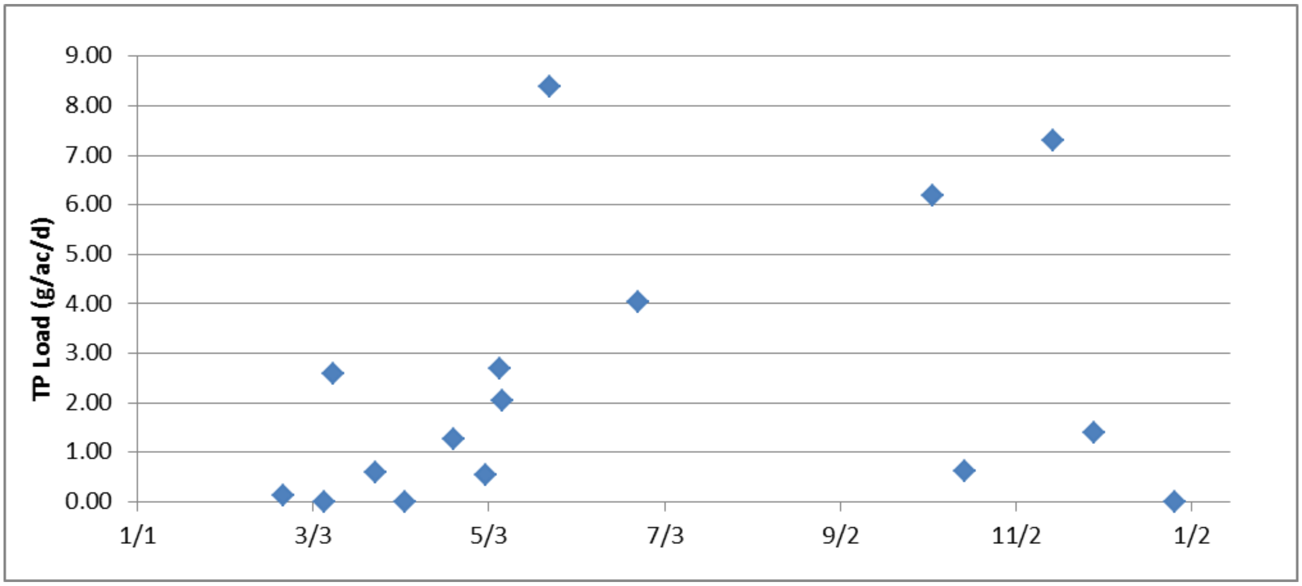

Figure C1 - Dry weather data loads by month for three years sampling.

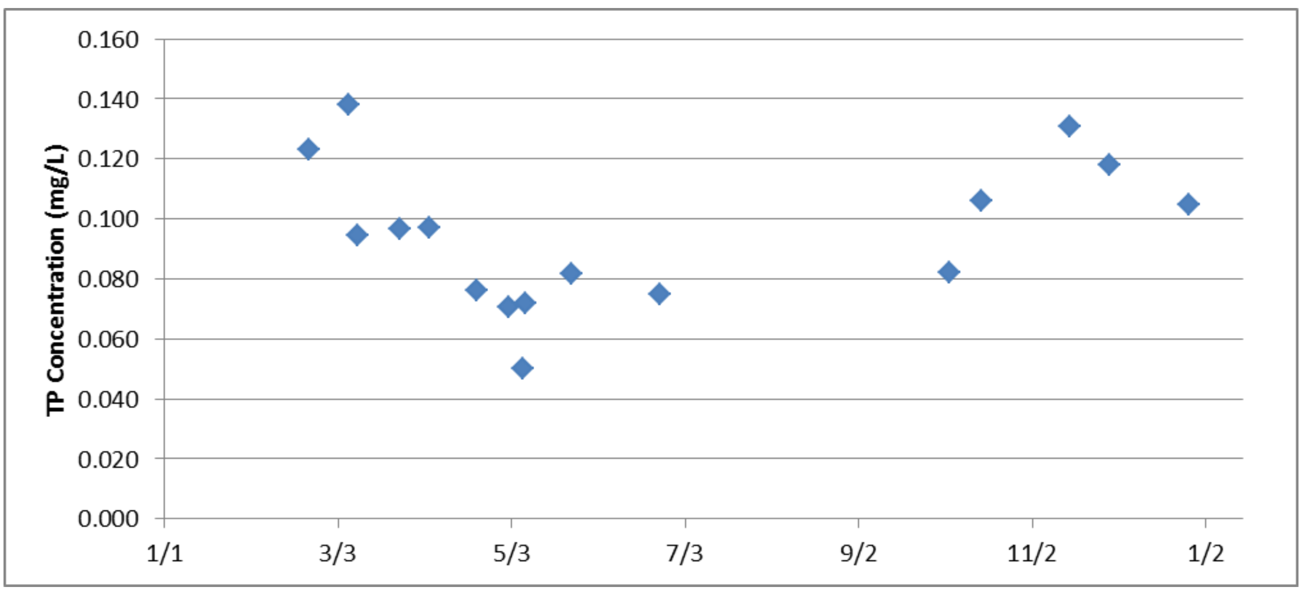

Figure C2 - Dry weather data concentrations by month for three years sampling.

Caldwell Data

Dry weather data was collected from a subdivision developed in the ~1960s. The drainage area is estimated to be 200 acres (rough est.).

Table C3 – Dry weather data collected from Caldwell subdivision

Date	Discharge (cfs)	TP (mg/L)	TP g/ac/d
6/28/2013	2.9	0.163	5.9
7/15/2013	2.8	0.150	5.1
7/26/2013	2.3	0.126	3.5
8/13/2013	3.1	0.144	5.4
Avg	2.8	0.146	5.0

Appendix D – Wet Weather May -Sep Fraction

Precipitation data collected at the Boise Airport from 1940 to 2012 is summarized in Table D.

Table D Precipitation data collected at the Boise Airport from 1940 to 2012 (NOAA 2014)

Station:(101022) BOISE WSFO AIRPORT														
From Year=1940 To Year=2012														
	Precipitation											Total Snowfall		
	Mean	High	Year	Low	Year	1 Day Max.		>= 0.01 in.	>= 0.10 in.	>= 0.50 in.	>= 1.00 in.	Mean	High	Year
	in.	in.	-	in.	-	in.	dd/yyyy or yyyymmdd	# Days	# Days	# Days	# Days	in.	in.	-
January	1.40	3.87	1970	0.12	1949	1.13	18/1953	12	5	0	0	6.2	21.4	1964
February	1.07	3.70	1986	0.18	1997	0.92	04/1951	10	4	0	0	3.3	25.2	1949
March	1.25	3.46	1989	0.17	1992	1.60	20/1981	10	5	0	0	1.6	11.9	1951
April	1.20	3.04	1955	0.09	1949	1.27	06/1969	9	4	0	0	0.5	8.0	1967
May	1.29	4.40	1998	0.00	1992	1.77	29/1990	8	4	0	0	0.1	4.0	1964
June	0.84	3.41	1941	0.01	1960	1.91	12/1958	6	3	0	0	0.0	0.0	1940
July	0.25	1.62	1982	0.00	1942	0.94	30/1960	2	1	0	0	0.0	0.0	1940
August	0.28	2.37	1968	0.00	1943	1.61	13/1979	2	1	0	0	0.0	0.0	1940
September	0.55	2.93	1986	0.00	1943	1.73	11/1976	4	2	0	0	0.0	0.0	1940
October	0.81	2.59	2000	0.00	1952	0.90	12/2000	6	3	0	0	0.1	2.7	1971
November	1.32	3.36	1988	0.14	1976	0.78	26/1971	10	5	0	0	2.0	18.6	1985
December	1.42	4.23	1983	0.09	1976	1.03	23/1955	11	5	0	0	5.8	26.2	1983
Annual	11.70	18.77	1983	6.64	1966	1.91	19580612	90	39	3	0	19.6	46.5	1964
Winter	3.90	6.45	1969	1.31	1977	1.13	19530118	33	13	1	0	15.3	43.3	1949
Spring	3.75	7.11	1980	0.83	1992	1.77	19900529	26	12	1	0	2.2	11.9	1951
Summer	1.38	4.13	1941	0.08	1966	1.91	19580612	11	4	1	0	0.0	0.0	1940
Fall	2.68	4.99	1940	0.40	1952	1.73	19760911	20	9	1	0	2.1	18.6	1985

Table updated on Oct 31, 2012

Appendix E – Previous TMDL Dry Weather Loads

Data used for the Lake Lowell TMDLs and the Boise River Implementation Plan (IDEQ 2008) were collected during ACHD Phase I monitoring in 2006 (Table E1). The original analyses (Table E2 and E3), which were dated June 26, 2007, were prepared by Jack Harrison during stormwater work group meetings.

These dry weather loads are based on samples collected bi-weekly for the period July 20, 2006 through September 27, 2006 (Table E4). These were relatively continuous flows and appear to be primarily associated with groundwater discharging from these urban/suburban areas.

Table E1 – summary of stormwater sampling locations with Dry Weather Flows

Station	Type	Land Use	Catchment Area (acres)	Receiving Water
Walnut	Dry	74% low-density residential 13% high-density residential 8% open space 5% commercial/industrial	369	Boise River
Lucky	Dry	100% low-density residential	233	Eagle Drain
Americana	Dry	34% Commercial/Industrial 66% High density residential	615	Boise River

Noted:

- The Americana storm drain system collects drainage from approximately 615 acres. Groundwater, surface flows from the foothills drainage Hulls Gulch, and overflows from the Boise City Canal are known sources of water in the Americana system.
- The Walnut storm drain system conveys drainage from approximately 369 acres in the dry season. Groundwater is also a significant source of flow in this system. The Walnut system is also influenced by water from the Boise City Canal.
- The Lucky Dry site collects drainage from approximately 233 acres. Flows appear to be composed primarily of groundwater while some contributions from the Farmers Union Canal and Boise Valley Canal are suspected

Table E2- Dry weather flows, concentrations and loads for three ACHD sampling locations. Groundwater discharges are the primary source of the dry weather flows.

Americana		
TP (mg/L)	Flow (cfs)	Load (kg/d)
0.15	0.37	0.16
Area ac)		615
Load (g/ac/day)		0.26
Walnut		
TP (mg/L)	Flow (cfs)	Load (kg/d)
0.03	0.87	0.06
Area ac)		369
Load (g/ac/day)		0.16
Lucky		
TP (mg/L)	Flow (cfs)	Load (kg/d)
0.16	0.44	0.16
Area ac)		233
Load (g/ac/day)		0.70

Table E3 - Average dry weather flows, concentrations and loads primarily associated with groundwater discharges.

Average		
TP (mg/L)	Flow (cfs)	Load (kg/d)
0.11	0.56	0.13
Area (ac)		406
Load (g/ac/day)		0.37

Table E4- DryWx:2 – ACHD Phase I data collected in 2006

Americana				Walnut				Lucky			
Date	TP (mg/L)	Flow (cfs)	Load (kg/d)	Date	TP (mg/L)	Flow (cfs)	Load (kg/d)	Date	TP (mg/L)	Flow (cfs)	Load (kg/d)
Median	0.15	0.37	0.16		0.03	0.92	0.06		0.08	0.84	0.16
7/20/2006	0.05	1.66	0.19	7/20/2006	0.06	0.24	0.03	7/20/2006	0.09	0.42	0.09
7/26/2006	0.07	1.15	0.18	7/26/2006	0.05	0.37	0.04	7/26/2006	0.17	0.40	0.17
7/27/2006	0.05	1.20	0.15	7/27/2006	0.04	0.42	0.04	7/27/2006	0.15	0.45	0.16
7/31/2006	0.06	1.00	0.14	7/31/2006	0.04	0.96	0.10	7/31/2006	0.18	0.31	0.13
8/3/2006	0.11	0.93	0.25	8/3/2006	0.03	0.60	0.05	8/3/2006	0.08	1.49	0.28
8/9/2006	0.20	0.47	0.22	8/9/2006	0.03	0.90	0.07	8/9/2006	0.16	0.38	0.15
8/10/2006	0.09	0.88	0.18	8/10/2006	0.04	0.88	0.08	8/10/2006	0.08	1.26	0.25
8/14/2006	0.27	0.39	0.26	8/14/2006	0.03	1.07	0.07	8/14/2006	0.16	0.43	0.16
8/17/2006	0.40	0.31	0.30	8/17/2006	0.02	1.59	0.10	8/17/2006	0.16	0.92	0.37
8/21/2006	0.17	0.48	0.20	8/21/2006	0.03	0.85	0.06	8/21/2006	0.16	0.52	0.20
8/23/2006	0.29	0.29	0.21	8/23/2006	0.03	0.86	0.06	8/23/2006	0.17	0.43	0.18
8/28/2006	0.14	0.32	0.11	8/28/2006	0.03	0.77	0.05	8/28/2006	0.16	0.38	0.15
8/30/2006	0.11	0.34	0.09	8/30/2006	0.03	0.98	0.07	8/30/2006	0.18	0.33	0.14
9/6/2006	0.29	0.23	0.16	9/6/2006	0.03	0.77	0.06	9/6/2006	0.16	0.24	0.09
9/11/2006	0.16	0.24	0.09	9/11/2006	0.03	0.85	0.07	9/11/2006	0.08	1.30	0.26
9/13/2006	0.16	0.32	0.13	9/13/2006	0.03	1.01	0.07	9/13/2006	0.16	0.31	0.12
9/18/2006	0.12	0.45	0.13	9/18/2006	0.03	0.76	0.05	9/18/2006	0.07	0.86	0.15
9/20/2006	0.12	0.33	0.10	9/20/2006	0.05	1.14	0.14	9/20/2006	0.08	0.82	0.15
9/25/2006	0.15	0.24	0.09	9/25/2006	0.05	0.99	0.11	9/25/2006	0.07	1.01	0.16
9/27/2006	0.18	0.24	0.10	9/27/2006	0.02	1.00	0.06	9/27/2006	0.06	1.78	0.25
MEAN	**0.16**	**0.57**	0.22		**0.03**	**0.85**	0.07		**0.13**	**0.70**	0.22

Appendix D. AQUATOX Modeling Analysis

Table D-1. Summary of AQUATOX model inputs for the final TMDL allocation scenario.

Input	Flow	Total Phosphorus (adjusted)[a] (mg/L)
Upstream Background	2012–13 flow balance	0.01
Boise River—Main Stem		
Lander	2012–13 flows + loads for 15 mgd	May–Sept. 0.1 (0.12) Oct.–Apr. 0.35 (0.43)
West Boise	2012–13 flows + loads for 24 mgd	May–Sept. 0.1 (0.15) Oct.–Apr. 0.35 (0.57)
Middleton	2012–13 flows + loads for 1.83 mgd	May–Sept. 0.1 (0.3) Oct.–Apr. 0.35 (1.44)
Caldwell	2012–13 flows + loads for 8.5 mgd	May–Sept. 0.1 (0.11) Oct.–Apr. 0.35 (0.52)
IDFG Eagle	2012–13 flows + loads for 4.25 mgd	May–Sept. 0.1 (0.1) Oct.–Apr. 0.1 (0.14)
Tributaries		
Fifteenmile Creek—Meridian	2012–13 flows + loads for 10.2 mgd	May–Sept. 0.07 (0.074) Oct.–Apr. 0.07 (0.146)
Mill Slough—Star	2012–13 flows + loads for 1.85 mgd	May–Sept. 0.07 (0.071) Oct.–Apr. 0.07 (0.084)
Mason Creek—Sorrento	2012–13 flows + loads for 1.52 mgd	May–Sept. 0.07 (0.070) Oct.–Apr. 0.07 (0.080)
Indian Creek— Nampa Kuna IDFG Nampa ConAgra	2012–13 flows + loads for 18.0 mgd + loads for 3.5mgd + loads for 19.38 mgd + loads for 0.48 mgd	May–Sept. 0.07 (0.089) Oct.–Apr. 0.07 (0.132)
Conway Gulch—Notus	2012–13 flows +loads for 0.11 mgd	May–Sept. 0.07 (0.070) Oct.–Apr. 0.07 (0.072)
Dixie Drain— Wilder Greenleaf	2012–13 flows + loads for 0.25 mgd + loads for 0.24 mgd	May–Sept. 0.07 (0.070) Oct.–Apr. 0.07 (0.072)
All other tributaries	2012–13 flows	Year-round 0.070
Ground Water and Unmeasured Flows		
Segment 4 (Dry Creek)—Avimor	2012–13 flows + loads for 0.42 mgd	May–Sept. 0.03 Oct.–Apr. 0.05
Segment 10—Darigold	2012–13 flows + loads for 1.7 mgd	May–Sept. 0.07 (0.07) Oct.–Apr. 0.07 (0.09)
All other ground water, unmeasured flows, nonstormwater, stormwater	2012–13 flows	Year-round 0.07 mg/L TP + stormwater and nonstormwater loads
Sediment (Total Suspended Sediment)	37% reduction in all segments	

[a] All NPDES-permitted facilities set to loading equivalent for design flows of 0.1 mg/L TP May 1–September 30 and 0.35 mg/L TP October 1–April 30 (except the Eagle and Nampa IDFG facilities set to loading equivalent of 0.1 mg/L TP year-round). Stormwater (wet weather) TP loading to ground water/unmeasured flows was set to an average 42% reduction. A 0.5 correction was modeled to more accurately represent the effect of wet weather TP concentration and load spikes on monthly periphyton growth. All tributaries, ground water, and stormwater (dry weather) were set to the loading equivalents of 0.07 mg/L TP year-round; however, TP loadings are adjusted for those tributaries and segments where increased TP loading is attributed to POTW facilities and/or stormwater (wet weather) loads.

Table D-2. Summary of final TMDL scenario results for TP targets in model segment 13 (near Parma).

Criteria	Results (mg/L)
May 1–September 30	
Seasonal average TP ≦0.07 mg/L at Parma	Mean TP = 0.06 Median TP = 0.06 Max TP = 0.12
October 1–April 30	
Seasonal average TP mg/L at Parma	Mean TP = 0.08 Median TP = 0.09 Max TP = 0.20

Table D-3. Summary of TMDL scenario results for mean monthly periphyton chlorophyll *a* targets.

Month	Mean Monthly Periphyton (mg/m^2)				
	Seg 9	Seg 10	Seg 11	Seg 12	Seg 13
January	1.1	1.0	0.7	0.7	0.6
February	14.0	16.8	6.8	6.6	5.0
March	15.8	21.2	12.3	8.7	12.6
April	1.7	2.2	1.0	0.8	1.5
May	0.7	1.1	2.1	0.4	1.3
June	0.7	2.9	44.1	0.7	4.5
July	0.7	35.5	118.8	1.2	30.2
August	0.6	195.8	79.3	14.2	69.4
September	7.9	114.3	153.3	29.9	90.6
October	68.8	110.8	98.8	88.1	73.1
November	87.3	93.2	121.4	62.7	122.7
December	50.4	68.8	34.4	37.8	50.6
Mean Monthly Periphyton ≥ 150 mg/m^2	**0%**	**8%**	**8%**	**0%**	**0%**

Table D-4. Summary of TMDL scenario results for mean monthly TP concentrations.

Month	Mean Monthly TP Concentration (mg/L)				
	Seg 9	**Seg 10**	**Seg 11**	**Seg 12**	**Seg 13**
January	0.09	0.10	0.10	0.10	0.10
February	0.08	0.09	0.09	0.09	0.09
March	0.06	0.08	0.07	0.07	0.07
April	0.05	0.06	0.06	0.05	0.05
May	0.03	0.03	0.03	0.04	0.04
June	0.04	0.05	0.05	0.05	0.05
July	0.05	0.05	0.05	0.06	0.06
August	0.06	0.07	0.07	0.07	0.07
September	0.07	0.08	0.08	0.08	0.08
October	0.09	0.10	0.10	0.09	0.09
November	0.09	0.11	0.10	0.10	0.10
December	0.10	0.11	0.11	0.11	0.11
Mean Monthly TP Concentration > 0.1 mg/L	**0%**	**17%**	**8%**	**8%**	**8%**

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Appendix E. Public Participation and Public Comments

DEQ has consulted and coordinated with the Lower Boise Watershed Council (LBWC) during regular and frequent intervals toward developing a nutrient TMDL since the river was listed as impaired by nutrients in the 1998 §303(d) list from Star to the mouth and again after the final SR-HC TMDL was approved by EPA in September 2004.

Since revitalizing this specific TMDL effort in March 2012, DEQ has consulted, coordinated, and met with the Southwest Basin Advisory Group (BAG), LBWC, technical advisory committee (TAC) and other workgroups, EPA, USGS, and other interested stakeholders in more than 100 meetings, of which, nearly all were open and announced to the public. This continual stakeholder participation was, and will be, critical before, during, and after the public comment period in June 2015 and in the subsequent TMDL implementation. In addition to these meetings, DEQ also kept the public apprised of progress by posting specific TMDL-related information on the DEQ Lower Boise River Watershed Advisory Group webpage: *www.deq.idaho.gov/regional-offices-issues/boise/basin-watershed-advisory-groups/lower-boise-river-wag*. The meetings and presentations included, but were not limited to, the following:

1. April 6, 2012, LBWC TAC
2. April 12, 2012, LBWC
3. May 10, 2012, LBWC
4. June 14, 2012, LBWC
5. June 19, 2012, LBWC TAC
6. July 12, 2012, LBWC
7. July 26, 2012, LBWC TAC
8. August 23, 2012, LBWC TAC
9. September 13, 2012, LBWC
10. September 27, 2012, LBWC TAC
11. October 11, 2012, LBWC
12. October 25, 2012, LBWC TAC
13. November 8, 2012, LBWC
14. November 28, 2012, Modeling Workgroup
15. November 29, 2012, LBWC TAC
16. January 3, 2013, LBWC TAC
17. January 10, 2013, LBWC
18. January 16, 2013, BAG
19. January 17, 2013, Modeling Workgroup
20. January 24, 2013, LBWC & TAC Combined
21. February 14, 2013, LBWC
22. February 21, 2013, Modeling Workgroup
23. February 28, 2013, LBWC TAC
24. March 14, 2013, LBWC
25. March 21, 2013, Modeling Workgroup
26. April 2, 2013, Modeling Work Session
27. April 4, 2013, LBWC TAC
28. April 9, 2013, Modeling Work Session
29. April 11, 2013, LBWC
30. April 16, 2013, Modeling Work Session
31. April 23, 2013, Modeling Work Session
32. April 25, 2013, LBWC TAC
33. April 30, 2013, Modeling Work Session
34. May 2, 2013, LBWC TAC
35. May 9, 2013, LBWC
36. May 14, 2013, Modeling Work Session
37. May 23, 2013, LBWC TAC
38. May 28, 2013, Modeling Work Session
39. June 3, 2013, Ada Soil Conservation District
40. June 11, 2013, Modeling Work Session
41. June 11, 2013, Canyon Soil Conservation District
42. June 13, 2013, LBWC
43. June 18, 2013, Model Work Session
44. June 25, 2013, Model Work Session
45. June 27, 2013, LBWC TAC
46. July 2, 2013, Model Work Session
47. July 9, 2013, Model Work Session
48. July 11, 2013, LBWC
49. July 16, 2013, Model Work Session
50. July 18, 2013, LBWC Monitoring TAC
51. July 23, 2013, Model Work Session
52. July 25, 2013, LBWC TAC
53. August 6, 2013, Model Work Session
54. August 13, 2013, Model Work Session
55. August 22, 2013, LBWC TAC

56. August 22, 2013, DEQ Water Quality Trading Open House
57. August 27, 2013, Model Work Session
58. September 3, 2013, Model Work Session
59. September 10, 2013, Model Work Session
60. September 12, 2013, LBWC
61. September 24, 2013, Model Work Session
62. September 26, 2013, LBWC TAC
63. October 10, 2013, LBWC
64. October 15, 2013, Model Work Session
65. October 22, 2013, Model Work Session
66. October 24, 2013, LBWC TAC
67. November 5, 2013, Model Work Session
68. November 14, 2013, LBWC
69. November 26, 2013, Model Work Session
70. December 3, 2013, Model Work Session
71. December 19, 2013, Model Work Session
72. January 9, 2014, LBWC
73. January 21, 2014, Model Work Session
74. January 23, 2014, LBWC TAC
75. February 13, 2014, LBWC
76. February 18, 2014, Model Work Session
77. February 26, 2014, LBWC TAC
78. February 27, 2014, Idaho Association of Commerce and Industry
79. March 12, 2014, Ada County Highway District
80. March 13, 2014, LBWC
81. March 17, Treasure Valley Partnership
82. April 3, 2014, LBWC TAC
83. April 10, 2014, Small Municipalities of the Treasure Valley
84. April 10, 2014, LBWC
85. April 15, 2014, Model-Techno-Policy Workgroup
86. April 16, 2014, BAG
87. April 24, 2014, LBWC TAC
88. April 25, 2014, LBWC Stormwater
89. April 30, 2014, Model-Techno-Policy Workgroup
90. May 8, 2014, LBWC
91. May 14, 2014, Model-Techno-Policy Workgroup
92. May 28, 2014, Model-Techno-Policy Workgroup
93. May 29, 2014, LBWC TAC
94. June 11, 2014, Model-Techno-Policy Workgroup
95. June 12, 2014, LBWC
96. July 9, 2014, Model-Techno-Policy Workgroup
97. July 10, 2014, LBWC
98. July 23, 2014, Model-Techno-Policy Workgroup
99. July 30, 2014, LBWC TAC
100. August 11, 2014, LBWC Stormwater
101. August 19, 2014, LBWC Stormwater
102. August 22, 2014, Amalgamated Sugar
103. September 11, 2014, Treasure Valley Partnership
104. September 12, 2014, LBWC Stormwater
105. September 24, 2014, LBWC TAC
106. October 9, 2014, LBWC
107. December 4, 2014, LBWC TAC
108. December 11, 2014, LBWC
109. December 12, 2014, LBWC Stormwater
110. January 8, 2015, LBWC
111. January 21, 2015, LBWC TAC
112. February 12, 2015, LBWC
113. March 12, 2015, LBWC
114. March 12, 2015, LBWC TAC
115. April 9, 2015, LBWC TAC
116. April 9,2015, LBWC
117. May 14, 2015, LBWC TAC
118. May 14, 2015, LBWC
119. June 11, 2015, LBWC TAC

<table>
<tr><td colspan="3">Comments and Response Table</td></tr>
<tr><td colspan="3">07/06/2015 Ada County Highway District (ACHD)</td></tr>
<tr><td>Comment #</td><td>Section</td><td>Comment</td></tr>
<tr><td>1</td><td>Pg. xx</td><td>“if it appears that full support of beneficial uses in the lower Boise River is not being attained during the 5-year review or subsequent post-TMDL implementation,…”
How would DEQ define non-support? Is it based on periphyton levels above 150mg/m2 and if so, how often/how many exceedances?</td></tr>
<tr><td colspan="3">Response: Limited exceedances above the 150 mg/m2 target may be acceptable, so long as they do not impair the beneficial uses. This is a numeric target (150mg/m²) for meeting a narrative standard. The TMDL Implementation Plan will help to develop the appropriate spatial and temporal criteria for monitoring the periphyton growth. Therefore, DEQ will assess the effectiveness of the TMDL implementation based on how the numeric targets relate to the narrative criteria. Continued monitoring and reassessment during the 5-year review will determine an allowable exceedance frequency that is sufficient to maintain full support of beneficial uses.</td></tr>
<tr><td>2</td><td>Pg. xx</td><td>“…other habitat measures may be considered to further reduce periphyton growth.”
What other measures would be used; could examples be cited?</td></tr>
<tr><td colspan="3">Response: Other habitat measures considered during the five-year review would include mechanisms other than TP that are determined to be contributing to favorable conditions for periphyton growth. Examples may include but are not limited increasing water depth by decreasing the channel width/depth, increasing riparian shade, and increasing the channel complexity by adding sinuosity and pools. Habitat characteristics will be assessed during the 5-year review of observed conditions, and is not being determined prior to implementation of this TMDL.</td></tr>
<tr><td>3</td><td>Pg. xix,
Table B</td><td>Current dry weather and Current wet weather concentrations (0.44mg/l) are listed as the same. The data submitted by Stormwater workgroup is not consistent with this concentration. A footnote in the table is necessary to explain how this concentration was determined. It looks like wet weather and dry weather concentrations were averaged ((.75 +.12)/2=.435mg/l)</td></tr>
<tr><td colspan="3">Response: The data submitted by the stormwater workgroup for dry and wet weather concentrations were averaged in order to provide a broader and more robust estimate given the low number of data points and high variability. DEQ did use the wet and dry TP loads (lbs/day) and seasonal flows (cfs) provided by the Stormwater workgroup. A footnote was added to Table B.</td></tr>
</table>

<table>
<tr><td>4</td><td>Pg. 5, Figure 1</td><td>Assessment Unit titled “Tenmile Creek” appears to be inaccurate. It should be “Fifteenmile Creek”.</td></tr>
<tr><td colspan="3">Response: Thank you for your comment. Revised to Tenmile Creek-Fifteen mile Creek.</td></tr>
<tr><td>5</td><td>Pg. 38 (Table 9), and
Pg. 95 (Table 29)</td><td>Footnotes for Canyon Highway District, Nampa Highway District, and Notus-Parma Highway District are labeled incorrectly. They should have footnote of “a” instead of “c”.</td></tr>
<tr><td colspan="3">Response: Thank you for your comment. Revised tables accordingly.</td></tr>
<tr><td>6</td><td>Pg. 40</td><td>Idaho Transportation Department, District 3</td></tr>
<tr><td colspan="3">Response: Thank you for your comment. Revised accordingly.</td></tr>
<tr><td>7</td><td>Pg. 40</td><td>“This information does not represent entities with active stormwater management programs or policies, such as retention onsite, within, or outside of permitted areas but not under the regulation of MS4 permits”
This text is very confusing. The meaning is unclear.</td></tr>
<tr><td colspan="3">Response: Thank you for your comment. Text was revised for clarity.</td></tr>
<tr><td>8</td><td>Pg. 96, Figure 27</td><td>What is the purpose of a figure showing TP concentration targets? Table 29 states DEQ intends wasteload allocation to be expressed as percent load reduction in NPDES permits. The inclusion of Figure 27 creates confusion by adding TP target concentrations to the discussion.</td></tr>
<tr><td colspan="3">Response: Although the stormwater wasteload allocations are expressed as a percent load reduction in the NPDES permits, the TMDL TP target in the lower Boise River near Parma is expressed as a concentration (≤ 0.07). The purpose of Figure 27 is to illustrate how stormwater TP load reduction targets are projected to also reduce the TP concentrations, if stormwater flow conditions remained the same. Since the TMDL target is concentration based it is important to show that load reductions will correlate to concentration reductions.</td></tr>
<tr><td>9</td><td>Pg. 100, 5th Paragraph</td><td>(i.e., portions of Meridian, Eagle, and unincorporated urbanized Ada County ~~and southwest Boise~~)
Southwest Boise is part of unincorporated, urbanized Ada County.</td></tr>
<tr><td colspan="3">Response: Thank you for your comment. Revised text accordingly.</td></tr>
</table>

10	Pg. 100, 5th Paragraph	*"These permitted areas receive a are included as load wasteload allocations in the TMDL….* Paragraph is incorrect as written. These areas are covered under an NPDES permit and therefore receive a wasteload allocation. The paragraph is confusing. Permittees are not determined by area, but by who is the owner/operator of the MS4 in the urbanized area.
Response: Thank you for your comment. Text was revised for clarity.		
11	Pg. 101, Table 30	Use same table as the one included in *Lower Boise River TMDL Addendum* (tributary TMDL), Table 30 (Page 53). The "Facility" information as listed in Table 30 (page 101) is incorrect.
Response: Thank you for your comment. Table was revised.		
12	Pg. 107 (Table 33), Pg. 112 (Table 36)	Why is Stormwater Wet Weather Percent Reduction listed as 43%? All other references in document list reduction at 42%
Response: Thank you for your comment. They are actually different. Summer WWx reductions came out to 42%, whereas winter WWx reductions came out to 42.9% (43).		
13	Pg. 118, last paragraph	*EPA Gold ~~G~~Book*
Response: Thank you for your comment. Text was revised accordingly.		
07/06/2015 US Environmental Protection Agency (EPA)		
1	General	The first thing to say about this effort is that the Environmental Protection Agency commends IDEQ for the open and thorough way that the staff worked through the inputs to the AQUATOX model and developed consensus among the stakeholders. Every step of the way decisions made in the development of this TMDL were fully vetted and explained to the Watershed Advisory Group, EPA, and all concerned. This open approach contributed in a major way to the successful completion of this document.
Response: Thank you for your comment.		

<table>
<tr><td>2</td><td>pages xvi-xvii (see also Page 133)</td><td> “This addendum relies on a stated implementation strategy as referenced in US Environmental Protection Agency’s phased TMDL clarification memo (EPA 2006). The staged implementation strategy for the Lower Boise River acknowledges that National Pollutant Discharge Elimination System (NPDES)-permitted point sources will strive to achieve the TMDL target as soon as possible but can be given up to two permit cycles (10 Years from the approval of the TMDL) to achieve their wasteload allocations.” This statement conflates “staged implementation” as described in the clarification memo (link below) with compliance schedules in NPDES permits, when, in fact, those are separate and distinct. It’s good that they used the phrase “as soon as possible” to describe the schedule for NPDES permitted sources, but, as written, this makes it seem as if this is something that’s articulated in the clarification memo when, in fact, it’s a regulatory requirement that would apply whether or not there was a TMDL and regardless of any implementation schedule associated with the TMDL (40 CFR 122.47). I suggest they add the regulatory citation for “as soon as possible.” I also suggest they delete the language about “up to two permit cycles” or “10 years.” A TMDL is not the place to make a judgment as to the amount of time necessary to achieve a WQBEL in a permit. http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/tmdl_clarification_letter.cfm </td></tr>
<tr><td colspan="3"> Response: Thank you for your comment. Revised text to state: This addendum relies on a staged implementation strategy as referenced in the US Environmental Protection Agency’s (EPA’s) phased TMDL clarification memo (EPA 2006). The staged implementation strategy for the lower Boise River acknowledges that National Pollutant Discharge Elimination System (NPDES)-permitted point sources will strive to achieve the TMDL target as soon as possible through compliance schedules that will be written into the NPDES permits consistent with 40 CFR 122.47. </td></tr>
<tr><td>3</td><td>Page xxix (see also Page 119)</td><td>Figure D would be more clear if the x-axis listed the modeled TP concentration or load from point sources (which is the main thing that changes between different modeling scenarios), instead of the model scenario numbers (which are arbitrary).</td></tr>
<tr><td colspan="3">Response: Thank you for your comment. DEQ felt that this edit would complicate the figure because the x axis values (scenarios) represent facilities, and nonpoint sources; and also include summer/winter period allocations. The x axis label would be too complicated to describe. A reference to the full scenario descriptions was added to the Figure caption.</td></tr>
<tr><td>4</td><td>Pg. 22</td><td>In the second paragraph of Section 2.4.1, I think the authors may have meant to say “total phosphorus” when they said “orthophosphate.”</td></tr>
<tr><td colspan="3">Response: The meaning of the paragraph is as written. To address the comment concerns about total phosphorus, additional text was inserted to clarify.</td></tr>
</table>

5	Pg. 138	The last sentence in the first paragraph states, "*For water quality trading to be authorized, it must be specifically mentioned within a TMDL document*." This is not actually correct. EPA's most recent draft TMDL guidance (2012) says that existing TMDLs don't need to be reopened to authorize trading. Therefore, while it is best to mention trading in a new TMDL, it isn't necessarily a requirement. The fact that a TMDL does need to exist before trading occurs is still a true statement.
Response: Thank you for your comment. The sentence was removed from TMDL.		
6	General	Earlier drafts of the Lower Boise River TMDL included TMDLs for Mason Creek and Sand Hollow Creek. These TMDLs were removed from the current draft TMDL document. These seemed to be appropriate TMDLs for impaired waters on the 303(d) List of Impaired Waters. It seems like the exclusion of these TMDLs will result in extra effort and additional expense to the taxpayers to re-evaluate what is already known. New reports will have to be developed and the public process will need to be done all over again.
Response: DEQ appreciates your concerns. Because Mason Creek is not the only impaired tributary to the Boise River, DEQ believes that it would be more appropriately addressed in a separate watershed plan along with the other listed tributaries to the Lower Boise River (LBR) including Indian Creek, Tenmile Creek, and Fivemile Creek. A watershed plan is currently required for the tributaries to the lower Boise River that are impaired, thus adding the work that has been completed for Mason Creek is not expected to result in extra effort. Additionally, Mason Creek and other tributaries to the lower Boise River are listed differently in the Integrated Report ("cause unknown, nutrients suspected") than the lower Boise River which is listed for TP. Addressing all the tributaries to the lower Boise River with the same listing in one watershed plan is appropriate and efficient. Sand Hollow Creek was removed from the TMDL because it is a tributary to the Snake River, and thus should be addressed in a separate TMDL Addendum to the Snake River Hells Canyon TMDL. A Separate plan will be completed to address the tributaries to the LBR that are impaired for cause unknown—nutrients suspected. Additionally, a separate plan will be completed to address the cause unknown—nutrients suspected impairment in Sand Hollow Creek. Although Mason Creek was removed from the TMDL, it will maintain an allocation at the mouth of 0.07 mg/L year-around corresponding with 56 lbs/day May-Sept and 29 lbs/day Oct-Apr. Sand Hollow Creek, because it is a tributary to the Snake River and not the LBR, will have an allocation of 0.07 mg/L May-Sept and 53 lbs/day. Even with this not being a TMDL for Mason Creek, the loading analysis and allocations for Mason Creek did not change for winter or summer months. Because the loading analysis and allocations for Mason Creek were included in this LBR TMDL, trading in that watershed was not jeopardized. Sand Hollow Creek was completely removed from this TMDL and is more appropriately addressed in addendum to the Snake River Hells Canyon TMDL.		
7	General	The October through April chlorophyll a target of <=150 mg/m^2 is stated to be a monthly mean target. Many states use this concentration as a not to exceed level for periphyton chlorophyll a. What is the reason for making this a mean target?

Response: The states that use this concentration as a "not to exceed" level do not include year around targets for chlorophyll-a (typically only June or July through September), as is the case in the lower Boise River. In addition, literature suggests nuisance aquatic algae become apparent between 100 and 200 mg/m^2 (Welch et al. 1988), therefore DEQ felt that a mean target of ≤ 150 mg/m^2 was appropriate.		
07/01/2015 City of Nampa		
1	General	The City appreciates the DEQ's diligence and hard work in completing this important document. The City supports the DEQ's goal of improving water quality in the Lower Boise River watershed.
Response: Thank you for your comment.		
2	General	The City supports the use of an adaptive management approach throughout the Lower Boise River TMDL development. Given the limited data set for many key inputs, variability of stormwater data, and calibration of the AQUATOX model, the results of the AQUATOX model should be used in a multiple lines of evidence approach in the TMDL. The AQUATOX model is an important tool that can help us understand the sensitivity of periphyton to specific inputs but should not necessarily be used for the direct calculation of wasteload allocations. The results of this modeling effort and resulting wasteload and load allocations should continue to be compared to changes in the Lower Boise River, and the allocations should be adjusted when needed to meet water quality goals.
Response: Wasteload allocations were calculated outside of the AQUATOX model and were provided as inputs to the model. Wasteload allocations were determined by the USGS mass balance model as well as flow and water quality duration curves based on historical data. Multiple lines of evidence were used in the development of this TMDL; historical data (USGS, ISDA), AQUATOX Model, and 2012-13 USGS synoptic sampling. The 5-Year review process will be used to evaluate the wasteload allocations and their effectiveness at meeting the water quality goals.		
3	General	The City strongly supports the concept of water quality trading as a viable method for meeting water quality goals. While the TMDL is not the correct vehicle for detailing the exact implementation of this approach, which should be discussed in a Trading Framework, the City appreciates the DEQ's inclusion of water quality trading as a potential implementation approach for reducing point and non-point source discharges. Furthermore, the City would encourage the DEQ to continue to support and investigate both water quality trading and integrated water management approaches as viable options for meeting water quality goals.
Response: Thank you for your comment.		
4	2.4.4 (pg. 33) Table 6	The City recommends the addition of modeling as an additional option for more accurately representing and characterizing groundwater, stormwater, and nonstormwater flows in future documents.

<table>
<tr><td colspan="3">Response: DEQ anticipates that additional data will be collected by permittees and plans to include any newly collected data in the 5-year review.</td></tr>
<tr><td>5</td><td>4 (pg. 51)</td><td>The first sentence of the first paragraph states:
"Information concerning pollution control efforts for POTWs, urban and suburban storm drainage, and agricultural and other nonpoint sources (including rural roads, septic systems, and sewer lines) can be found in the 2013 Phase I and 2009 Phase II permits."
The permits referenced are MS4 permits, and, therefore, do not pertain to all of the sectors listed. Please revise this description. Additionally, this section appears to be lacking an introduction. Please add an introduction to provide context.</td></tr>
<tr><td colspan="3">Response: Thank you for your comment. Revised first sentence to include all NPDES permits and added an introduction.</td></tr>
<tr><td>6</td><td>3.1.2 (Pg. 52)
Table 8</td><td>The Clean Water Act lists the allowable non-stormwater discharges included in permits. It is suggested that this serve as the basis for the data in Table 8 rather than referring to a typical permit, which may not be applicable to all permit holders. The text in this section should be updated to match this reference as well.</td></tr>
<tr><td colspan="3">Response: IDEQ declines to make the changes requested by the commenter. The federal National Pollutant Discharge Elimination System (NPDES) regulations establish the categories of “allowable non-stormwater discharges” which can flow through a regulated MS4, provided such discharges are not identified as sources of pollutants, nor deemed to be significant contributors of pollutants, to waters of the United States. [See 40 CFR 122.26(d) (2) (iv) (B) (1)), and 40 CFR 122.34(b) (3) (iii), respectively.] Since 2006, IDEQ has incrementally consulted with the U.S. Environmental Protection Agency, Region 10 (EPA) – (in EPA’s capacity as the NPDES Permitting Authority for the State of Idaho) to refine the categories of “allowable non-stormwater discharges” cited in Idaho’s MS4 permits to ensure consistency with the Idaho water quality standards and respond to public input. The categories of “allowable non-stormwater discharges” listed in Table 8 of the LBR TMDL are fully consistent with the federal regulations and interagency discussions between EPA and IDEQ.</td></tr>
<tr><td>7</td><td>5.1.2 (Pg. 65)</td><td>The City supports DEQ's approach to establish the appropriate exceedance frequency as a part of the 5 year review. As a starting point, it is suggested that the toxics exceedance criteria (i.e. 1 in 3 year frequency) be used as an upper limit for this frequency as the periphyton target is aesthetics-based. The City believes that an exceedance frequency of 1 in 3 years for the periphyton target would support beneficial uses while not overly burdening dischargers.</td></tr>
<tr><td colspan="3">Response: Limited exceedances above the 150 mg/m^2 concentration may be acceptable, so long as they do not impair the beneficial uses. This is a numeric target for meeting a narrative standard. Therefore, DEQ will assess the effectiveness of the TMDL implementation based on how the numeric targets relate to the narrative criteria. Continued monitoring and reassessment during the 5-year review will determine an allowable exceedance frequency that is sufficient to maintain full support of beneficial uses.</td></tr>
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<tr><td>8</td><td>5.3.1.3 (Pg. 75)</td><td>Additional modeling may be an alternative means to better define existing stormwater loads. Along these lines, the City suggests that the last sentence of the first paragraph be modified as follows:
"This known uncertainty will be addressed during implementation planning through additional monitoring, modeling, and further characterization of stormwater."</td></tr>
<tr><td colspan="3">Response: Thank you for your comment. Revised text to state which may include additional modeling.</td></tr>
<tr><td>9</td><td>5.3.2 (Pg. 83)</td><td>The City agrees with the DEQ's approach for separating wet weather and dry weather (i.e., agricultural return and groundwater) loads. It is the City's view that the dry weather flows are allowable as non-contaminated flows under its current NPDES permit. However, the City does not have and does not intend to implement any method for controlling these flows outside of routine maintenance. The City assumes that background water quality conditions for dry weather flows are allowable discharges, will be managed as a load allocation, and are not included in the waste load allocation for the MS4.</td></tr>
<tr><td colspan="3">Response: Comment noted. Using the information available, DEQ has estimated pollutant loading occurring through regulated MS4 discharges during dry weather. DEQ concurs that certain types of uncontaminated groundwater and irrigation water are “authorized non-stormwater discharges” under the current MS4 permit(s) for Nampa and other regulated MS4 entities. While MS4 operators are not obligated to implement controls for such irrigation and ag return flows, DEQ’s analysis supports the implementation of additional, new actions by MS4 permitees specifically, to identify all existing MS4 outfalls discharging during dry weather, and to sufficiently characterize such flows to identify the type and source of such flows, including to confirm whether such groundwater and/or irrigation water flows are indeed “uncontaminated.” DEQ expects such actions to be required by the applicable MS4 permit(s) to be issued in the future by the EPA.</td></tr>
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<tr><td>10</td><td>5.4.1.3
(Pg. 94)</td><td>The City recommends that the DEQ evaluate methods for separating stormwater baseflow in order to identify the dry weather flows as part of the 5 year review. For example, the following two public-domain tools can separate base flow:

• Web-Based Hydrograph Analysis Tool (WHAT) - https://wiki.epa.gov/watershed2/index.php/Web-Based_Hydrograph_AnalysisTool _(WHAT)
• PART - http://water.usgs.gov/ogw/part/

Along these lines, it is suggested the following being added to the first paragraph in Section 5.4.1.3 NPDES-Permitting Municipal Stormwater and Nonstormwater:

"Stormwater (wet weather) allocations were derived from data provided by the LBWC stormwater workgroup (Appendix C) through several meetings and correspondence. The stormwater load estimates were not derived from the AQUATOX or mass balance models; therefore, refinements should be made as additional characterization information becomes available. For example, analytical methods for separating stormwater baseflow would allow for the refinement of the dry weather flow estimates. Further, these TP wasteload and load allocations may need to be adjusted to reflect MS4 boundary and land use changes in the subbasin."</td></tr>
<tr><td colspan="3">Response: Thank you for your comment. Added text as stated.</td></tr>
<tr><td>11</td><td>5.4.1
(Pg. 98)</td><td>The rationale and feasibility of the assumed 42% and 84% load

reductions are unclear based on the description provided in the text. Many stormwater BMPs remove only 10-45% of influent phosphorus loads (Simpson and Weammert, 2007). It is neither technically nor

economically feasible to treat all stormwater runoff from a locality, and, thus, the percent required load reductions may not be achievable since they are near the maximum of the noted removal efficiencies which represent ideal conditions. Moreover, on a dollar-per-pound basis, the costs of reducing urban stormwater loads can be 2-3 orders of magnitude higher than other sectors (Jones, 2010; Wieland, 2009). For these reasons, the reduction value should not be interpreted as an appropriate goal for any single locality or MS4 permit. Rather, TMDL-related activities by the stormwater sectors should be determined on a locality-by-locality basis, based on a reasonable level of effort in individual permit terms. Trading with other sectors and sources should be allowed and encouraged, to facilitate cost-effective load reductions.</td></tr>
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<tr><td colspan="3">Response: The 42% is within the range of loads that BMPs can remove. If load reductions were decreased below 42%, all other sources/sectors would require a higher reduction (Simpson and Weammert, 2007).
The 84% derived from information in Appendix E (Table 2), which was provided by the stormwater workgroup. The 84% reduction for non-stormwater was based on the estimated current TP load (394 lbs/day) that was provided by the stormwater group that will be required to attain the equivalent loading of 0.07 mg/L (63 lbs/day). The 72% reduction allocation given to tributaries is an average of the tributary load reductions with a range of 34-80%, and average POTW reductions were 95% (May-Sept) and 82% (Oct-Apr).</td></tr>
<tr><td>12</td><td>General</td><td>Monitoring to assess compliance with dry weather loads and wet weather loads could become very challenging given the variability in stormwater runoff.</td></tr>
<tr><td colspan="3">Response: Thank you for your comment.</td></tr>
<tr><td>13</td><td>5.4.1.3 (Pg. 99)</td><td>The City supports DEQ's approach to modifying the baseline stormwater loads should additional data or evaluations provide more detailed information. The City requests that the following statement be added to the TMDL:
`Should baseline stormwater load estimates change, these changes will be reflected in the percent reduction requirements for this sector based on the wasteload and load allocations established in this TMDL.'</td></tr>
<tr><td colspan="3">Response: The requirements for this sector would be applied and implemented through wasteload and load allocations in the appropriate NPDES permit.</td></tr>
<tr><td>14</td><td>5.4.1.3 (Pg. 99)</td><td>Add the following as the last sentence of the second paragraph in the Concentration vs. Load section:
"Trading with other sectors and sources should be allowed and encouraged to facilitate cost-effective load reductions."</td></tr>
<tr><td colspan="3">Response: Thank you for your comment. Added text to section 5.4.1.3.</td></tr>
<tr><td>15</td><td>Table 28 (Pg. 94) and Table 35 (Pg. 110)</td><td>The City supports the wasteload allocation approach for large WWTFs in the Lower Boise River watershed (i.e., wasteload allocation based on 0.1 mg/L and 0.35 mg/L discharge from WWTFs). While this concentration still approaches the current limits of technology, the proposed wasteload allocations provide some operational flexibility.</td></tr>
<tr><td colspan="3">Response: Thank you for your comment.</td></tr>
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<table>
<tr><td>16</td><td>5.4.3.1
(Pg. 117)</td><td>The City supports the DEQ's proposed approach (i.e., channel modifications in the Lower Boise River) to further improve water quality in the Lower Boise River. The growth of periphytic algae in the Lower Boise River, like any system, is complex with any number of factors influencing the ultimate concentrations in the river. Because of this, there appears to be a limit to the effectiveness of total phosphorus controls to meet water quality goals, as shown in Figure 47. It is important that the DEQ continues to look for the most cost-effective methods for improving water quality.</td></tr>
<tr><td colspan="3">Response: Thank you for your comment.</td></tr>
<tr><td>17</td><td>5.4.3.1
(Pg. 118)</td><td>The City supports the DEQ's use of AQUATOX for the quantification of the periphytic algae in the Lower Boise River. However, as discussed in Comment No. 2, there is still uncertainty associated with the use of the calibrated AQUATOX model. Because of this, the City requests that the DEQ use a multiple lines of evidence approach in the development of this TMDL and the review of its effectiveness in the future. This approach would be further supported by the collection of additional water quality data that could serve to better calibrate the current AQUATOX model.</td></tr>
<tr><td colspan="3">Response: Wasteload allocations were calculated outside of the AQUATOX model and were provided as inputs to the model. Wasteload allocations were determined by the USGS mass balance model as well as flow and water quality duration curves based on historical data. Multiple lines of evidence were used in the development of this TMDL; historical data (USGS, ISDA), AQUATOX Model, and 2012-13 USGS synoptic sampling. The 5-Year review process will be used to evaluate the wasteload allocations and their effectiveness at meeting the water quality goals.</td></tr>
<tr><td>18</td><td>5.4.7
(Pg. 132)</td><td>Allocation for future municipal growth is critically important to the City. Therefore, the City supports DEQ's proposed approach to allocating loads for future growth, which both achieves water quality goals and allows cities to grow.</td></tr>
<tr><td colspan="3">Response: Thank you for your comment.</td></tr>
<tr><td>19</td><td>Appendix C</td><td>The City requests that Appendix C be removed from the TMDL documentation. This document was not developed by the Stormwater Group, as referenced in the document, and, as such, does not necessarily represent the views of the entire group. This document should be viewed similarly to other input received from stakeholders throughout the process, which is not included in the formal TMDL documentation. This is not consistent with other information provided. The City recommends that either DEQ include all major contributing documents as appendices or reference them as additional information.</td></tr>
</table>

Response: Appendix C will remain in the TMDL for reference. This was the information provided to DEQ by LBWC Stormwater workgroup to help develop the stormwater loading estimates and allocations. However, the names referenced above (Cheryl Jenkins, Mike Mieyr, and Ted Douglass), who have since requested to be removed from Appendix E, will have a strike through on their name on the Title Page of Appendix C, indicating their request to be removed from the document. The administrative record will illustrate that the referenced names were involved in the stormwater workgroup.		
07/03/2015 Idaho Conservation League		
1	General	We support the May 1st - Sept 30th TP concentration target of less than or equal to 0.07 mg/l and the corresponding waste load allocations for point sources and load allocations for non-point sources. We support the mean monthly Benthic Chlorophyll-a target of less than or equal to 150 mg/m^2 and the TP allocations associated with this target during both the May 1- Sept 30 and Oct 1 – April 30 time periods. That said, we believe that DEQ needs to develop an in river TP target for the Oct 1 –April 30 time period. DEQ makes repeated reference to its belief that adherence to the Benthic Chlorophyll-a target will result in TP concentrations of less than or equal to 0.1 mg/l, but falls short of articulating this 0.1 mg/L as an actual target. TP concentrations of less than or equal to 0.1 mg/l would be an acceptable target during the Oct 1 – April 30 time period and should be explicitly adopted as such. An in river concentration target is necessary to ensure compliance and gauge progress towards achieving the TP goals of the TMDL during the Oct 1 – April 30 time period.
Response: DEQ appreciates your concerns. The May 1st – Sept 30th TP concentration of ≤ 0.07 was established in this TMDL to specifically meet the target at the mouth of the Boise River to ensure the target in the Snake River Hells Canyon TMDL is met. This target, did not address wintertime concentrations. A separate in stream target for chlorophyll-a (≤ 150 mg/m^2), which included wintertime allocations, was established to address the impaired segments of the lower Boise River. This ≤ 150 mg/m^2 is a numeric target for meeting Idaho's narrative criteria. Continued monitoring and reassessment during the 5-year review will determine if the targets in the TMDL are sufficient to maintain full support of beneficial uses. Further, it is identified in the TMDL's Reserve for Growth (Section 5.4.7) that, "…an allowance for future growth is not recommended at this time, unless new or expansion of existing point sources discharging directly or indirectly to the lower Boise River: (1) receive a mean monthly NPDES permit limit for TP of ≤0.07 mg/L May through September and ≤0.10 mg/L October through April…"		

<table>
<tr><td>2</td><td>General</td><td>We are comfortable with the decision to adopt a ‘staged implementation’ strategy. However, DEQ needs to incorporate limits on the implementation timeframes. Failure to do so will allow timelines to slip, as mere ‘recommendations’ will not be adhered to.

Regarding point sources and NPDES permits, DEQ provides that dischargers should strive to meet the targets “as soon as possible but can be given up to two permit cycles (10 years from the approval of the TMDL).” This is an acceptable schedule to ICL. However, there is a track record of facilities operating on permits for years after the effective expiration date of the permit. We ask the DEQ clarify that facilities must meet their waste load allocations in 10 years – irrespective of whether or not there are still operating on their second (or first) permit since TMDL approval.

Regarding agricultural non-point sources, we object to DEQ’s failure to provide any implementation timeframes for these sources. Failure to provide any schedule whatsoever dooms agricultural implementation to failure and makes it virtually impossible to monitor progress towards achieving the goals of the TMDL. DEQ must develop some benchmarks so that implementation can be gauged at the 5-year review and beyond.</td></tr>
<tr><td colspan="3">Response: In consultation with DEQ, appropriate compliance schedules may be incorporated into point source permits on a case-by-case basis, consistent with 40 CFR 122.47. All tasks and deliverables in these compliance schedules will be NPDES permit requirements and must be achieved by the date identified in the NPDES permit. Administrative extension of any expired permit will not affect the date compliance is required. This TMDL addendum, however, does not define an implementation time frame for nonpoint sources; rather, implementation would begin as soon as possible and continue as quickly as possible until the load allocation targets are met. This acknowledges that successfully achieving the TMDL target and allocations will depend in part on the installation of voluntary BMPs.</td></tr>
<tr><td>3</td><td>General</td><td>We are concerned that three stream reaches appear to have been removed from consideration in the later stages of drafting this TMDL. It is not clear to us why this occurred. Could DEQ please explain this in the response to comments? Also, could DEQ please explain what the implications are of not including these stream reaches in the TMDL?</td></tr>
</table>

<table>
<tr><td colspan="3">Response: DEQ appreciates your concerns. Because Mason Creek is not the only impaired tributary to the Boise River, DEQ believes that it would be more appropriately addressed in a separate watershed plan along with the other listed tributaries to the Lower Boise River (LBR) including Indian Creek, Tenmile Creek, and Fivemile Creek. A watershed plan is currently required for the tributaries to the lower Boise River that are impaired, thus adding the work that has been completed for Mason Creek is not expected to result in extra effort. Additionally, Mason Creek and other tributaries to the lower Boise River are listed differently in the Integrated Report (“cause unknown, nutrients suspected”) than the lower Boise River which is listed for TP. Addressing all the tributaries to the lower Boise River with the same listing in one watershed plan is appropriate and efficient.

Sand Hollow Creek was removed from the TMDL because it is a tributary to the Snake River, and thus should be addressed in a separate TMDL Addendum to the Snake River Hells Canyon TMDL. A Separate plan will be completed to address the tributaries to the LBR that are impaired for cause unknown—nutrients suspected. Additionally, a separate plan will be completed to address the cause unknown—nutrients suspected impairment in Sand Hollow Creek.

Although Mason Creek was removed from the TMDL, it will maintain an allocation at the mouth of 0.07 mg/L year-around corresponding with 56lbs/day May-Sept and 29 lbs/day Oct-Apr. Sand Hollow Creek, because it is a tributary to the Snake River and not the LBR, will have an allocation of 0.07 mg/L May-Sept and 53 lbs/day.

Even with this not being a TMDL for Mason Creek, the loading analysis and allocations for Mason Creek did not change for winter or summer months. Because the loading analysis and allocations for Mason Creek were included in this LBR TMDL, trading in that watershed was not jeopardized. Sand Hollow Creek was completely removed from this TMDL and is more appropriately addressed in addendum to the Snake River Hells Canyon TMDL.</td></tr>
<tr><td>4</td><td>General</td><td>It appears that both Sand Hollow and Mason Creek did receive concentration based targets of .07 mg/L TP at their mouths from May through September, consistent with the SR-HC TMDL. However, it appears that no loading analysis was included in the final version of the draft TMDL. Could DEQ please discuss this in the response to comments and explain why this occurred?

We are concerned that jeopardizes the potential for pollutant trading in these tributaries.

Could DEQ please discuss this in the response to comments and explain what impact this will have on pollutant trading?</td></tr>
<tr><td colspan="3">Response: Although Mason Creek was removed from the TMDL, it will maintain an allocation at the mouth of 0.07 mg/L year-around corresponding with 56 lbs/day May-Sept and 29 lbs/day Oct-Apr. Sand Hollow Creek, because it is a tributary to the Snake River and not the LBR, will have an allocation of 0.07 mg/L May-Sept and 53 lbs/day.

The loading analysis and allocations for Mason Creek did not change for winter or summer months and remain included in the TMDL. Because the loading analysis and allocations for Mason Creek were included in the TMDL, trading in that watershed was not jeopardized. Sand Hollow Creek was completely removed from this TMDL and is more appropriately addressed in addendum to the Snake River Hells Canyon TMDL.</td></tr>
</table>

<table>
<tr><td>5</td><td>General</td><td>While we are generally supportive of the potential for pollutant trading to be used as a tool to restore water quality in the Lower Boise River, we are most comfortable with pollutant trading when it is orchestrated between two point sources. We have grave concerns about the potential for pollutant trading between point and non-point sources.

Our concern stems from the fact that it will be very difficult to ascertain if non-point sources are actually securing the reduction in TP discharge. If non-point sources are to be included in trading, the DEQ must develop some means of actually measuring TP reductions from each participating non-point source.</td></tr>
<tr><td colspan="3">Response: Thank you for your comment. DEQ supports trading between point and non-point sources. Trading between point and non-point sources is also consistent with EPA’s 2003 Trading Guidance. DEQ believes the safeguards for trading are in place within our 2010 Water Quality Pollutant Trading Guidance, and have been working to update it as a Water Quality Pollutant Trading Guidance “pilot” that integrates the necessary tracking, verification, and oversight we believe ICL may be concerned with. Actual trades will be fully vetted and must be consistent with a Trading Framework or individual trading plan as appropriate. Trades are also subject to review through the NPDES permit and DEQs 401 water quality certification with the result being a net environmental benefit to the water body/watershed. To be clear, the burden of a trade between the point and non-point source is squarely upon the point source who must ensure that the credits generated that are eligible to be purchased are real, reliable and verifiable on the ground and available during the time frame that the purchaser needs them. Trading between point and non-point sources is the key to accelerating clean-up of watersheds in many locations because non-point source compliance remains voluntary under the Clean Water Act. Trading helps incentivize action and participation for early adopters. Phased baselines will further help “ratchet up” getting to clean water for Lower Boise watershed.</td></tr>
<tr><td colspan="3">07/04/2015 Jack Harrison</td></tr>
<tr><td>1</td><td>General</td><td>My primary concern is the 100 ug/L wastewater wasteload allocation given to municipal wastewater treatment facilities versus the 70 ug/L load allocation for tributaries and groundwater. As discussed below, there is a high level of uncertainty in developing the proposed load and wasteload allocations. In general, the higher the level of uncertainty, the more conservation allocations should be. Contrary to this DEQ is proposing to give “extra” load allocation to municipal wastewater dischargers, who are the one major source group that has relatively low uncertainty, is more controllable, and has the resources to implement control measures.</td></tr>
</table>

Response: The USGS mass balance models (Etheridge 2013) indicate that significant point source phosphorus reductions will likely translate into significant reductions in nonpoint source loads downstream. As a result, the 95% WLA reduction from point sources will likely result in a subsequent load reduction in tributaries, drains and groundwater. This cumulative effect of decreasing phosphorus from the main stem of the Boise River should make the reductions for tributaries and groundwater more achievable. Additionally, the TP loading from nonpoint sources is expected to decrease further with the implementation of BMPs, and additional treatment methods. DEQ ran additional AQUATOX reduction scenarios with point source allocations reduced to ≤ 0.07 mg/L year-round, and 0.05 mg/L year-round—which is the approximate limit of technology—the additional scenarios showed a small net gain in environmental benefit for a large technological investment. The difference of the annual average periphyton growth between scenario 3 (point sources at 0.1 summer/0.35 Winter; NPS 0.07) and Scenario 7 (point sources at 0.05 year-round) is only 8 mg/m^2.		
2	General	There is a high level of uncertainty in each of the following areas, which are critical to setting these allocations: • Estimates of the individual components of non-point source loads • Potential for non-point source load reductions to be achieved (i.e., full implementation with necessary reductions) • Models used to demonstrate effectiveness of load reductions
Response: DEQ acknowledges that uncertainty exists in estimating and modeling the current phosphorus loads and load reductions, and this TMDL and associated reference documents (e.g. AQUATOX modeling report, USGS mass balance report) identify those uncertainties to the extent practicable. Further, the estimates and analyses in this TMDL utilized the most current, complete, and scientifically robust data, whenever possible. DEQ recognizes that additional monitoring and data gathering will be required to better characterize the tributary/groundwater loading to the lower Boise River. Additional data gathering will be an integral part of the implementation of this TMDL and will be used for future refinements of loads and implementation schedules. • The USGS mass balance model (Etheridge 2013) characterizes the nonpoint source inputs. • The load allocations in the TMDL are simply the amounts of pollutants that can be discharged from each source category, but the TMDL does not specify how the discharges must attain their particular load allocation. During the initial implementation planning each source will investigate alternatives and feasibility for meeting individual allocations. Calculations of load reduction effectiveness are a routine part of the TMDL implementation program and will also be addressed during the 5-year review. • Two papers presented to the TAC on April 25, 2014 address best management practices effectiveness specific to the Lower Boise River projects.		

3	General	There is limited data available on the actual loads that are contributed from agriculture, stormwater, septic and other sources of phosphorus. Because of this uncertainty, they are grouped into loads for tributaries and groundwater, and are given the same load reduction target even though some may be almost impossible to control.
Response: DEQ acknowledges these data gaps. Implementation plans could include details regarding future data collection from these sources. As discussed in the February 2015 WAG meeting, septic system evaluation will be included in the implementation plan. Additionally, stormwater loading was largely derived from the data provided to DEQ by the stormwater workgroup. Implementation activities over the first 10 years are anticipated to involve actions that identify all existing MS4 outfalls discharging during dry weather and to sufficiently characterize such flows. Collected data such as these are expected to help refine the implementation of the TMDL.		
4	General	Agricultural representatives have expressed concerns that the proposed reductions cannot occur without major changes to current agricultural practices. The load allocation given to agricultural (also requiring an 84 % reduction) is based on the load discharging from tributaries and drains. Agriculture has stated that meeting a 70 ug/L concentration target in field runoff is impossible, and that conversion to sprinkler is not realistic. And yet, there are assumptions that this can and will occur.
Response: The 95% WLA reduction from point sources will have a corresponding load reduction in tributaries, drains and groundwater. This cumulative effect of decreasing phosphorus from the main stem of the Boise River should make the reductions for tributaries and groundwater more achievable. The USGS mass balance models (Etheridge 2013) indicate that significant point source phosphorus reductions will likely translate into significant reductions in nonpoint source loads downstream. As a result, the 95% WLA reduction from point sources will likely result in a subsequent load reduction in tributaries, drains and groundwater. This cumulative effect of decreasing phosphorus from the main stem of the Boise River should make the reductions for tributaries and groundwater more achievable. Additionally, the TP loading from nonpoint sources is expected to decrease further with the implementation of BMPs, and additional treatment methods. Although DEQ recognizes that groundwater needs better characterization and that implementation could take years, DEQ also recognizes that without groundwater load reductions, the point source load allocations would endure the majority of the reductions needed to meet the set targets, thus making the technological upgrades for point sources economically infeasible. DEQ ran additional AQUATOX reduction scenarios with point source allocations reduced to ≤ 0.07 mg/L year-round, and 0.05 mg/L year-round—which is the approximate limit of technology—the additional scenarios showed a small net gain in environmental benefit for a large technological investment. The difference of the annual average periphyton growth between scenario 3 (point sources at 0.1 summer/0.35 Winter; NPS 0.07) and Scenario 7 (point sources at 0.05 year-round) is only 8 mg/m^2.		

<table>
<tr><td>5</td><td>General</td><td>There are many assumptions regarding the effectiveness of implementation for other non-point source load reductions that are inaccurate and/or questionable. For example, there has been very little effort toward estimating septic loads that appear to have been given a load allocation requiring an 84% reduction. There are major concerns as to how the existing load can be controlled by the counties and other jurisdictions when Idaho currently does not have any approved approaches for reducing phosphorus in future septic discharges (let alone methods for decreasing existing loads).</td></tr>
<tr><td colspan="3">Response: As discussed in the February 2015 WAG meeting, septic system evaluation and other nonpoint source loading will be included in the implementation plan. Options for addressing nonpoint source include 319 funding and other grant money directly tied to nonpoint sources. However, in order to receive funding to address such nonpoint source pollution, a watershed plan with a loading analysis must first be completed.</td></tr>
<tr><td>6</td><td>General</td><td>There have been significant stormwater management efforts to “disconnect” surface discharge of stormwater through groundwater infiltration. Many assume that this stormwater infiltration is 100% effective at removing phosphorus. However, there are numerous studies that show this assumption is not correct. Yet again, we assume that this approach can be used to accomplish the 84% reduction goals.

The water quality models used to model the river and to assess the load allocations are highly complex, include many simplifying assumptions, and are understandable by only a few. These models appear to show that targets can be met. The high level of uncertainty in the construction of the models is readily acknowledged. Furthermore, the only way the model could be used to show that the targets were achieved was by adding additional assumptions to the “calibrated” model. These additional assumptions included setting instream and river bottom sediments at almost background levels. Another assumption was that future nitrogen and organic matter reductions would be generally comparable to the targeted phosphorus reductions even though target reductions were not set for these nutrients.</td></tr>
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<table>
<tr><td colspan="3">Response: DEQ agrees that the collection of additional data could serve to refine the AQUATOX model and other analyses used in this TMDL. DEQ also acknowledges that the load allocations are highly complex and include assumptions. In the development of this TMDL every effort was made to obtain the best available information pertinent to the loading analysis, while still considering the time constraints and limited resources for collecting additional data.

DEQ facilitated over 30 model workgroup meetings to vet the modeling process through interested LBWC members and the public, and DEQ facilitated AQUATOX discussions during 6 additional LBWC and TAC meetings. DEQ acknowledges that uncertainty exists in estimating and modeling the current phosphorus loads and load reductions, and this TMDL and associated reference documents (e.g. AQUATOX modeling report, USGS mass balance report) identify those uncertainties to the extent practicable. Further, the estimates and analyses in this TMDL utilized the most current, complete, and scientifically robust data, whenever possible.

The assumptions in the TMDL reduction scenario discussed above (instream river bottom sediments, future nitrogen and organic matter, etc.) had very little impact on the periphyton results in the model. In addition, it is reasonable to assume that with the installation of BMPs, nitrogen, and organic matter reductions would occur simultaneously with TP reductions.</td></tr>
<tr><td>7</td><td>General</td><td>There is a general expectation that municipalities will trade with nonpoint source loads. This is considered to be a major funding source for the voluntary agricultural non-point source reductions and would be helpful in meeting the non-point target reductions for the watershed. However, the extra allocation given to the cities will actually discourage this trading, and further increases the uncertainty relatively to meeting instream and downstream water quality targets.</td></tr>
<tr><td colspan="3">Response: DEQ supports trading between point and non-point sources. “Extra loading” was not given to the cities. DEQ ran additional AQUATOX reduction scenarios with point source allocations reduced to ≤ 0.07 mg/L year-round, and 0.05 mg/L year-round—which is the approximate limit of technology—the additional scenarios showed a small net gain in environmental benefit for a large technological investment. The difference of the annual average periphyton growth between scenario 3 (point sources at 0.1summer/0.35 Winter; NPS 0.07) and Scenario 7 (point sources at 0.05 year-round) is only 8 mg/m^2.

The 95% WLA reduction from point sources will have a corresponding load reduction in tributaries, drains and groundwater. This cumulative effect of decreasing phosphorus from the main stem of the Boise River should make the reductions for tributaries and groundwater more achievable. Additionally, the TP loading from nonpoint sources is expected to decrease further with the implementation of BMPs, and additional treatment methods.</td></tr>
<tr><td>8</td><td>General</td><td>Considering all the uncertainty, it would seem much more prudent to hold any “extra” load in reserve to address future growth in areas where capacity is most limited or give extra allocation to the smaller, downstream cities, which face much higher treatment costs. Another option would be to “not allocate the extra load” if future conditions indicate targets cannot be met (an outcome many suspect will occur).</td></tr>
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Response: There is no "extra" load in reserve. If a 5-year review indicates that TP reductions have led to full support of beneficial uses and state water quality standards being met, additional growth could be allowed. Otherwise, the TMDL Reserve for Growth section identifies, "Because these allocations are necessary to achieve the May–September TP concentration target and the mean monthly periphyton target, an allowance for future growth is not recommended at this time, unless new or expansion of existing point sources discharging directly or indirectly to the lower Boise River: (1) receive a mean monthly NPDES permit limit for TP of ≤0.07 mg/L May through September and ≤0.10 mg/L October through April, (2) a DEQ 5-year review identifies a growth reserve calculated as the difference between current TP loads and TP allocations, where the difference is divided among new/existing point sources, (3) implement approved water quality offsets or trading occur, (4) no additional discharge occurs, or (5) DEQ accepts studies and technical papers demonstrating the proposal to discharge meets the TMDL target. However, any changes to the TMDL would need to be made through the 5-year review process and an addendum to the TMDL." The selected WLA scenario was vetted by and approved by the watershed stakeholders, including small municipalities.		
07/04/2015 Idaho Rivers United		
1	General	Idaho Rivers United strongly agrees with state and federal agencies that have determined that phosphorus is polluting the Lower Boise River and many of its tributaries and impairing beneficial uses. Therefore, Idaho Rivers United supports the adoption of the 2015 Total Phosphorus Addendum with one significant modification. Idaho Rivers United does not support the 0.1 mg/L wasteload allocation for waste water treatment plants for May – September. Idaho Rivers United supports a wasteload allocation of 0.07 mg/L.
Response: Through the TMDL and modeling analyses, DEQ identified that the current TP load and wasteload allocations are necessary to achieve the May–September TP concentration target and the mean monthly periphyton target. Further, DEQ ran additional AQUATOX reduction scenarios with point source allocations reduced to ≤ 0.07 mg/L year-round, and 0.05 mg/L year-round—which is the approximate limit of technology—the additional scenarios showed a small net gain in environmental benefit for a large technological investment. The difference of the annual average periphyton growth between scenario 3 (point sources at 0.1summer/0.35 Winter; NPS 0.07) and Scenario 7 (point sources at 0.05 year-round) is only 8 mg/m^2, which also represents a further reduction than is necessary to achieve the May–September TP concentration target and the mean monthly periphyton target.		
2	General	Phosphorus loads from agriculture, stormwater, septic and other nonpoint sources are estimated based on limited data. At this time, we don't know the extent to which these loads can be controlled, how expensive such control is and whether unpermitted polluters have any means or incentive to control the loads. Despite these gross shortcomings in knowledge, they are being assigned a load allocation of .07 mg/L – and the attainment of beneficial use depends on them not exceeding that allocation.

Response: The USGS mass balance models (Etheridge 2013) indicate that significant point source phosphorus reductions will likely translate into significant reductions in nonpoint source loads downstream. As a result, The 95% WLA reduction from point sources will likely result in subsequent load reduction in tributaries, drains and groundwater. This cumulative effect of decreasing phosphorus from the main stem of the Boise River should make the reductions for tributaries and groundwater more achievable. Additionally, the TP loading from nonpoint sources is expected to decrease further with the implementation of BMPs, and additional treatment methods. DEQ ran additional AQUATOX reduction scenarios with point source allocations reduced to ≤ 0.07 mg/L year-round, and 0.05 mg/L year-round—which is the approximate limit of technology—the additional scenarios showed a small net gain in environmental benefit for a large technological investment. The difference of the annual average periphyton growth between scenario 3 (point sources at 0.1summer/0.35 Winter; NPS 0.07) and Scenario 7 (point sources at 0.05 year-round) is only 8 mg/m^2 which also represents a further reduction than is necessary to achieve the May–September TP concentration target and the mean monthly periphyton target.		
3	General	Idaho Rivers United believes that phosphorus impairs beneficial use of Indian Creek, Mason Creek, Ten Mile Creek, and Five Mile Creek. This impairment was first recognized by the Environmental Protection Agency more than twenty years ago. Idaho DEQ is obligated to develop phosphorus TMDL for those Boise River tributaries. IRU is disappointed that this 2015 addendum doesn't address all of the tributaries. It's not a judicious use of tax dollars to write numerous TMDLs when they can be dealt with at the same time. IRU is especially disappointed that this TMDL no longer applies to Mason Creek. DEQ must start work on a TMDL addendum to address the impaired tributaries.

<table>
<tr><td colspan="3">Response: DEQ appreciates your concerns. Because Mason Creek is not the only impaired tributary to the Boise River, DEQ believes that it would be more appropriately addressed in a separate watershed plan along with the other listed tributaries to the Lower Boise River (LBR) including Indian Creek, Tenmile Creek, and Fivemile Creek. A watershed plan is currently required for the tributaries to the lower Boise River that are impaired, thus adding the work that has been completed for Mason Creek is not expected to result in extra effort. Additionally, Mason Creek and other tributaries to the lower Boise River are listed differently in the Integrated Report (“cause unknown, nutrients suspected”) than the lower Boise River which is listed for TP. Addressing all the tributaries to the lower Boise River with the same listing in one watershed plan is appropriate and efficient.

Sand Hollow Creek was removed from the TMDL because it is a tributary to the Snake River, and thus should be addressed in a separate TMDL Addendum to the Snake River Hells Canyon TMDL. A Separate plan will be completed to address the tributaries to the LBR that are impaired for cause unknown—nutrients suspected. Additionally, a separate plan will be completed to address the cause unknown—nutrients suspected impairment in Sand Hollow Creek.

Although Mason Creek was removed from the TMDL, it will maintain an allocation at the mouth of 0.07 mg/L year-around corresponding with 56 lbs/day May-Sept and 29lbs/day Oct-Apr. Sand Hollow Creek, because it is a tributary to the Snake River and not the LBR, will have an allocation of 0.07 mg/L May-Sept and 53 lbs/day.

Even with this not being a TMDL for Mason Creek, the loading analysis and allocations for Mason Creek did not change for winter or summer months. Because the loading analysis and allocations for Mason Creek were included in this LBR TMDL, trading in that watershed was not jeopardized. Sand Hollow Creek was completely removed from this TMDL and is more appropriately addressed in addendum to the Snake River Hells Canyon TMDL.</td></tr>
<tr><td>4</td><td>General</td><td>Idaho Rivers United supports establishment of TP load allocations for October 1 – April 30. USGA data show that algae grows throughout the year when conditions are right. Also, phosphorus persists in the aquatic ecosystem for months, if not years. There should never be a “free” period when phosphorus can be discharged without restriction into the Boise River. River conditions during this time period should be closely monitored and more research conducted in coming years to augment the existing limited data and body of knowledge to better inform decision makers during the five-year TMDL review.</td></tr>
<tr><td colspan="3">Response: DEQ acknowledges the need to collect more data and encourages more collection.</td></tr>
</table>

Appendix F. Distribution List

Ben Cope and Bill Stewart, EPA

US Bureau of Reclamation Pacific Northwest Region and Snake River Office

Lower Boise Watershed Council, TAC, §319 TAC, and Workgroup Participants

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